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Vol. 2

Safety Evaluation Report
Related to the License Renewal of the Millstone Power Station, Units 2 and 3

Docket Nos. 50-336 and 50-423

Dominion Nuclear Connecticut, Inc.

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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Prepared by
J. H. Eads

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Millstone Power Station (MPS), Units 2 and 3, license renewal applications (LRAs) by the staff of the U.S. Nuclear Regulatory Commission (NRC) (the staff). By letter dated January 20, 2004, Dominion Nuclear Connecticut, Inc. (Dominion or the applicant) submitted the LRAs for MPS in accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54). Dominion is requesting renewal of the operating licenses for MPS Units 2 and 3, (Facility Operating License Numbers DPR-65 and NPF-49, respectively) for a period of 20 years beyond the current expiration dates of midnight July 31, 2015, for Unit 2 and midnight November 25, 2025, for Unit 3.

The MPS units are located on an approximately 500-acre site in the town of Waterford, CT, on the north shore of Long Island Sound. The NRC issued the construction permits for MPS Units 2 and 3 on December 12, 1970, and August 9, 1974, respectively. The operating licenses were issued by the NRC on September 26, 1975, for Unit 2 and January 31, 1986, for Unit 3. MPS Unit 2 consists of a two-steam-generator, four-coolant-loop, pressurized-light-water-reactor, with a nuclear steam supply system supplied by Combustion Engineering, Inc. and a turbine generator furnished by General Electric Corporation. The balance of the plant was originally designed and constructed by Northeast Nuclear Energy Company with the assistance of its agent, Bechtel Corporation. Unit 2 was designed to generate 2560 megawatt thermal (MWt), or approximately 865 megawatt electric (MWe), but in 1979, the unit was uprated to a core power output of 2700 MWt with a gross electrical output of approximately 895 MWe. MPS Unit 3 consists of a four-steam-generator, four-coolant-loop, pressurized-light-water-reactor, with a nuclear steam supply system supplied by Westinghouse Electric Corporation and a turbine generator furnished by General Electric Corporation. The balance of the plant was originally designed and constructed by Northeast Nuclear Energy Company with the assistance of its agent, Stone and Webster Corporation. MPS Unit 3 operates at a licensed power output of 3411 MWt, with a gross electrical output of approximately 1195 MWe.

This SER presents the status of the staff's review of information submitted to the NRC through July 22, 2005, the cutoff date for consideration in the SER. The staff identified open items and confirmatory items that had to be resolved before the staff could make a final determination on the application. Sections 1.5 and 1.6 of this report summarize these items and their resolutions. Section 6 provides the staff's final conclusion on the review of the MPS LRAs.

The NRC license renewal project manager is Mr. Johnny H. Eads. Mr. Eads may be reached at (301) 415-1471. Written correspondence should be addressed to the License Renewal and Environmental Impacts Program, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

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ABBREVIATIONS

ΔRT_{NDT}	irradiation induced shift in the reference nil ductility transition temperature
AAC	alternate alternating current
AC	air conditioning or alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum conductor steel reinforced
AERM	aging effects requiring management
AFW	auxiliary feedwater
AHU	air handling unit
AISC	American Institute of Steel Construction
AMP	aging management program
AMR	aging management review
AMSAC	ATWS mitigating system actuating circuitry
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
B&PV	boiler and pressure vessel
B&W	Babcock and Wilcox
BMI	bottom-mounted instrumentation
BTP	branch technical position
BWR	boiling-water reactor
CASS	cast austenitic stainless steel
CCC	computer code collection
CE	Combustion Engineering
CEA	control element assembly
CEDM	control element drive mechanism
CEOG	Combustion Engineering Owners Group
CFR	*Code of Federal Regulations*
CFS	cubic feet per second
CI	confirmatory item
CF	chemistry factor
CL&P	Connecticut Light & Power
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CO_2	carbon dioxide
CR	condition report
CRD	control rod drive
CRDM	control rod drive mechanism
CSPE	chloro-sulfonated polyethylene
CUF	cumulative usage factor
CVCS	chemical and volume control system
CVPS	Central Vermont Public Service Corporation

Cv_{use}	charpy upper shelf energy
DBA	design-basis accident
DBE	design-basis earthquake
DBS	design-basis summary
DC	direct current
DG	draft regulatory guide
DOR	Division of Reactors
DOTIV	discrete ordinates transport code
DSS	diverse scram system
DWST	demineralized water storage tank
ECT	eddy current testing
EDG	emergency diesel generator
EEQ	electrical equipment qualification
EFPD	effective full power days
EFPH	effective full power hours
EFPY	effective full power year
ELD	electronic licensing documentation database
EOC	electric overhead crane
EOL	end of life
EPDM	ethylene propylene diene monomer
EPR	ethylene propylene rubber
EPRI	Electric Power Research Institute
EQ	environmental qualification
EQML	equipment qualification master list
EQR	environmental qualification report
ER	Environmental Report (10 CFR 51)
ESF	engineered safety feature
ETA	ethanolamine
FAC	flow accelerated corrosion
FHA	fire hazards analysis
FMP	fatigue monitoring program
FP	fire protection
FPER	fire protection evaluation report
FSAR	final safety analysis report
GALL	NUREG-1801, "Generic Aging Lessons Learned Report"
GDC	general design criterion
GDLS	guidelines
GEIS	generic environmental impact statement
GL	generic letter
GPM	gallons per minute
GRITS	generation records information tracking system
GSI	generic safety issue
GTR	generic technical report
HELB	high-energy line break
HMWPE	high molecular weight polyethylene
HVAC	heating, ventilation, and air conditioning
HPSI	high pressure safety injection
IASCC	irradiation-assisted stress corrosion cracking
ICI	incore instrumentation

IEEE	Institute of Electrical and Electronics Engineers
ID	inner diameter
IGSCC	intergranular stress corrosion cracking
ILRT	integrated leak-rate test
IN	information notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
IR	insulation resistance
ISG	interim staff guidance
ISI	inservice inspection
I&C	instrumentation and controls
IWB	requirements for Class 1 components of light-water cooled power plants
IWC	requirements for Class 2 components of light-water cooled power plants
IWD	requirements for Class 3 components of light-water cooled power plants
kV	kilovolt
LBB	leak before break
LCO	limiting condition for operation
LCR	load center room
LER	licensee event report
LLRT	local leak rate testing
LOCA	loss-of-coolant accident
LPSI	low pressure safety injection
LR	license renewal
LRA	license renewal application
LRIMS	license renewal information management system
LSI	limited structural integrity
LTOP	low temperature overpressurization protection
MAER	material aging effects report
MCC	motor control center
MCL	main coolant line
MEAP	material, environment, aging effects, and aging management program
MEPL	materials and equipment parts list
MIC	microbiologically induced corrosion
MMOD	minor modification
MMWEC	Massachusetts Municipal Wholesale Electric Company
MNSA	mechanical nozzle seal assembly
MOV	motor operated valve
MPS	Millstone Power Station
MR	Maintenance Rule
MRP	materials reliability program
MRRF	Millstone Radwaste Reduction Facility
MSL	mean sea level
MSLB	main steam line break
MSRC	Management Safety Review Committee
MSVB	main steam valve building
MW	megawatt
MWe	megawatts-electrical
MWt	megawatt-thermal
NACE	National Association of Corrosion Engineers

NCFM	nuclear component fatigue management
NDE	non-destructive examination
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NPRDS	nuclear plant reliability data system
NRC	U.S. Nuclear Regulatory Commission
NSAC	Nuclear Safety Analysis Center
NSR	non-safety-related
NS>SR	non-safety-related affecting safety-related
NSSS	nuclear steam supply system
OBE	operating basis earthquake
ODSCC	outside diameter stress corrosion cracking
OE	operating experience
OI	open item
PAID	piping and instrumentation diagram
PB	pressure boundary
PCM	personnel contamination monitor
PDT	primary drain tank
PLL	predicted lower limit
PM	preventive maintenance
PMMS	production maintenance management system
PNNL	Pacific Northwest National Laboratory
PPB	parts per billion
PPM	parts per million
PRA	probabilistic risk assessment
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
QAP	quality assurance program
QC	quality control
QDR	qualification document review
RAI	request for additional information
RBCCW	reactor building closed cooling water system
RCCA	rod cluster control assembly
RCD	regulatory commitment database
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RFO	refueling outage
RHR	residual heat removal
RPCC	reactor plant component cooling
RI-ISI	risk informed - inservice inspection
RG	regulatory guide
RPV	reactor pressure vessel
RSST	reserve station service transformer

RT	radiography testing
RTD	resistance temperature detector
RT_{NDT}	reference nil ductility transition temperature
RT_{PTS}	reference temperature for pressurized thermal shock
RV	reactor vessel
RVHP	reactor vessel head penetration
RVI	reactor vessel internals
RVID	reactor vessel integrity database
RVSP	reactor vessel surveillance program
RWST	refueling water storage tank
SAMA	severe accident mitigation alternative
SBO	station blackout
SC	structure and component
SCBA	self contained breathing apparatus
SCC	stress corrosion cracking
SDC	shutdown cooling
SER	safety evaluation report
SFRM	safety function requirements manual
SG	steam generator
SGFP	steam generator feedwater pump
SGSIP	steam generator structural integrity program
SI	safety injection
SIAS	safety injection actuation signal
SPCS	steam and power conversion systems
SR	safety-related
SRP	Standard Review Plan
SRP-LR	NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants"
SSC	structures, systems, and components
SVI	single volumetric indication
SW	service water
SWGR	switchgear
t	thickness
TBCCW	turbine building closed cooling water
TGSCC	transgranular stress corrosion cracking
TIC	temperature indicating controllers
TLAA	time-limited aging analysis
TRM	technical requirements manual
TS	technical specification
TSCR	technical specification change request
TSP	trisodium phosphate dodecahydrate
USE	upper shelf energy
UT	ultrasonic testing
UV	ultraviolet
VAC	voltage alternating current
VETIP	vendor equipment technical information program
VT	visual test
WINCDMS	chemistry data management system
WOG	Westinghouse Owners Group
XLPE	cross-linked polyethylene

3.1 Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

3.1A Unit 2 Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the reactor vessel, internals, and reactor coolant system components and component groups associated with the following systems:

- reactor vessel
- reactor vessel internals
- reactor coolant system
- steam generator

3.1A.1 Summary of Technical Information in the Application

In LRA Section 3.1, the applicant provided AMR results for reactor vessel, internals, and reactor coolant system components and component groups. In LRA Table 3.1.1, "Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Vessel, Internals, and Reactor Coolant System," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the reactor vessel, internals, and reactor coolant system components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1A.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Detail of the staff's audit evaluation are documented in the MPS audit and review report and are summarized in Section 3.1A.2.1 of this SER.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.1.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluation are documented in the MPS audit and review report and are summarized in Section 3.1A.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with or not address in the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluation are documented in the MPS audit and review report and summarized in Section 3.1A.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.1A.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the reactor vessel, internals, and reactor coolant system components.

Table 3.1A-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.1 that are addressed in the GALL Report.

Table 3.1A-1 Staff Evaluation for Reactor Vessel, Internals, and Reactor Coolant System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor coolant pressure boundary components (Item Number 3.1.1- 01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue
Steam generator shell assembly (Item Number 3.1.1- 02)	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry	Chemistry control for secondary systems program (B2.1.6); Inservice inspection program: systems, components (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.2)
Pressure vessel ferritic materials that have a neutron fluence greater than 1.0E17 n/cm2 (E>1 MeV) (Item Number 3.1.1- 04)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99	TLAA	This TLAA is evaluated in Section 4.2, Reactor Vessel Neutron Embrittlement.
Reactor vessel beltline shell and welds (Item Number 3.1.1- 05)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Reactor vessel surveillance (B2.1.20)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.3)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Westinghouse and Babcock & Wilcox (B&W) baffle/former bolts (Item Number 3.1.1- 06)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant-specific		Not applicable (See Section 3.1.2.2.3) MPS Unit 2 is of Combustion Engineering design. Baffle/former bolts are not used in the reactor vessel internals.
Small-bore reactor coolant system and connected systems piping (Item Number 3.1.1- 07)	Crack initiation and growth due to SCC, IGSCC, and thermal and mechanical loading	Inservice inspection; water chemistry; one-time inspection	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.4)
Vessel shell (Item Number 3.1.1- 10)	Crack growth due to cyclic loading	TLAA		Not applicable (See Section 3.1.2.2.5)
Reactor internals (Item Number 3.1.1- 11)	Changes in dimension due to void swelling	Plant-specific	Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.6)
PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains (Item Number 3.1.1- 12)	Crack initiation and growth due to SCC and/or PWSCC	Plant-specific	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18); Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)
CASS reactor coolant system piping (Item Number 3.1.1- 13)	Crack initiation and growth due to SCC	Plant-specific	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni alloys (Item Number 3.1.1- 14)	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)
Westinghouse and B&W baffle former bolts (Item Number 3.1.1- 15)	Crack initiation and growth due to SCC and irradiation-assisted stress corrosion cracking (IASCC)	Plant-specific		Not applicable (See Section 3.1.2.2.8) MPS Unit 2 is of Combustion Engineering design. Baffle/former bolts are not used in the reactor vessel internals.
Westinghouse and B&W baffle former bolts (Item Number 3.1.1- 16)	Loss of preload due to stress relaxation	Plant-specific		Not applicable (See Section 3.1.2.2.9) MPS Unit 2 is of Combustion Engineering design. Baffle/former bolts are not used in the reactor vessel internals.
Steam generator feedwater impingement plate and support (Item Number 3.1.1- 17)	Loss of section thickness due to erosion	Plant-specific		Not applicable (See Section 3.1.2.2.10)
(Alloy 600) Steam generator tubes, repair sleeves, and plugs (Item Number 3.1.1- 18)	Crack initiation and growth due to PWSCC, ODSCC, and/or IGA, or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry	Chemistry control for primary systems program (B2.1.5); Chemistry control for secondary systems program (B2.1.6); Steam generator structural integrity (B2.1.22)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.11)
Tube support lattice bars made of carbon steel (Item Number 3.1.1- 19)	Loss of section thickness due to flow-accelerated corrosion (FAC)	Plant-specific		Not applicable (See Section 3.1.2.2.12)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Carbon steel tube support plate (Item Number 3.1.1- 20)	Ligament cracking due to corrosion	Plant-specific		Not applicable (See Section 3.1.2.2.13)
Steam generator feedwater inlet ring and supports (Item Number 3.1.1- 21)	Loss of material due to flow accelerated corrosion	Combustion engineering (CE) steam generator feedwater ring inspection	Flow-accelerated corrosion program (B2.1.11)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.14) Although the Unit 2 steam generators are not CE System 80 steam generators, the feedwater inlet ring is included in the flow accelerated corrosion program.
Reactor vessel closure studs and stud assembly (Item Number 3.1.1- 22)	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
CASS pump casing and valve body (Item Number 3.1.1-23)	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1A.2.1.1)
CASS piping (Item Number 3.1.1-24)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL (See Section 3.1.2.1.1) Loss of Fracture Toughness is managed with inservice inspection program: systems, components and supports, which takes some exception to the GALL AMP.
BWR piping and fittings; steam generator components (Item Number 3.1.1-25)	Wall thinning due to flow- accelerated corrosion	Flow- accelerated corrosion	Flow-accelerated corrosion (B2.1.11)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1.2)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high pressure and high temperature systems (Item Number 3.1.1-26)	Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting integrity	Consistent with GALL, (See Section 3.1.2.1.3)
CRD nozzle (Item Number 3.1.1-35)	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting) (Item Number 3.1.1-36)	Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC	Inservice inspection; water chemistry	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel internals CASS components (Item Number 3.1.1-37)	Loss of fracture toughness due thermal aging, neutron irradiation embrittlement, and void swelling	Thermal aging and neutron irradiation embrittlement	Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
External surfaces of carbon steel components in reactor coolant system pressure boundary (Item Number 3.1.1-38)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Steam generator secondary manways and handholds (carbon steel) (Item Number 3.1.1-39)	Loss of material due to erosion	Inservice inspection		Not applicable (See Section 3.1.2.3.4) The steam generators are recirculating- type steam generators.

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor internals, reactor vessel closure studs, and core support pads (Item Number 3.1.1-40)	Loss of material due to wear	Inservice inspection	Inservice inspection program: reactor vessel internals (B2.1.17); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Pressurizer integral support (Item Number 3.1.1-41)	Crack initiation and growth due to cyclic loading	Inservice inspection	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Upper and lower internals assembly (Westinghouse) (Item Number 3.1.1-42)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring		Not applicable. MPS Unit 2 reactor vessel was designed by Combustion Engineering.
Reactor Vessel internals in fuel zone region (except Westinghouse B&W baffle former bolts) (Item Number 3.1.1-43)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	PWR vessel internals; water chemistry	Inservice inspection program: reactor vessel internals (B2.1.17); Chemistry control for primary systems program (B2.1.5)	Consistent with GALL (See Section 3.1.2.1.4)
Steam generator upper and lower heads, tubesheets, and primary nozzles and safe ends (Item Number 3.1.1-44)	Crack initiation and growth due to SCC, PWSCC, and/or IASCC	Inservice inspection; water chemistry	Inservice inspection program: systems, components and supports (B2.1.18); Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Vessel internals (except Westinghouse and B&W baffle former bolts) (Item Number 3.1.1-45)	Crack initiation and growth due to SCC and IASCC	PWR vessel internals; water chemistry	Inservice inspection program: reactor vessel internals (B2.1.17); Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor internals (B&W screws and bolts) (Item Number 3.1.1-46)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring		Not applicable. MPS Unit 2 reactor vessel was designed by Combustion Engineering.
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-47)	Loss of material due to wear	Reactor head closure studs		Not consistent with GALL (See Section 3.1.2.3)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor internals (Westinghouse upper and lower internal assemblies, CE bolts and tie rods) (Item Number 3.1.1-48)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	Inservice inspection program: reactor vessel internals (B2.1.17)	Not consistent with GALL (See Section 3.1.2.1)

The staff's review of the MPS reactor vessel, internals, and reactor coolant system components and associated components followed one of several approaches. One approach, documented in Section 3.1A.2.1, involves the staff's review of the AMR results for components in the reactor vessel, internals, and reactor coolant system components that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.1A.2.2, involves the staff's review of the AMR results for components in the reactor vessel, internals, and reactor coolant system components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.1A.2.3, involves the staff's review of the AMR results for components in the reactor vessel, internals, and reactor coolant system components that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the reactor coolant system components is documented in Section 3.0.3 of this SER.

3.1A.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Section 3.1.2.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the reactor vessel, internals, reactor coolant system, and steam generator components:

- boric acid corrosion program
- chemistry control for primary systems program
- chemistry control for secondary systems program
- inservice inspection program: reactor vessel internals program
- inservice inspection program: systems, components and supports program
- reactor vessel surveillance program
- closed-cycle cooling water system program
- general condition monitoring program
- work control process program
- flow-accelerated corrosion program
- steam generator structural integrity program

Staff Evaluation. In Tables 3.1.2-1 through 3.1.2-4 of the LRA, the applicant provided a summary of AMRs for the reactor vessel, internals, reactor coolant system, and steam generator, and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the Unit 2 LRA, as documented in the MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.1A.2.1.1 Loss of Fracture Toughness Due to Thermal Aging Embrittlement

In the discussion section of Table 3.1.1, Item 24 of the LRA, the applicant stated that loss of fracture toughness is not an aging effect requiring management for applicable CASS piping and components. During the audit and review, the staff asked the applicant for clarification as to why loss of fracture toughness is not an aging effect requiring management. The applicant replied that loss of fracture toughness of the CASS piping is not an aging effect requiring management because the results of leak-before-break (LBB) analysis demonstrated that there was a large margin between detectable flaw size and flaw instability. The staff reviewed the applicant's TLAA report on "leak-before-break" and found that the LBB analysis is not a flaw tolerance evaluation as specified by the GALL Report. The applicant agreed that the LBB analysis cannot be used to manage the loss of fracture toughness due to thermal aging embrittlement. The applicant submitted an LRA supplement letter dated July 7, 2004, and stated that:

> Note "6" for Unit 2 Tables 3.1.2-1 through 3.1.2-4 (Pages 3-101), should state the following:
>
>> For potentially susceptible CASS materials, either enhanced volumetric examinations or a unit or component specific flaw tolerance evaluation (considering reduced fracture toughness and unit specific geometry and stress information) will be used to demonstrate that the thermally-embrittled material has adequate fracture toughness in accordance with NUREG-1801 Section XI.M12.
>>
>> 'Loss of Fracture Toughness' as an aging effect for component groups 'Pipe (Safe Ends for SI and SDC)', 'Pipe (Surge Line Piping and Fittings)', and 'Pressurizer (Safe End for PZR Surge Nozzle)' should be added in Unit 2 Table 3.1.2-3, (pages 3-72, 74, and 77, respectively). The 'Loss of Fracture Toughness' is managed by the inservice inspection program: systems, components and supports and corresponds to GALL Item IV.C2.1-f. The Notes for these entries are "A,6" and the 'Table 1 Item' is "3.1.1-24." The material for the pressurizer component (identified above) will designate that it is CASS material. NOTE: Only the 'Loss of Fracture Toughness' entry will have Note "6" listed for the above component groups.
>
> The "Discussion" column in Unit 2 Table 3.1.1, Item 24, (page 3-31) should have been read as follows:
>
>> Consistent with NUREG-1801. Loss of Fracture Toughness is managed with the inservice inspection program: systems, components and supports and this program takes some exception to the NUREG-1801 AMP.

Additionally, a new commitment, Item 27, should be added to Appendix A, Table A6.0-1 as follows and will be implemented prior to the period of extended operation:

> For potentially susceptible CASS materials, either enhanced volumetric examinations or a unit or component specific flaw tolerance evaluation (considering reduced fracture toughness and unit specific geometry and stress information) will be used to demonstrate that the thermally-embrittled material has adequate fracture toughness in accordance with NUREG-1801 Section XI.M12.

The applicant modified the corresponding LRA to reflect the audit findings. The staff reviewed the applicant's LRA supplement and concluded that the applicant appropriately addressed the aging mechanism with the above mentioned new commitment, as recommended in the GALL Report.

3.1A.2.1.2 Wall Thinning due to Flow-Accelerated Corrosion

Steam Generator Steam Nozzle Flow Restrictor and Steam Nozzle. On page 3-95 of the LRA, the applicant stated that wall thinning due to flow-accelerated corrosion in steam generator flow restrictor exposed to steam is managed using MPS AMP B2.1.11, "Flow-Accelerated Corrosion." During the audit and review, the staff asked the applicant to clarify how the flow restrictor is being managed using the flow-accelerated corrosion (FAC) program. The applicant replied that FAC concerns for the flow restrictor (restricting venturi) are addressed by video inspection and venturi ID measurements performed as part of MPS AMP B2.1.22, "Steam Generator Structural Integrity," and not part of the FAC program. The applicant stated that it will provide clarification in an LRA supplement. Furthermore, the applicant stated that the steam nozzle flow restrictor is fabricated from carbon steel and is integral to the steam nozzle. The steam nozzle itself is not subjected to direct steam flow and, therefore, does not have FAC concerns.

By letter dated July 7, 2004, the applicant submitted its LRA supplement letter. In its response, the applicant stated that the FAC AMP should be replaced with MPS AMP B2.1.22, "Steam Generator Structural Integrity" for the 'Steam Nozzle Flow Restrictor' component group in Unit 2 Table 3.1.2-4 (page 3-95). Also, the Note "D" should be "E" for the same entry. In addition, the "Discussion" column in Table 3.1.1, Item 3.1.1-25 (page 3-31), should replace "Flow-Accelerated Corrosion program" with the following:

> Flow-Accelerated Corrosion program for all items except the steam nozzle flow restrictor which is managed by the steam generator structural integrity program AMP.

The staff reviewed the applicant's response, as documented in the staff's MPS audit and review report, and confirmed that inspections of the SG flow restrictors are performed. In addition, the applicant utilizes the charged-coupled device (CCD) camera to inspect the steam nozzle venturies and utilizes the video probe to inspect steam nozzle venturies.

For loss of material in a steam environment for the carbon steel steam nozzle and safe-end component group, in LRA Table 3.1.2-4 (page 3-94), the applicant credited both the chemistry control for secondary systems program and the FAC program. In its letter dated July 7, 2004, the applicant stated that the FAC program was inadvertently listed as an aging management program for the steam nozzle and safe-end component group. The staff reviewed the applicant's response and concluded that the chemistry control for secondary systems program alone is adequate to manage this aging effect.

On the basis of its review, the staff concluded that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

Steam Generator Feedwater Nozzle Thermal Sleeve. In LRA Table 3.1.2-4 (page 3-89), the applicant stated that wall thinning due to FAC in steam generator feedwater thermal sleeve exposed to treated water is managed using MPS AMP B2.1.11, "Flow-Accelerated Corrosion." During the audit and review, the staff asked the applicant to clarify how the thermal sleeve is being managed using the FAC program. The applicant replied that there is an inner 16-inch diameter, Schedule 80 carbon steel thermal sleeve (shield) at the feedwater inlet nozzle. Because of the external nozzle, UT examination is not being performed on the thermal sleeve (shield) itself. The applicant initiated a corrective action report to address the need for establishing proper monitoring for wall thickness as part of the FAC program. On the basis of its review, the staff concludes that the applicant's response is acceptable.

3.1A.2.1.3 Loss of Material Due to Wear; Loss of Preload Due to Stress Relaxation; Crack Initiation and Growth Due to Cyclic Loading and/or Stress Corrosion Cracking

In LRA Table 3.1.1, Item 26 (page 3-31), the applicant stated that cracking and loss of preload are managed using AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports." Also, the applicant stated that loss of material due to wear is not an aging effect requiring management for this bolting.

The staff noted that SRP-LR Table 3.1-1 recommended GALL AMP XI.M18, "Bolting Integrity," for managing closure bolting in a high pressure or high temperature system for loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or stress corrosion cracking.

The staff questioned the applicant on whether all of the resolutions of the generic safety issue for bolting, as stated in NUREG-1339, are addressed. By letter dated December 3, 2004, the applicant submitted its LRA supplement. In its response, the applicant stated that it has developed a specific bolting integrity aging management program that addresses degradation of bolting at MPS. The bolting integrity program was reviewed and is addressed in Section 3.0 of this SER.

By letter dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaced the existing information in the "Discussion" column of LRA Table 3.1.1, Item 26 with "consistent with the NUREG-1801."

The staff reviewed the applicant's response and finds this acceptable since it is consistent with the GALL Report.

3.1A.2.1.4 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement, and Void Swelling

In LRA, Table 3.1.1, Item 43 (page 3-35), the applicant stated that loss of fracture toughness is managed using MPS AMP B2.1.17, "Inservice Inspection Program: Reactor Vessel Internals." Also, the applicant stated that MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program" is not credited to manage these aging effects, but is applied to all reactor vessel internals components as a corrosion mitigation program.

The staff reviewed the inservice inspection program: reactor vessel internals program and the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.12 and Section 3.0.3.2.2 of this SER, respectively. On the basis of its review, the staff agreed with the applicant that the chemistry control for primary systems program is a corrosion mitigation program and the program also applies to all reactor vessel internal components. Therefore, the staff concluded that the applicant's proposed program is adequate to manage loss of fracture toughness due to neutron irradiation embrittlement and void swelling.

On the basis of its audit and review, the staff determined that for all other AMRs not requiring further evaluation, as identified in LRA Table 3.1.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. The staff has evaluated the applicant's claim of consistency with the GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In Section 3.1.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for reactor vessel, internals, reactor coolant system, and steam generator components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to pitting and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement
- crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking
- crack growth due to cyclic loading
- changes in dimension due to void swelling

- crack initiation and growth due to stress corrosion cracking or primary water stress corrosion cracking
- crack initiation and growth due to stress corrosion cracking or irradiation-assisted stress corrosion cracking
- loss of preload due to stress relaxation
- loss of section thickness due to erosion
- crack initiation and growth due to PWSCC, ODSCC, or intergranular attack or loss of material due to wastage and pitting corrosion or loss of section thickness due to fretting and wear or denting due to corrosion of carbon steel tube support plate
- loss of section thickness due to flow-accelerated corrosion
- ligament cracking due to corrosion
- loss of material due to flow-accelerated corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.1.3.2 of the SRP-LR. Details of the staff's audit are documented in the staff's MPS audit and review report. The staff's evaluation of is discuss below.

3.1A.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.1A.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the criteria in SRP-LR Section 3.1.2.2.2.

In Unit 2 LRA Section 3.1.2.2.2, the applicant addressed loss of material of steam generator assemblies due to pitting and crevice corrosion.

SRP-LR Section 3.1.2.2.2 stated that loss of material due to pitting and crevice corrosion could occur in the steam generator shell assembly. The existing program relied on control of water chemistry to mitigate corrosion and ISI to detect cracking due to loss of material. NRC Information Notice (IN) 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," stated that if general corrosion pitting of the shell exists, the existing program may not be sufficient. In that case the GALL Report recommends augmented inspections to manage the aging effect.

The AMPs recommended by the GALL Report for managing the aging of steam generator assemblies due to pitting and crevice corrosion are GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," to detect loss of material and

GALL AMP XI.M2, "Water Chemistry," to mitigate corrosion. The GALL Report also recommends a plant-specific program to conduct augmented inspections.

In the Unit 2 LRA, the applicant credits MPS AMP B.2.18, "Inservice Inspection Program: Systems, Components and Supports," and MPS AMP B.2.1.6, "Chemistry Control for Secondary Systems," for managing loss of material due to pitting and crevice corrosion for the internal surfaces of the steam generator shell. The staff evaluated these programs and its evaluations are documented in Section 3.0.3.2.13 and Section 3.0.3.2.3 of this SER, respectively.

The staff reviewed IN 90-04, which identified the need to augment inspections beyond the requirements of ASME Section XI if general corrosion pitting of the steam generator shell is known to exist in order to differentiate isolated cracks for inherent geometric conditions. In the Unit 2 LRA, the applicant stated that it replaced the Unit 2 steam generators in 1992. The staff reviewed operating experience which indicated that no pitting corrosion of the steam generator shell has been detected to date, and that water chemistry has been maintained for these new steam generators per EPRI guidelines. The staff finds that the augmented inspections recommended by NRC IN 90-04 and referenced in the SRP-LR do not currently apply to the Unit 2 steam generators.

Since pitting corrosion has not been detected on the steam generator shell since installation, the staff finds that augmented inspections are not required and that the current water chemistry control and inservice inspection programs adequately manage this aging effect.

The staff finds that, based on the programs identified above, the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed Unit 2 LRA Section 3.1.2.2.3 against the criteria contained in SRP-LR Section 3.1.2.2.3.

In LRA Section 3.1.2.2.3, the applicant addressed (1) loss of fracture toughness due to neutron irradiation embrittlement for ferritic materials that have a neutron fluence of greater than 10^{17} n/cm^2 at the end of the license renewal term, and (2) loss of fracture toughness due to irradiation embrittlement of the reactor vessel beltline materials. In addition, the applicant stated that (3) the baffle/former bolts are not used in the reactor vessel internals and the discussion in this paragraph of NUREG-1800 is not applicable.

SRP-LR Section 3.1.2.2.3 stated that certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3 and that TLAAs are required to be evaluated in accordance with 10 CFR 54.2.(c)(1). Second, SRP-LR Section 3.1.2.2.3 stated that loss of fracture toughness due to neutron irradiation embrittlement could occur in the reactor vessel. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Finally, the SRP-LR

Section 3.1.2.2.3 statement that loss of fracture toughness due to neutron irradiation embrittlement and void swelling could occur in Westinghouse and B&W baffle/former bolts. Baffel/former bolts are not applicable to Unit 2 because Unit 2 reactor vessel internals do not include baffle/former bolts.

The AMP recommended by the GALL Report for managing loss of fracture toughness due to neutron irradiation embrittlement in the reactor vessel is GALL AMP XI.M31, "Reactor Vessel Surveillance," which complies with the requirements of 10 CFR Part 50, Appendices G and H, and 10 CFR Part 50.61.

Certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff's evaluation of this TLAA can be found in Section 4.2 of this SER, following the guidance in Section 4.2 of the Standard Review Plan for License Renewal (SRP-LR).

Loss of fracture toughness due to neutron irradiation embrittlement could occur in the reactor vessel. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Thus, further staff evaluation is required for license renewal. NUREG-1801 recommends further evaluation of the reactor vessel materials surveillance program for the period of extended operation. The staff verifies that the applicant has proposed an adequate reactor vessel materials surveillance program for the period of extended operation.

The limiting beltline material for upper shelf energy (USE) at Millstone Unit 2 is the intermediate and lower shell beltline axial welds, heat no. A8746. The limiting beltline material for pressurized thermal shock (PTS) at Millstone Unit 2 is the Lower Shell Plate C-506-1 (Heat No. C5667-1). The Millstone Unit 2, reactor vessel surveillance program, in conjunction with TLAA analyses, effectively manages loss of fracture toughness in the beltline materials. The reactor vessel surveillance program provides adequate material property and neutron dosimetry data to predict fracture toughness in beltline materials at the end of the period of extended operation. The analyses (see TLAAs, SER Section 4.2) for USE and PTS provide assurance that beltline material toughness values in the Millstone Unit 2 reactor vessel will remain at acceptable levels through the period of extended operation. The reactor vessel surveillance program is reviewed in SER Section 3.0.3.1.3 (AMP B2.1.20).

The staff finds that the applicant's AMR results are consistent with the GALL Report and that the applicant has demonstrated that the programs to manage the effects of aging will be adequate to maintain the intended functions consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2.4 Crack Initiation and Growth Due to Thermal and Mechanical Loading or Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.4 against the criteria contained in SRP-LR Section 3.1.2.2.4.

In LRA Section 3.1.2.2.4, the applicant addressed the potential for crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking (SCC), including intergranular SCC, that could occur in small-bore RCS and connected system piping less than 4-inch nominal pipe size (NPS 4).

SRP-LR Section 3.1.2.2.4 stated that the GALL Report recommends that a plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the period of extended operation. The applicant should verify that service-induced weld cracking is not occurring in small-bore piping less than NPS 4. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and that the component's intended function will be maintained during the period of extended operation. Per ASME Section XI, 1995 edition, Examination Category B-J or B-F, small-bore piping, defined as piping less than NPS 4, does not receive volumetric inspection.

The AMPs recommended by the GALL Report are GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," to detect loss of material, and GALL AMP XI.M2, "Water Chemistry," to mitigate SCC.

In the LRA, the applicant credited MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," and MPS AMP B2.1.5, "Chemistry Control for Primary Systems," to mitigate cracking of reactor coolant piping. The staff evaluated these programs and its evaluation is documented in Section 3.0.3.2.13 and Section 3.0.3.2.2 of this SER, respectively.

To address the GALL Report recommendation that a plant-specific destructive examination or an NDE that permits inspection of the inside surfaces of the piping be conducted, the applicant stated, in the LRA, that it has implemented an RI-ISI methodology to select RCS piping welds for inspection in lieu of the requirements specified in ASME Section XI. To address the GALL Report recommendation for a one-time inspection of small-bore piping less than NPS 4, the applicant indicated in the Unit 2 LRA that small-bore pipe butt-welded connections are included in the final weld selection for performance of volumetric examination. The staff verified that the applicant used the RI-ISI process to determine the most susceptible locations for performing the volumetric examination and did not eliminate small-bore pipe welds.

The staff reviewed and verified that the applicant's RI-ISI plan will perform volumetric examination, which is recommended to address cracking for small-bore Class 1 piping per ISG-12, "One-Time Inspection of Small-Bore Piping," on elements not currently required to be volumetrically examined. Based on the programs identified above, the staff finds that the applicant appropriately evaluated AMR results involving current inspection methods, as detailed in the inservice inspection program, and as supplemented by the water chemistry control, for managing cracking of small-bore piping systems.

The staff finds that the applicant's AMR results are consistent with the GALL Report, and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2.5 Crack Growth Due to Cyclic Loading

NUREG-1801 recommends further evaluation of programs to manage crack growth due to cyclic loading in the reactor vessel shell. Crack growth due to cyclic loading in reactor vessel shells are evaluated as a TLAA. Growth of intergranular separations (underclad cracks) in low-alloy or carbon steel heat-affected zones under austenitic stainless steel cladding is a TLAA to be evaluated for the period of extended operation for all the SA 508-Class 2 forgings where the cladding was deposited with a high heat input welding process. Since Millstone Unit 2 does not use SA 508-Class 2 forgings in the beltline region, this evaluation is not applicable. In addition, the Millstone Unit 2 LRA, Section 3.1.2.2.5 states that there are no detected underclad cracks identified in the reactor vessel.

3.1A.2.2.6 Changes in Dimension Due to Void Swelling

In LRA Section 3.1.2.2.6, the applicant addressed changes in dimension due to void swelling that could occur in reactor internals components.

SRP-LR Section 3.1.2.2.6 stated that the GALL Report recommends that changes in dimension due to void swelling in reactor internals components be evaluated to ensure that this aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated to manage the effects of changes in dimension due to void swelling and the loss of fracture toughness associated with swelling.

In general, the applicant has concluded that void swelling is an aging related effect for the reactor vessel internals, but currently only credits the ASME Section XI, Subsection IWB, Category B-N-3 inservice inspections to manage change in dimensions due to void swelling. In lieu of the implementation of augmented inspections, such as enhanced visual VT-1 examinations or enhanced volumetric examination, Millstone will follow industry efforts to determine the necessary steps for managing void swelling. Currently no augmented inspection will be performed. However, since the EPRI Materials Research Project - Reactor Internals Issue Task Group is currently addressing this issue, the applicant will follow the industry effort related to void swelling and will implement the appropriate recommendations resulting from this guidance. In addition, the applicant has identified the implementation of the industry initiatives as commitment 13 in Appendix A, Table A6.0-1 of the LRA.

The staff reviewed the inservice inspection program: reactor vessel internals program and its evaluation is documented in Section 3.0.3.2.12 of this SER. The staff finds that this program is consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS)," and GALL AMP XI.M16, "PWR Vessel Internals."

The staff finds the applicant's approach for managing changes in dimension due to void swelling acceptable because the approach will be based on the guidelines developed by the ongoing industry activities related to void swelling. The applicant has committed to implement the appropriate recommendations resulting from the industry efforts. The applicant also committed, through an LRA supplement letter, dated July 7, 2004, that the revised program description, including a comparison with the 10 program elements of the NUREG-1801 program, will be submitted to the NRC for approval prior to the period of extended operation.

The staff finds that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2.7 Crack Initiation and Growth Due to Stress Corrosion Cracking or Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.7 against the criteria in SRP-LR Section 3.1.2.2.7, which recommends plant-specific programs to address these aging mechanisms.

In LRA Section 3.1.2.2.7, the applicant addressed (1) crack initiation and growth due to SCC and primary water stress corrosion cracking (PWSCC) in the pressurizer (spray head assembly/nozzle assembly). Reactor vessel items included in this grouping are the surveillance capsule holders, core stabilizing lugs, core stop lugs, and the flow baffle and skirt. Steam generator items included in this grouping are the tube plate cladding, channel head divider plate, and primary instrument nozzles; (2) crack initiation and growth due to SCC in the pressurizer surge line piping, fittings and pipe (safe-ends for safety injection (SI) and shutdown cooling (SDC)) fabricated of CASS; and (3) crack initiation and growth due to PWSCC in nickel-based alloy components such as the pressurizer instrumentation nozzles, heater sheaths and sleeves, and thermal sleeves.

SRP-LR Section 3.1.2.2.7 states that:

- Crack initiation and growth due to SCC and PWSCC could occur in core support pads (or core guide lugs), instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC.
- Crack initiation and growth due to SCC could occur in CASS RCS piping and fittings and pressurizer surge line nozzles. The GALL Report recommends further evaluation of piping that does not meet either the reactor water chemistry guidelines of EPRI TR-105714 or material guidelines of NUREG-0313, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," Revision 2, January 1988.
- Crack initiation and growth due to PWSCC could occur in pressurizer instrumentation penetrations and heater sheaths and sleeves made of nickel alloys. The existing program relies on ASME Section XI inservice inspection and on control of water chemistry to mitigate PWSCC. However, the existing program should be augmented to manage the effects of SCC on the intended function of nickel-alloy components. The GALL Report recommends that the applicant provide a plant-specific AMP or participate in industry programs to determine appropriate AMPs for PWSCC of the Alloy 182 weld.

The applicant credited the following plant-specific programs for each of the three SRP-LR criteria:

- Cracking of nickel-based alloy components due to PWSCC is managed by the nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) aging management activities, which are part of MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," supplemented by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." Additionally, EPRI, through its material reliability program (MRP) and in conjunction with the PWR Owners Group, is developing a strategic plan to manage and mitigate cracking of nickel-based alloy items. The applicant stated that the guidance developed by the MRP will be used to identify the appropriate aging management activities and will implement the appropriate recommendations resulting from this guidance as described in the License Renewal Commitment, Item 14.

- Crack initiation and growth due to SCC at welded connections, including the pressurizer surge line and fittings and pipe safe-ends for SI and SDC, is managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," and MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports."
- The programs credited for the management of PWSCC of these nickel-based alloy items are the nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) aging management activities, which are part of MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," and MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." As described above, the applicant committed to participate in the nickel-based alloys industry programs to identify appropriate aging management activities and will implement the appropriate recommendations from the guidance developed by industry programs.

The GALL Report recommends that a plant-specific aging management program be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR). The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

Crack initiation and growth due to SCC could occur in PWR cast austenitic stainless steel (CASS) reactor coolant system piping and fittings and the pressurizer surge line nozzle. For PWRs, NUREG-1801 recommends further evaluation of piping that does not meet the reactor water chemistry guidelines of TR-105714, "PWR Primary Water Chemistry Guidelines, Revision 3," November 1995, or later. Since Millstone Unit 2 uses the guidelines of Revision 4 to TR-105714, no further evaluation of a plant-specific AMP is required since the applicant minimizes the potential for SCC by using the later revision of TR-105714 in accordance with NUREG-1801. In addition the applicant uses AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports" to manage cracking of CASS components. The applicant's AMP B2.1.18 includes the AMP recommendations for CASS components in NUREG-1801, AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," and AMP XI.M1, "ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD."

Crack initiation and growth due to PWSCC could occur in PWR pressurizer instrumentation penetrations and heater sheaths and sleeves made of nickel-based alloys. The existing program relies on ASME Section XI Inservice Inspection (ISI) and on control of water chemistry to mitigate PWSCC. However, the existing program should be augmented to manage the effects of SCC on the intended function of components fabricated from nickel-based alloys. NUREG-1801 recommends that the applicant provide a plant-specific AMP or participate in industry programs to determine an appropriate AMP for PWSCC of Inconel 182 weld. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR). The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects. Millstone Unit 2 has nickel-based alloys (Alloy 600 and 82/182) in the pressurizer instrumentation penetrations and heater sheaths and sleeves. Millstone Unit 2 has no reactor vessel bottom mounted instrumentation penetrations. Millstone Unit 2 has committed to participate in industry programs to determine appropriate measures to manage PWSCC. This commitment is identified in the Millstone Unit 2 LRA, Appendix A, Table A6.0-1 License Renewal Commitments, Item 14. In addition, the applicant has committed to replace the pressurizer with PWSCC resistant material. The aging management program for PWSCC is discussed in AMP B2.1.18. Additional assurance of crack detection is through the boric acid corrosion program, which is described in AMP B2.1.3. In this program leakage detection is utilized to detect cracks in Alloy 600 base metal and Alloy 82/182 weld metal components in the pressurizer, as specified in NRC Bulletin 2004-01.

The pressurizer spray head for the Millstone Unit 2 is a nickel-based alloy and not CASS. The plant-specific aging management program for managing the aging effects associated with the pressurizer spray head is the chemistry control for primary systems program. NUREG-1801 recommends a plant-specific AMP to be evaluated to manage PWSCC of Alloys 600 and 82/182. However, Dominion stated that it intends to replace the Unit 2 pressurizer during the fall 2006 refueling outage. The replacement pressurizer will be constructed of PWSCC-resistant materials. Therefore, since the pressurizer will be replaced with PWSCC-resistant material, no further evaluation is required for the pressurizer spray head.

The staff's evaluation of the chemistry control for primary systems program and the inservice inspections programs: systems, components and supports program is documented in Section 3.0.3.2.2 and Section 3.0.3.2.13 of this SER, respectively.

The nickel-based alloys aging management activity is part of MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," and the staff's evaluation of the nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) aging management is documented in Section 3.0.3.2.13 of the SER.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to stress corrosion cracking or primary water stress corrosion cracking for components in the reactor systems, as recommended in NUREG-1801. On the basis of this finding, and the finding that the remainder of the applicant's program is consistent with NUREG-1801, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2.8 Crack Initiation and Growth Due to Stress Corrosion Cracking or Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.8 against the criteria in SRP-LR Section 3.1.2.2.8.

In LRA Section 3.1.2.2.8, the applicant addressed crack initiation and growth due to SCC or irradiation-assisted stress corrosion cracking (IASCC) that could occur in baffle/former bolts in the reactor. The applicant stated that Unit 2 reactor vessel internals do not include baffle/former bolts and that the discussion in this paragraph of the SRP-LR is not applicable. SRP-LR Section 3.1.2.2.8 stated that crack initiation and growth due to SCC or IASCC could occur in baffle/former bolts in the reactors. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. On the basis that the baffle/former bolts are not part of the Unit 2 design of reactor vessel internals, the staff finds that this aging effect is not applicable to Unit 2.

3.1A.2.2.9 Loss of Preload Due to Stress Relaxation

The staff reviewed LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9.

In LRA Section 3.1.2.2.9, the applicant stated that baffle/former bolts are not used in the reactor vessel internals and that the discussion in this paragraph of the SRP-LR is not applicable. SRP-LR Section 3.1.2.2.9 stated that loss of preload due to stress relaxation could occur in baffle/former bolts in the reactor. The GALL Report recommends a plant-specific AMP to ensure that this aging effect is adequately managed. On the basis that the baffle/former bolts are not part of the Unit 2 design of reactor vessel internals, the staff finds that this aging effect is not applicable.

3.1A.2.2.10 Loss of Section Thickness Due to Erosion

The staff reviewed LRA Section 3.1.2.2.10 against the criteria in SRP-LR Section 3.1.2.2.10. In LRA Section 3.1.2.2.10, the applicant stated that the Unit 2 steam generators do not have feedwater impingement plates and that the discussion in this paragraph of the SRP-LR is not applicable. SRP-LR Section 3.1.2.2.10 stated that loss of section thickness due to erosion could occur in steam generator feedwater impingement plates and supports. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. On the basis that feedwater impingement plates are not part of the Unit 2 steam generator design, the staff finds that this aging effect is not applicable to Unit 2.

3.1A.2.2.11 Crack Initiation and Growth Due to Primary Water Stress Corrosion Cracking, Outside Diameter Stress Corrosion Cracking, or Intergranular Attack or Loss of Material Due to Wastage and Pitting Corrosion or Loss of Section Thickness Due to Fretting and Wear or Denting Due to Corrosion of Carbon Steel Tube Support Plate

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

In LRA Section 3.1.2.2.11, the applicant addressed crack initiation and growth due to PWSCC, outside diameter SCC, or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion or deformation due to corrosion that could occur in nickel-based alloy components of the steam generator tube plugs.

For the tube component type of nickel-based alloy material in a treated water environment, the plant-specific note in the LRA Table 3.1.2.4 (page 3-97), indicates that the material for this component is not addressed by the GALL Report. Furthermore, these tubes are fabricated from Alloy 690. The applicant also stated that Alloy 690 is a high-chromium nickel-based alloy that is more resistant to SCC than Alloy 600. For that reason, the applicant stated that the material match was not made to the GALL Report items that referenced Alloy 600 material. Therefore, the tubes discussion is addressed in Section 3.1A.2.3.4 of this SER.

SRP-LR Section 3.1.2.11 states that crack initiation and growth due to PWSCC, outside diameter SCC, or IGA or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in Alloy 600 components of the steam generator tubes, repair sleeves, and plugs. All PWR licensees have committed voluntarily to a steam generator degradation management program described in NEI 97-06, "Steam Generator Program Guidelines." These guidelines are currently under NRC staff review. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or other regulatory bases for steam generator degradation management, should be developed to ensure that this aging effect is adequately managed.

The SRP-LR also states that crack initiation and growth due to PWSCC, outside diameter SCC, or IGA or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in nickel-based alloy components of the steam generator tubes and plugs.

To manage the effects of aging, the applicant credits MPS AMP B2.1.23, "Steam Generator Structural Integrity," supplemented by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," and MPS AMP B2.1.6, "Chemistry Control for Secondary Systems Program." The staff's evaluation of the steam generator structural integrity program is documented in Section 3.0.3.1 of this SER. The staff reviewed the chemistry control for primary systems and chemistry control for secondary systems programs and its evaluations are documented in Section 3.0.3.2.2 and Section 3.0.3.2.3 of this SER, respectively. For general and pitting corrosion, assessment of tube integrity, and plugging or repair criteria of flawed tubes, the steam generator structural integrity program acceptance criteria are in accordance with NEI 97-06 guidelines.

On the basis of its review of the primary and secondary water chemistry control, the staff finds that the applicant appropriately evaluated AMR results involving plant-specific programs to address these aging mechanisms, as recommended in the GALL Report.

The staff finds that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.1A.2.2.12 Loss of Section Thickness Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12.

In LRA Section 3.1.2.2.12, the applicant stated that the steam generator tube support lattice bars are constructed of stainless steel. Therefore, loss of section thickness of these bars is not an applicable aging effect for Unit 2. SRP-LR Section 3.1.2.2.12 states the loss of section thickness due to FAC could occur in tube support lattice bars made of carbon steel. The GALL Report recommends that a plant-specific AMP be evaluated and, on the basis of the guidelines of NRC GL 97-06, an inspection program for steam generator internals be developed to ensure that this aging effect is adequately managed. On the basis that carbon steel tube support lattice bars are not part of the Unit 2 steam generator design, the staff finds that this aging effect is not applicable.

3.1A.2.2.13 Ligament Cracking Due to Corrosion

The staff reviewed LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13. In LRA Section 3.1.2.2.13, the applicant stated that tube support plates are not used in the steam generators. Therefore, ligament cracking due to corrosion is not an applicable aging effect for Unit 2. SRP-LR Section 3.1.2.2.13 states that ligament cracking due to corrosion could occur in carbon steel components in the steam generator tube support plate. All PWR licensees have committed voluntarily to a steam generator degradation management program described in NEI 97-06; these guidelines are currently under NRC staff review. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or other regulatory bases for steam generator degradation management, be developed to ensure that this aging effect is adequately managed. On the basis that tube support plates are not used in the steam generators at Unit 2, the staff finds that this aging effect is not applicable.

3.1A.2.2.14 Loss of Material Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.14 against the criteria in SRP-LR Section 3.1.2.2.14.

SRP-LR Section 3.1.2.2.14 states that loss of material due to FAC could occur in the feedwater inlet ring and supports. As noted in Combustion Engineering (CE) IN 90-04, NRC IN 91-19, "Steam Generator Feedwater Distribution Piping Damage," and License Event Report (LER) 50-362/90-05-01, this form of degradation has been detected only in certain CE System 80 steam generators. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting loss of material due to FAC.

The staff noted, in LRA Table 3.1.2-4 (page 3-88), that for loss of material of the feedwater inlet ring and the support component type of carbon steel exposed internally to a treated water environment, the applicant credited the chemistry control for secondary systems program. During the audit, the staff asked the applicant to clarify why the FAC program is not assigned to this component.

The applicant responded in its LRA supplement letter dated July 7, 2004, that the FAC program should be added for the feedwater inlet ring and support component type. In addition, the GALL Report item match for this entry should be IV.D1.3-a with Note B. Also, the 'Table 1 Item' entry should be 3.1.1-21. Furthermore, the applicant stated that LRA Section 3.1.2.2.14 (page 3-20) and LRA Table 3.1.1, the discussion column for Item 3.1.1-21 (page 3-30), should state:

> Although the Unit 2 steam generators are not CE System 80 steam generators, the feedwater inlet ring is included in the Flow Accelerated Corrosion program.

The staff further requested that the applicant clarify how the FAC inspection of the steam generator feedwater ring would be performed. The applicant responded that FAC inspection of the feedwater inlet is performed using the program generic FAC inspection techniques for gridding and UT.

On the basis of its review, the staff finds that the applicant has demonstrated that the effect of aging will be adequately managed so that the intended function will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2.15 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's quality assurance program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent, and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.1.2-1 through 3.1.2-4 of the Unit 2 LRA, the applicant provided additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

In Tables 3.1.2-1 through 3.1.2-4, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Staff Evaluation. For component type, material and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff's evaluation is discussed below in Sections 3.1A.2.3.1 through 3.1A.2.3.3

3.1A.2.3.1 Reactor Vessel Aging Management Evaluation - Table 3.1.2-1

In Section 3.1.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the reactor vessel and associated pressure boundary components:

- boric acid corrosion
- chemistry control for primary systems program
- inservice inspection program: reactor vessel internals
- inservice inspection program: systems, components and supports
- reactor vessel surveillance

In Table 3.1.2-1 of the LRA, the applicant provided a summary of AMRs for the reactor vessel and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

The staff reviewed Table 3.1.2-1 of the Unit 2 LRA, which summarized the results of AMR evaluations for the reactor vessel component groups. The staff has reviewed the information in this table and agrees that the applicant has identified the applicable aging effects because the aging effects are appropriate for these materials and environment and are consistent with industry operating experience, except for the following components, which are discussed below.

NUREG-1801, Section IVA2.8-b states that the pressure vessel skirt support, cantilever/column support, and neutron shield tank are subject to loss of material due to boric acid corrosion. The applicant was requested in RAI 3.1.1-1 to include this aging effect and the necessary AMPs for these components concerning loss of material due to boric acid corrosion in Table 3.1.2-1 of the LRA or provide justification for concluding that boric acid corrosion is not an aging effect.

In response to RAI 3.1.1-1, in a letter dated December 3, 2004, the applicant stated that the structural supports for major reactor coolant system components are evaluated separately from the component and its integral parts, as NSSS Equipment Supports. There are no skirt support, cantilever/column support, or neutron shield tank components for the Millstone Unit 2 reactor vessel support system. The Millstone Unit 2 reactor pressure vessel supports are included as structural members in LRA Table 3.5.2-24. Therefore, loss of material due to boric acid corrosion is identified for these structural members consistent with NUREG-1801 item III.B1.1.1-b, and is managed with the boric acid corrosion and general condition monitoring AMPs. The staff agrees that this resolves RAI 3.1.1-1.

Table 3.1.2-1 of the LRA does not specify loss of material/wear for the closure head stud assembly as identified by NUREG-1801, Section IVA.2.1-d. Therefore, the applicant was requested in RAI 3.1.1-2 to include this aging effect and the corresponding aging management program (AMP XI.M3 of NUREG-1801 "Reactor Head Closure Studs") in Table 3.1.2-1 of the LRA or provide justification for concluding that loss of material/wear is not an aging effect.

In response to RAI 3.1.1-2, in a letter dated December 3, 2004, the applicant stated that the closure head stud assembly does not experience relative motion other than normal stud removal and installation during refueling activities. These activities are closely monitored by procedure and any degradation is dispositioned by supplemental examination, corrective measures or repairs, analytical evaluation of the component function, or replacement of the component to ensure continued structural integrity and function of the component. There is no significant continuing wear to the reactor vessel closure studs that would lead to a loss of component function and require monitoring by an aging management program. Therefore, the applicant did not consider loss of material due to wear as an applicable aging effect for the closure head stud assembly. However, AMP XI.M3 of NUREG-1801 and RG 1.65 indicates that reactor closure studs are susceptible to loss of material due to wear. In addition, RG 1.65 recommends, and the applicant uses, coatings and lubrication which are used to reduce wear. Therefore, the staff requested that the LRA specify loss of material due to wear as an aging effect for the closure head stud assembly and specify the AMP to be applied.

In its response dated February 8, 2005 to supplemental RAI 3.1.1-2, the applicant stated that although wear of the reactor closure studs is not expected to affect the intended function of the bolting, loss of material due to wear will be considered as an aging effect consistent with NUREG-1801, item IV.A2.1-d. The aging effect will be managed by the inservice inspection program: systems, components and supports AMP. The staff finds this response acceptable since it has identified the applicable aging effect and provides an aging management program which requires inspection of the closure studs in accordance with the ASME Code requirements that are capable of detecting loss of material. This resolves RAI 3.1.1-2.

Table 3.1.2-1 of the LRA does not specify loss of fracture toughness/neutron irradiation embrittlement for the upper shell as identified by NUREG-1801, Section IVA.2.5-c. The applicant was requested in RAI 3.1.1-3 to include this aging effect and the corresponding aging management program (AMP XI.M31 of NUREG-1801 "Reactor Vessel Surveillance") in Table 3.1.2-1 of the LRA or provide justification for concluding that fracture toughness/neutron irradiation embrittlement is not an aging effect.

In response to RAI 3.1.1-3, in a letter dated December 3, 2004, the applicant stated loss of fracture toughness due to neutron irradiation embrittlement is an applicable aging effect for those reactor pressure vessel subcomponents exposed to a neutron fluence greater than $1x10^{17}$ n/cm^2 (E>1Mev). This threshold level of fluence is experienced by the beltline region subcomponents identified in LRA Table 3.1.2-1 as susceptible to loss of fracture toughness. Based on a supplemental evaluation performed by the applicant, the upper shell and primary outlet nozzles are subjected to loss of fracture toughness due to neutron irradiation embrittlement and will be managed with the reactor vessel surveillance AMP. In addition, the applicant's response to RAI 4.2.2-1 stated that an assessment has been performed to address an expansion of the Millstone Unit 2 reactor pressure vessel beltline region resulting from the period of extended operation. This assessment was used to evaluate all materials that were determined to exceed the $1.0x10^{17}$ n/cm^2 (E>1.0 MeV) boundary.

The applicant provided results for the upper/intermediate circumferential welds, but not for the upper shell and primary outlet nozzles that are subject to loss of fracture toughness due to neutron irradiation embrittlement. Based on the information provided by the LRA and the applicant's responses to RAIs 3.1.1-3 and 4.2.2-1, the staff notes that the applicant did not provide the USE and PTS evaluations for these reactor pressure vessel subcomponents as required by Appendix G to10 CFR Part 50, and 10 CFR 50.61, respectively.
Therefore to confirm that the USE and PTS evaluations for these subcomponents meet regulatory requirements at the end of the period of extended operation, the staff requests the applicant to include the USE and PTS evaluation (similar to the data currently in Tables 1 and 2 of the FSAR for the other reactor vessel subcomponents) for the upper shell and primary nozzles and their associated welds into Tables 1 and 2 of the Millstone Unit 2 FSAR supplement and determine the effect on the limiting materials.

In response to supplemental RAI 3.1.1-3, in a letter dated February 8, 2005, the applicant provide the USE and PTS evaluations for the upper shell and primary nozzles, and their associated welds. The applicant calculated the USE values for these materials in accordance with 10 CFR Part 50, Appendix G, and performed the PTS evaluation in accordance with 10 CFR 50.61 through the extended period of operation. The USE and PTS values for these subcomponents were also included in Tables 3.1.1-3-1 through 3.1.1-3-4 in the applicant's response for both units. The results of the USE and PTS evaluations on these expanded beltline regions had no effect on the limiting material. The staff confirmed that the limiting material previously identified in the LRA is still valid. Therefore, since the applicant evaluated all materials that were determined to exceed the $1.0x10^{17}$ n/cm^2 (E>1.0 MeV) boundary and identified that the limiting material specified in sections 4.2.2 and 4.2.3 of this SER is still valid, the staff finds this response acceptable. In addition, the level of detail described in the FSAR supplement follows the recommendations of NUREG-1800, Table 4.2-1. This resolves RAI 3.1.1-3.

Table 3.1.2-1 of the LRA does not specify loss of material/wear for the vessel flange and core support ledge as identified by NUREG-1801, Section IVA.2.5-f. Therefore, the applicant was requested in RAI 3.1.2-1 to include the aging effect and the corresponding aging management program described in NUREG-1801 (AMP XI.M1, "Inservice inspection") in the LRA or provide justification for concluding that loss of material/wear is not an aging effect.

In its response to RAI 3.1.2-1, dated December 3, 2004, the applicant stated that loss of material due to wear was not considered an applicable aging effect for the reactor vessel flange and core support ledge since they do not experience relative motion other than normal reactor disassembly and reassembly during refueling activities. These activities are closely monitored by procedure and any degradation is dispositioned by supplemental examination, corrective measures or repairs, analytical evaluation of the component function, or replacement of the component to ensure continued structural integrity and function of the component. The applicant also stated that there is no significant continuing wear to the reactor vessel flange and core support ledge that would lead to a loss of component function that would require monitoring by an aging management program. However, the staff considers wear to be an aging effect as identified by NUREG-1801, Section IVA.2.5-f, because the reactor vessel flange and support ledge do experience relative motion during reactor disassembly and reassembly during refueling activities. This aging effect should then be monitored. Since the applicant stated this refueling activity is monitored by procedures, some type of inspection should be performed to monitor wear of these components. Therefore, the staff requested that the LRA specify loss of material due to wear as an aging effect for the reactor vessel flange and core support ledge. In addition, the applicant was requested to discuss the inspections performed by the refueling activity procedures that monitor wear for these components or include the corresponding aging management program recommended by NUREG-1801 (AMP XI.M1, "Inservice Inspection").

In its response to supplemental RAI 3.1.2-1 dated February 8, 2005, the applicant stated that although wear of the reactor vessel flange and core support ledge is not expected to affect the intended function of these components, loss of material due to wear will be considered as an aging effect consistent with NUREG-1801, Item IV.A2.5-f. The aging effect will be managed by the Millstone inservice inspection program: reactor vessels internals AMP. The staff finds this response acceptable since it has identified the applicable aging effect along with an appropriate aging management program that is consistent with NUREG-1801 for these components. This resolves RAI 3.1.2-1.

In Table 3.1.2-1, the applicant has identified cracking as an aging effect requiring management for the CEDM pressure boundary components and the vessel head penetration components manufactured from stainless steel and nickel-based alloys that are exposed to treated water. The aging effect is managed by the inservice inspection program: systems, components and supports, and the chemistry control for primary systems program. The aging effect, material, and the environment is consistent with NUREG 1801, Item IV.A2.2-a and Item IV.A2.2-b and no further evaluation is required. The staff notes that the inservice inspection program: systems, components and supports includes nickel-alloy nozzles and penetrations program. This program is used to manage PWSCC of nickel alloys. The staff concludes the inservice inspection program: systems, components and supports (which includes the nickel-alloy nozzles and penetrations program) and the chemistry control for primary systems program will be effective in managing cracking for the CEDM pressure boundary components and the vessel head penetrations.

Based on the above information, the staff finds the applicant's management of cracking to be acceptable.

In Table 3.1.2-1, the applicant also identified loss of material as an aging effect requiring management for the CEDM pressure boundary components and the vessel head penetration components manufactured from stainless steel and nickel-based alloys that are exposed to treated water. The applicant stated the aging effect is managed by the chemistry control for primary systems program. The aging effect, material, and the environment is not addressed in NUREG 1801 for Item IV.A2.2-a and Item IV.A2.2-b. In RAI 3.1-A-1 the staff requested that the applicant provide justification on why the chemistry control for primary systems program alone is sufficient to manage loss of material without the need to credit an inspection-based AMP to verify that the chemistry control program is accomplishing its mitigative aging management function.

In response to RAI 3.1-A-1, in a letter dated December 3, 2004, the applicant stated that the stainless steel and nickel-based alloy materials exposed internally to primary treated water are not expected to be subject to significant loss of material as a result of corrosion. In addition, NUREG-1801 does not identify loss of material due to corrosion as an aging effect requiring management for these materials in the RCS. However, loss of material was conservatively considered in the Millstone LRA for the RCS components in the primary water environment. The chemistry control for primary systems program provides reasonable assurance that loss of material resulting from corrosion will not prevent these components from performing their intended functions.

Verification of the effectiveness of the chemistry control for primary systems program is provided by the work control process as described in LRA Appendix B, Section B2.1.5. The work control process provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process provides input to the corrective action program if aging effects are identified. The corrective actions program evaluates the cause and extent of the condition and, if required, recommends enhancements to ensure continued effectiveness of the chemistry control for primary systems program.

In Unit 2 LRA Table 3.1.2-1, the applicant identified no aging effects for the following stainless steel and nickel-based alloy reactor vessel component types exposed externally to air: CEDM head penetration nozzle, CEDM head penetration nozzle flange, CEDM pressure housings, head vent pipe, and instrument tubes. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that dry air on metal will not result in aging that will be of concern during the period of extended operation. These RCS components are exposed to high-temperature internal flow, which creates a dry air environment. Stainless steel and nickel-based alloy components in a dry air environment are not susceptible to general corrosion that would affect their intended function. Therefore, the staff concludes that there are no applicable aging effects requiring management for metal in a dry air environment. This resolves RAI 3.1-A-1.

In Unit 2 LRA Table 3.1.2-1, the applicant proposed using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," to manage loss of material for the following stainless steel, nickel-based alloy, and low-alloy steel clad with stainless steel component types of the reactor vessel exposed internally to treated, borated water: core stabilizing lugs and core stop lugs, flow skirt flow baffle, and surveillance capsule holders; CEDM head penetration nozzle, CEDM head penetration nozzle flange, CEDM pressure housings, CEDM head dome, CEDM head flange, instrument tubes, instrument tube flange and studs/nuts/washers, head vent pipe, primary inlet/outlet nozzle and safe-end, bottom head, upper shell, and vessel flange and core support ledge. The staff accepted the chemistry control for primary systems program and its evaluation of this program is documented in Section 3.0.3.2.2 of this SER.

In Unit 2 LRA Table 3.1.2-1, for each of these same component and material combinations, the applicant is also managing cracking using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," and MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports." MPS AMP B2.1.18 is also credited with managing PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals. The staff accepted the chemistry control for primary systems program and the inservice inspection program: systems, components and supports program, and its evaluation of these programs is documented in Section 3.0.3.2.2 and Section 3.0.3.2.13 of this SER, respectively. The Alloy 600 base metal and Alloy 82/182 weld metals PWSCC management portion of the AMP has been reviewed and the staff's evaluation of this program is documented in Section 3 of this SER. The staff finds that the applicant managed cracking in a manner consistent with the GALL Report.

On the basis that cracking of stainless steel, nickel-based alloy, and low-alloy steel clad with stainless steel is being managed by the water chemistry control and inservice inspection programs, and the effects of pitting and crevice corrosion on stainless steel and nickel-based alloy components are not significant in chemically treated, borated water, the staff finds that management of loss of material using water chemistry control is adequate.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.3.2 Reactor Vessel Internals - Aging Management Evaluation - Table 3.1.2-2

In Section 3.1.2.1.2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the reactor vessel internals and associated pressure boundary components:

- chemistry control for primary systems program
- inservice inspection program: reactor vessel internals

In Table 3.1.2-2 of the LRA, the applicant provided a summary of AMRs for the reactor vessel internals and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

The staff reviewed Unit 2 LRA Table 3.1.2-2, which summarized the results of AMR evaluations for the reactor vessel internals component groups.

Table 3.1.2-2 of the LRA did not specify loss of fracture toughness/neutron irradiation embrittlement for the core support barrel upper flange as identified by Section IVB.3.3-a. Therefore, the applicant was requested in RAI 3.1.2-2 to include the aging effect and the corresponding aging management program (AMP XI.M16 of NUREG-1801 "PWR Vessel Internals") in the LRA or provide justification for concluding that fracture toughness/neutron irradiation embrittlement is not an aging effect.

In response to RAI 3.1.2-2, in a letter dated December 3, 2004, the applicant stated that due to the location of the stainless steel core support barrel upper flange, and the distance from the reactor core, loss of fracture toughness due to irradiation embrittlement is not expected to be significant. However, as part of the aging management program for the reactor vessel internals, Dominion has committed to follow the industry efforts related to internals aging issues, including neutron irradiation embrittlement. This commitment is described in LRA Appendix B, Section B2.1.17 "Inservice Inspection Program: Reactor Vessel Internals" and in LRA Appendix A, Table A6.0-1, Item 13, in a letter to NRC, S/N: 04-320 dated July 7, 2004. The staff finds this acceptable since the applicant commits to follow the industry efforts for neutron irradiation embrittlement for the applicable reactor vessel internals. This resolves RAI 3.1.2-2.

Table 3.1.2-2 of the LRA did not specify the loose parts monitoring AMP to manage the loss of preload/stress relaxation aging effect for the CEA shroud bolts as identified by NUREG-1801, Section IVB.3.2-g. Therefore, the applicant was requested in RAI 3.1.2-3 to provide this aging management program or provide justification for not including this AMP.

In response to RAI 3.1.2-3, in a letter dated December 3, 2004, the applicant stated that the bolted connections in the reactor vessel internals are managed by the effects of loss of preload by the inservice inspection program: reactor vessel internals AMP. This AMP provides for inspection of the internals in accordance with examination category B-N-3 of the ASME Code, Section XI, Subsection IWB.

These inspections include VT-3 examinations of the bolted connections to detect a gross loss of preload, such as looseness and improper fit, prior to failure of the connection. Therefore, the applicant does not rely upon the loose parts monitoring program as suggested in NUREG-1801 since this approach would require failure of the bolting in order to be effective. The staff finds this acceptable since the applicant is using inspections to prevent the failure of the bolted connections, and the use of the inspection in the inservice inspection program: reactor vessel internals AMP provides reasonable assurance that degradation would be detected prior to the loss of the intended function. This resolves RAI 3.1.2-3.

Table 3.1.2-2 of the Millstone Unit 2 LRA specified core support barrel snubber assemblies with the following aging effects: void swelling, loss of fracture toughness, and loss of material/wear. Figure 3.3-12 of the FSAR shows bolts for this assembly. In RAI 3.1.2-4, the applicant was requested to clarify if these aging effects also apply to the bolts. In addition, the applicant was requested to provide the associated AMPs or justification for concluding that these bolts are not subject to these aging effects. Also, the applicant was asked if loss of preload is an aging effect on these bolts. The appropriate AMP or justification for concluding that these bolts are not subject to loss of preload should be provided.

In response to RAI 3.1.2-4, in a letter dated December 3, 2004, the applicant stated the aging effects shown in the Millstone Unit 2 LRA, Table 3.1.2-2 for the core support barrel snubber assemblies applied to all parts of the assembly, including the bolts. The applicable aging management programs are the inservice inspection program: reactor vessel internals AMP and the chemistry control for primary systems program. The loss of preload aging effect was inadvertently omitted from LRA Table 3.1.2-2 for this assembly. The inservice inspection program: reactor vessel internals AMP manages loss of preload for this bolting through VT-3 examinations in accordance with examination category B-N-3. The staff finds this acceptable since the applicant identified the applicable aging effects for the whole snubber assembly and manages these aging effects in accordance with the ASME Code and NUREG-1801. This resolves RAI 3.1.2-4.

Table 3.1.2-2 of the Millstone Unit 2 LRA specified core shroud assembly fabricated from stainless steel. Figure 3.3-13 of the FSAR showed the core shroud assembly consists of a lower segment and an upper segment joined by tie rod assemblies. Therefore, in RAI 3.1.2-5, the applicant was requested to clarify if there are welds in the individual segments of the core shroud. If the core shroud segments are bolted, provide the aging effects, including loss of preload for these core shroud assembly bolts and the associated AMP. If these core shroud segments are welded, the applicant was asked if the welds and adjacent base material susceptible to irradiation assisted stress corrosion cracking (IASCC). In addition, the applicant was requested to provide the appropriate AMP for IASCC (including type of inspection, inspection frequency and acceptance criteria) or provide justification for concluding that these welds and adjacent base material are not susceptible to IASCC.

In response to RAI 3.1.2-5, in a letter dated December 3, 2004, the applicant stated the Millstone Unit 2 core shroud assembly upper segment and lower segment are weldments and do not include bolting. The welds are included as part of the core shroud assembly subcomponent in LRA Table 3.1.2-2 and are subjected to the aging effects identified for this subcomponent, which includes cracking (stress corrosion cracking, irradiation-assisted stress corrosion cracking) consistent with NUREG-1801, Item IV.B3.4-a. Cracking will be managed by the inservice inspection program: reactor vessel internals AMP and the chemistry control for primary systems program. The staff finds this acceptable since the applicant has identified the applicable aging effects for its design of the core shroud assembly and is managed in accordance with the recommendations of NUREG-1801. This resolves RAI 3.1.2-5.

Section 3.1.2.2.7.1 of the LRA stated that the reactor vessel flange leak detection line is not within the scope of license renewal because it does not meet the criteria of 10 CFR 54.4(a) as an intended function. However, NUREG-1801, Section IV A.2.1-f identifies that this component is subject to a crack initiation and growth/stress corrosion cracking aging mechanism. Therefore, the applicant was requested in RAI 3.1.2-6 to provide a plant-specific aging management program as identified by NUREG-1801 for cracking of this component.

In response to RAI 3.1.2-6, in a letter dated December 3, 2004, the applicant stated the reactor vessel leak detection system, including the leak detection line, is not within the scope of license renewal. As stated on page 3-18 in the Millstone Unit 2 LRA, the reactor vessel closure head and shell flanges are sealed by inner and outer hollow metallic O-rings.

Any leakage through this seal arrangement is directed to the leakage detection system through a 3/16-inch hole in the vessel flange. Leakage flow past the inner reactor vessel flange O-ring is limited in the event of seal failure by the 3/16-inch diameter hole in the reactor vessel flange which is smaller than the inside diameter of the leak detection line. Additionally, the potential flowrate through the 3/16-inch diameter hole in the flange is within the normal make-up capability of the chemical and volume control system such that the leak detection system doses not constitute the RCS pressure boundary. The failure of the leak detection system components has been evaluated and cannot affect the function of safety-related systems, structures or components. As such, the reactor vessel flange seal leak detection system, including the leak detection line does not meet the criteria of 10 CFR 54.4(a) and is not within the scope of license renewal. Therefore, the system is not subject to aging management review and there is no aging management program applicable to the leak detection line. The staff review to determine if this was acceptable was identified as Open Item 3.1.2-6.

In response to Open Item 3.1.2-6, in a letter dated April 1, 2005, the applicant revised its position and has now included the leak detection components within the scope of license renewal. In addition, the applicant stated that the leak detection system consists of piping, tubing, and valves that are long-lived, passive components and are consistent with the existing component types in the reactor coolant system included in LRA Table 2.3.1-3. These stainless steel components are exposed to a treated water environment and are managed for loss of material and cracking aging effects by the chemistry program for primary systems AMP and the inservice inspection program: systems, components, and supports as indicated for piping, tubing, and valves component types in LRA Table 3.1.2-3. The applicant noted that the loss of fracture toughness aging effect listed in Table 3.2.1-3 is not applicable to these valves since the valves are not CASS.

Based on the applicant's inclusion of the leak detection components within the scope of license renewal, Open Item 3.1.2-6 is closed.

Table 3.1.2-2 of the Millstone Unit 2 LRA did not specify a hold-down ring that is subject to loss of material/wear. The applicant was requested in RAI 3.1.2-7 to include this aging effect and the necessary aging management programs in the LRA for this component as recommended by NUREG-1801, item IV.B.3.1.4.

In response to RAI 3.1.2-7, in a letter dated December 3, 2004, the applicant stated that it uses the terminology "Expansion Compensating Ring" in LRA Table 3.1.2-2 in lieu of hold-down ring for the Millstone Unit 2 reactor vessel internals. Since the applicant includes this subcomponent in the LRA and manages the loss of material aging effect in accordance with NUREG-1801, item IV.B.3.1.4, the staff finds this response acceptable. This resolves RAI 3.1.2-7.

Table 3.1.2-2 of the Millstone Unit 2 LRA did not specify core shroud assembly bolts that are subject to fatigue, cracking, void swelling, loss of fracture toughness, and loss of preload. The applicant was requested in RAI 3.1.2-8 to include these aging effects and the necessary aging management programs in the LRA for this component as recommended by NUREG-1801, item IV.B.3.4.2.

In response to RAI 3.1.2-8, in a letter dated December 3, 2004, the applicant stated that the core shroud assembly for the Millstone Unit 2 reactor vessel internals utilizes welded construction and there are no core shroud assembly bolts. As discussed in RAI 3.1.2-5, the core shroud assembly upper segment and lower segment are weldments and do not include bolting. The two core shroud assemblies are connected using tie rod assemblies. Both of these assemblies are included in the LRA along with the applicable aging management programs in accordance with NUREG-1801. Therefore, since the core shroud design does not include core shroud assembly bolts, the staff finds the applicant's response acceptable. This resolves RAI 3.1.2-8.

Table 3.1.2-2 of the Millstone Unit 2 LRA did not specify core support column bolts that are subject to fatigue, cracking/IASCC, void swelling, and loss of fracture toughness. The applicant was requested in RAI 3.1.2-9 to include these aging effects and the necessary aging management programs in the LRA for this component as recommended by NUREG-1801, item IV.B.3.5.5.

In response to RAI 3.1.2-9, in a letter dated December 3, 2004, the applicant stated that the core support columns for the Millstone Unit 2 reactor vessel internals utilize welded construction and there are no core support column bolts. Therefore, NUREG-1801, item IV.B.3.5.5 is not applicable. The core support columns are identified in the LRA along with the applicable aging effects and aging management programs in accordance with NUREG-1801, and therefore the staff finds the applicant's response acceptable. This resolves RAI 3.1.2-9.

In Unit 2 LRA Table 3.1.2-2, the applicant proposed to manage loss of material for the following stainless steel component types of the reactor vessel internals system - control element assembly (CEA) shroud assembly components such as CEA shroud extension shaft guides, CEA shrouds - dual, CEA shrouds - single, core shroud assembly, core shroud tie rods, core support barrel, core support barrel alignment keys, core support barrel snubber assemblies, core support barrel upper flange, core support columns, core support plate, expansion compensating ring, fuel alignment pins, fuel alignment plate, fuel alignment plate guide lugs and guide lug inserts, incore instrumentation (ICI) support plate and guide tubes, lower support structure beam assemblies, and upper guide structure support plate - exposed internally to treated, borated water using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff accepted the chemistry control for primary systems program and its evaluation of this program is documented in Section 3.0.3.2.2 of this SER.

In LRA Table 3.1.2-2, for each of these same component and material combinations, the applicant stated that it is also managing cracking using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," and MPS AMP B2.1.17, "Inservice Inspection Program: Reactor Vessel Internals." MPS AMP B2.1.17 credits the ASME Section XI, Subsection IWB, Category B-N-3 inservice inspections and additional examinations based on future industry developments. The staff reviewed the embrittlement effects on the CASS portion of the inservice inspection program: reactor vessel internal program, and its evaluation of this part of the program is documented in Section 3.0.3.2.12 of this SER. The evaluation of aging management of such issues as void swelling (change in dimensions), stress corrosion cracking (PWSCC and IGSCC) and loss of preload for the reactor vessel internals components have been reviewed and the evaluation is documented in Section 3 of this SER. The staff finds that the applicant managed cracking in a manner consistent with the GALL Report. In addition, the staff reviewed the applicable part of MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," which discusses the ASME Section XI, Subsection IWB, Category B-N-3 portion of the inservice inspection program. The staff accepted the inservice inspection program: systems, components and supports program and its evaluation of this program is documented in Section 3.0.3.2.13 of this SER.

On the basis that cracking of stainless steel is being managed by the water chemistry control and inservice inspection programs, and the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated, borated water, the staff finds that management of loss of material using water chemistry control is adequate.

The GALL Report recommends a loose parts monitoring program to manage loss of mechanical closure integrity for CEA shroud extension shaft guides, cylinders, and bases; shroud base; shroud flow channel; shroud flow channel cap; shroud shaft retention pin; shroud retention block; spanner nuts; shroud fasteners; guide tubes; ICI thimble support plate assembly; ICI support plate, grid, lifting support, lifting plate, column, plates, and funnel; pad, ring, nipple, hex bolt, and spacer; and threaded rod, hex jam nut, thimble support nut, cap screws, and reactor vessel internals.

In the Unit 2 LRA, the applicant proposed to manage this aging effect using the MPS AMP B2.1.17, "Inservice Inspection Program: Reactor Vessel Internals." The staff reviewed and accepted the inservice inspection program: reactor vessel internals program and its evaluation of this program is documented in Section 3.0.3.2.12 of this SER.

On the basis that the inservice inspection program: reactor vessel internals program detects aging effects prior to the loss of mechanical integrity of these components, the staff finds that the use of this program in lieu of a loose parts monitoring program is acceptable.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.3.3 Reactor Coolant - Aging Management Evaluation - Table 3.1.2-3

In Section 3.1.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the reactor coolant system and associated pressure boundary components:

- boric acid corrosion
- chemistry control for primary systems program
- closed-cycle cooling water system
- general condition monitoring
- inservice inspection program: systems, components and supports
- work control process

In Table 3.1.2-3 of the LRA, the applicant provided a summary of AMRs for the reactor coolant system and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

The staff reviewed the Unit 2 LRA Table 3.1.2-3, which summarized the results of AMR evaluations for the RCS component group.

In Unit 2 LRA Table 3.1.2-3, the applicant identified no aging effects for the following stainless steel, nickel-based alloy, and carbon steel component types exposed externally to air for the RCS: flow orifices, piping, tubing, valve; pressurizer nozzles, safe-ends and instruments and heaters (sheaths and sleeves), manway cover and insert; quench tank, reactor coolant pump (RCP) seal coolers, RCP thermal barriers, RCP casing, RCP rupture disks. Air is not identified in the GALL Report as an environment for these components and materials.

In the Unit 2 LRA, the applicant stated that the RCS stainless steel components are externally insulated. The applicant's FSAR concludes (page 5-6) that the use of external thermal insulation on RCS components in conformance with RG 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel," dated December 1973, provided reasonable assurance that the reactor coolant pressure boundary material will be adequately protected from conditions that would lead to loss of integrity from stress corrosion. Based on its review of the applicant's FSAR, the staff agreed with the applicant that the RCS stainless steel components are adequately protected from conditions that could lead to loss of integrity from stress corrosion.

On the basis of its review of current industry research and operating experience, the staff finds that dry air on metal will not result in aging that will be of concern during the period of extended operation. These RCS components are exposed to high-temperature internal flow, which creates a high-temperature dry air environment, and general corrosion is not likely to occur under such an environment. Additionally, stainless steel and nickel-based alloy in a dry air environment are not susceptible to general corrosion that would affect the intended function of components. The only carbon steel component is the pressurizer manway cover and insert, which is inspected each time the manway is opened. Therefore, the staff concluded that there are no applicable aging effects requiring management for metal in a dry air environment.

In Unit 2 LRA Table 3.1.2-3, the applicant identified the RCP seal cooler inner tube exposed to borated treated water as subject to cracking which is being managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." During the audit and review, the staff asked the applicant what other means are used to manage cracking and to explain the consequence of the inner tube cracking on safety functions. The applicant responded that in the event cracking does occur, the radiation monitors in the reactor building closed cooling water (RBCCW) system will detect activity and a corrective action report will be initiated to correct the condition. The applicant also stated to the staff that a plant modification has been implemented to address the inter-system loss-of-coolant accident (LOCA) concern of the RCP seal cooler (inner tube) failing. Furthermore, the applicant's FSAR Section 9.4.3.2 described the relief valves that were added to protect the RBCCW system from an inter-system LOCA from a RCP seal cooler (inner tube) failure.

In an LRA supplement letter dated July 7, 2004, the applicant stated that for RCP seal cooler (inner tube) exposed to treated water subject to cracking, which is being managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," the GALL Report match for the RCP seal cooler (inner tube) (Unit 2 LRA page 3-82) should be changed to "None." In addition, Note E will be changed to Note H and a new plant-specific note will be added that states the following:

> Cracking of the component group "RCP Seal Cooler (Inner Tube)" is managed by Primary Water Chemistry. However, there are additional means for detecting cracking. The additional means consist of monitoring the radiation monitors in the RBCCW System and chemistry sampling of the RBCCW.

On the basis that inservice inspection is not feasible, the staff reviewed the applicant's FSAR and determined that the applicant has demonstrated that the cracking will be adequately managed by the primary water chemistry control program and radiation monitoring in the RBCCW system.

In Unit 2 LRA Table 3.1.2-3 (page 3-83), the applicant stated that the CASS RCP thermal barrier exposed to treated water with aging effect of cracking is to be managed by the chemistry control for primary systems program and the inservice inspection program: systems, components and supports program. The staff asked the applicant to clarify which part of the inservice inspection program is being credited with managing the aging effect for the RCP thermal barrier. The applicant responded that it was confirmed with the inservice inspection coordinator that the inservice inspection program does not perform examinations associated with the thermal barriers. The work control process program is credited for managing the effects of aging for the RCP thermal barriers. The RCPs are refurbished, designated as spares, and reinstalled during future outages. Examples of work orders are identified where, through the work control process program, the thermal barriers associated with spare RCPs are blown down of the closed cooling water and a sample of the closed cooling water is taken.

The applicant submitted an LRA supplement letter, dated July 7, 2004, which stated the following in response to the staff's request for clarification:

> Note 6 should be added for Unit 2 LRA Table 3.1.2-3 (page 3-83) for the RCS component group 'RCP Thermal Barriers' and aging effect 'Loss of Fracture Toughness.' The Note for this item is revised by Item 42-1 of this clarification letter and is applicable to this component because it is CASS material.
>
> The "Inservice Inspection Program: Systems, Components and Supports" should be replaced by the "Work Control Process" for Unit 2 LRA Table 3.1.2-3 (page 3-83), for the RCS component group 'RCP Thermal Barriers' and aging effect 'Cracking.' The Note for this item should be "E" in the Unit 2 LRA. Also, the "Discussion" column in Unit 2 Table 3.1.1, Item 3.1.1-36 (page 3-33), should read as follows:
>
>> Not consistent with NUREG-1801. Cracking is managed with the chemistry control for primary systems program and the inservice inspection program: systems, components and supports except for the RCP thermal barriers, which are managed with chemistry, and the work control process. These programs take some exceptions to the NUREG-1801 AMPs.

The staff reviewed the work control process program and Specification SP-EE-364, "Specification for Refurbishment of a Millstone Unit 2 Reactor Coolant Pump Motor," Revision 1, dated July 7, 1996, and determined that the applicant has demonstrated that the effects of aging of RCP thermal barriers will be adequately managed.

In Unit 2 LRA Table 3.1.2-3 (page 3-79), the applicant stated that for the pressurizer spray head assembly/nozzle assembly component type of nickel-based alloy material in a treated water and steam environment, the applicant credits the chemistry control for primary systems program to manage cracking. The staff asked the applicant to provide justification regarding how PWSCC can be managed by the chemistry control for primary systems program alone. The applicant responded that it intends to replace the Unit 2 pressurizer during the fall 2006 refueling outage.

The replacement will be fabricated with PWSCC resistant materials as described in a letter dated June 3, 2004.

The staff reviewed the letter and determined that the aging effect of PWSCC will be reduced on the basis of a new replacement pressurizer fabricated with increased PWSCC resistant materials.

Table 3.1.2-3 of the LRA specifies the use of AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," for closure bolting in the RCP, valves and pressurizer manways. In addition, Section B2.0 of Appendix B of the LRA states that the aging management review did not identify the need for the "Bolting Integrity" AMP. However, NUREG-1801, Sections IVC2.3-e, IVC2.3-g, IVC2.4-e, IVC2.4-g, IVC2.5-n and IVC2.5-p specifies the use of AMP XI.M18, "Bolting Integrity" for these components. AMP XI.M18 of NUREG-1801 incorporates the requirements and guidelines of NUREG-1339, EPRI NP-5769 and EPRI TR-104213 concerning material selection, bolting preload control, inservice inspections, plant operation and maintenance, and evaluation of the structural integrity of bolted joints. Therefore, the applicant was requested in RAI 3.1.1-1 to provide the bolting integrity AMP as identified by NUREG-1801, or include all of the necessary information discussed above into AMP B2.1.18 of the LRA.

In response to RAI 3.1.3-1, in a letter dated December 3, 2004, the applicant stated that it has developed a specific bolting integrity AMP to manage the aging effects for closure bolting in the reactor coolant pump, valves and pressurizer manway. This response is acceptable since the applicant will manage the closure bolting of these components with a bolting integrity AMP as specified in NUREG-1801. The bolting integrity AMP is evaluated in Section 3.0.3.2.18 of this SER. This resolves RAI 3.1.3-1.

For the CASS spray head assembly identified in Table 3.1.2-3 of the LRA, the applicant specified the chemistry control AMP to manage cracking. NUREG-1801, Section IVC2.5-j, recommends a plant-specific AMP to be used to manage cracking. Therefore, the applicant was requested in RAI 3.1.3-2 to provide this AMP to the NRC for evaluation as recommended by NUREG-1801, Section IVC2.5-j.

In response to RAI 3.1.3-2, in a letter dated December 3, 2004, the applicant stated that material for the Millstone Unit 2 pressurizer spray head is a nickel-based alloy and not CASS. The plant-specific aging management program for managing the aging effects associated with the pressurizer spray head is the chemistry control for primary systems program.
In addition, Dominion intends to replace the Unit 2 pressurizer during the fall 2006 refueling outage. The replacement pressurizer will be constructed of PWSCC-resistant materials. The replacement of the pressurizer is also discussed in the evaluation of AMP B2.1.18. In response to RAI B2.1.18-1, also in the dated December 3, 2004, letter, the applicant stated that Dominion intends to replace the pressurizer during the fall of 2006 refueling outage for Millstone Unit 2 using materials that are resistant to PWSCC, as documented in its letter dated June 3, 2004. To track this commitment, the applicant is requested to revise the List of Commitments (Table A6.0-1 of Appendix A to the Millstone Unit 2 LRA) to include the commitment that the Millstone Unit 2 pressurizer will be replaced in fall 2006 with material resistant to PWSCC (i.e. Alloy 690 and 52/152). This is evaluated in Section 3.0.3.2.13 of this SER. This resolves RAI 3.1.3-2.

Table 3.1.2-3 of the Millstone Unit 2 LRA does not specify the pressurizer integral support that is subject to fatigue, cracking/IASCC, and boric acid corrosion. The applicant was requested in

RAI 3.1.3-4 to include these aging effects and provide the necessary aging management programs in the LRA for this component as recommended by NUREG-1801, item IV.C.2.5.12.

In response to RAI 3.1.3-4, in a letter dated December 3, 2004, the applicant stated that the integral supports identified in NUREG-1801 are considered to be the same as the component type "Pressurizer (Seismic and Valve Support Lugs)" and "Pressurizer (Support Skirt and Flange)" in the Millstone Unit 2 LRA, Table 3.1.2-3. The aging effects of loss of material due to boric acid corrosion and cracking are identified for these components consistent with NUREG-1801, Item IV.C.2.5.12. Fatigue is addressed as a TLAA and is identified in LRA Table 3.1.1, item 3.1.1-10. Since the pressurizer seismic lugs, support skirt, and flange are the integral supports, and are identified in the LRA along with the applicable AMPs consistent with NUREG-1801, the staff finds this response acceptable. This resolves RAI 3.1.3-4.

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the pressurizer, such that there is reasonable assurance that the component intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.3.4 Steam Generators Summary of Aging Management - Table 3.1.2-4

In Section 3.1.2.1.4 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the steam generator and associated pressure boundary components:

- boric acid corrosion
- chemistry control for primary systems program
- chemistry control for secondary systems program
- flow-accelerated corrosion
- inservice inspection program: systems, components and supports
- steam generator structural integrity
- work control process

In Table 3.1.2-4 of the LRA, the applicant provided a summary of AMRs for the steam generator and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

The applicant replaced the two steam generators (SGs) at Millstone Unit 2 in 1993 with replacement SGs fabricated by Babcock and Wilcox International. Each replacement SG nominally contains 8,523 thermally treated Alloy 690 tubes. Thermally treated Alloy 690 tubes have been shown in laboratory tests and operating nuclear power plants to be more resistant to PWSCC and outside diameter stress corrosion cracking (ODSCC) than the original mill annealed Alloy 600 tubes. Each tube has a nominal outside diameter of 0.750-inch and a nominal wall thickness of 0.0445-inch. The tubes were hydraulically expanded at both ends for the full length of the tubesheet and are supported by a number of Type 410 stainless steel tube support plates with a lattice arrangement. The U-bends of the tubes installed in rows 1 through 8 were thermally stress-relieved after bending.

The staff reviewed Table 3.1.2-4 of the Unit 2 LRA, which summarized the results of AMR evaluations for the steam generator component groups.

In LRA Table 3.1.2-4, the applicant identified the inservice inspection program as the AMP to manage the aging effect of cracking in the SG base support and flange, support brackets and lugs for Unit 2. In RAI 3.1.2-4-1, the staff asked the applicant to provide details for some of the AMP attributes (e.g., preventive actions, parameters monitored/inspected, detection of aging effects, monitoring and trending, and acceptance criteria) for these components since they are not addressed in the GALL inservice inspection AMP.

By letter dated December 3, 2004, the applicant responded that in GALL AMP XI.M1, the program scope of the inservice inspection AMP includes "all pressure retaining components and their integrally welded attachments." The integral weld attachment of the base support to the steam generators is included under ASME Section XI, Subsection IWB. The flange, support brackets and lugs are included under ASME Section XI, Subsection IWF. In LRA Appendix B Table B2.0, the applicant lists all the GALL AMPs and the designated Millstone AMP that meets the GALL requirements. In Table B2.0, the applicant stated that the inservice inspection AMP will address GALL Section XI.M1, ASME Section XI Inservice Inspections, Subsection IWB, IWC and IWD and Section XI.S3, ASME Section XI, Subsection IWF (for supports). Since the program elements in NUREG-1801, XI.M1 and XI.S3 are both addressed by the Millstone inservice inspection AMP, the applicant stated that they do not need to describe separately the attributes mentioned above. The staff finds the applicant's response acceptable because the applicant has clarified that the GALL inservice inspection AMP attributes for the base support flange, support brackets and lugs are addressed in the applicant's Inservice Inspection AMP.

In LRA Table 3.1.2-4, the applicant identifies cracking as the aging effect for the primary instrument nozzles and tube plugs under treated water. In RAI 3.1.2-4-2, the staff asked the applicant to identify the mechanism for cracking in the primary instrument nozzles and tube plugs (e.g., PWSCC or ODSCC).

By letter dated December 3, 2004, the applicant responded that consistent with GALL, the cracking mechanism for the primary instrument nozzles and tube plugs subcomponents is PWSCC. The staff finds the applicant's response acceptable because the applicant clarified that the aging mechanism for the primary instrument nozzles and tube plugs is PWSCC, consistent with what is stated in GALL.

In LRA Table 3.1.2-4, the applicant identified cracking as an aging effect and the inservice inspection as the AMP for the primary manway bolting in the air environment. In RAI 3.1.2-4-3, the staff asked the applicant to clarify the aging mechanism for cracking and to explain how the inservice Inspection AMP is used to manage this aging effect similar to the recommended bolting integrity AMP in the GALL.

By letter dated December 3, 2004, the applicant responded that consistent with GALL, the aging mechanism for the primary manway bolting is stress corrosion cracking, which can result from flaw initiation and growth. The applicant stated that it will implement a bolting integrity program to manage the aging effect of stress corrosion cracking as stated in GALL IV.D1.1-I. The staff finds the applicant's response acceptable because it is consistent with GALL.

In LRA Table 3.1.2-4, the applicant identified the only aging effect as cracking and the inservice inspection program as the AMP for the secondary manway and handhole bolting in the air environment. In RAI 3.1.2-4-4, the staff asked the applicant to justify why loss of preload and stress relaxation are not applicable aging effects, as stated in GALL IV.D1.1-f.

By letter dated December 3, 2004, the applicant responded that loss of preload due to stress relaxation is not an applicable aging effect for the ASME Class 2 secondary manway and handhole bolting. The applicant uses SA-193, Grade B7 bolting for these applications. The applicant stated that, according to ASME Section II, Part D, Table 4, stress relaxation may occur at temperatures of 700 °F or higher for Grade B7 bolting materials. The applicant's normal operating reactor coolant system hot leg temperature, which bounds the maximum temperature for SG secondary side components, is 600.5 °F for Unit 2 and 618 °F for Unit 3.

The applicant stated that since these temperatures are below the 700 °F, loss of preload due to stress relaxation is not an aging effect requiring aging management. The staff reviewed the operating thresholds and footnotes for stress relaxation in Section II of the ASME Boiler and Pressure Vessel Code for these bolting materials and confirmed that the applicant's determination is valid. The staff finds the applicant's response acceptable because the bolts will not be exposed to temperatures in excess of the threshold for stress relaxation in the bolting materials.

In LRA Table 3.1.2-4, the applicant identified loss of material as the aging effect for the tube supports lattice rings. In RAI 3.1.2-4-5, the staff stated that cracking is also a potential aging effect and therefore asked the applicant to justify why cracking is not considered as an aging effect for the tube support lattice rings under treated water and steam.

By letter dated December 3, 2004, the applicant responded that only high-strength carbon steels are susceptible to this stress corrosion cracking in this environment. Since the tube support lattice rings are made of carbon steel and not high strength carbon steel, they are not susceptible to stress corrosion cracking under the steam generator secondary-side environment. The staff finds the applicant's response acceptable because based on operating experience, carbon steel is not likely to be susceptible to stress corrosion cracking under the steam generator secondary-side environment.

In Unit 2 LRA Table 3.1.2-4, the applicant identified no aging effects for the following nickel-based alloy, low-alloy steel, and carbon steel component types of the steam generator exposed externally to air: primary instrument nozzles, primary manway cover and diaphragm, secondary manway and handhole covers, secondary side nozzles, safe-ends, transition cone, upper and lower shell. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of the current industry research and operating experience, the staff finds that dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air which is reactor building air environment. Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Nickel-based alloy and stainless steel are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concluded that there are no applicable aging effects requiring management for these metals in a dry air environment.

In Unit 2 LRA Table 3.1.2-4, the applicant proposed to use water chemistry control programs to manage loss of material for the following stainless steel, carbon steel, low-alloy steel, and nickel-based alloy component types of the steam generator that are exposed to treated water/steam and borated water: divider plate; feedwater inlet ring and support; feedwater nozzle and safe-end; feedwater nozzle thermal sleeve; lower head; primary manway cover and diaphragm; primary nozzle and safe-end (and cladding); secondary manway and handhole covers; secondary side nozzle (except steam and feedwater); shroud; steam nozzle and safe-end; steam nozzle flow restrictor; top head; tube support lattice bars; tube support lattice support rings; tubesheet (and cladding); steam generator tube plugs; and steam generator U-tubes. Additionally, the tubesheet, steam generator U-tubes, and tube support lattice support rings also are managed by the steam generator structural integrity program. The staff accepted MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," and MPS AMP B2.1.6, "Chemistry Control for Secondary Systems Program," and its evaluation of these AMPs is documented in Section 3.0.3.2.2 and Section 3.0.3.2.3 of this SER, respectively. The steam generator structural integrity program has been reviewed and is evaluated in Section 3 of this SER.

On the basis of industry operating experience with these materials and use of a water chemistry control program consistent with the GALL Report, the staff finds this acceptable.

In the Unit 2 LRA Table 3.1.2-4, the applicant proposed to use water chemistry control programs to manage cracking for the following stainless steel component types of the steam generator that are exposed to borated water: divider plate, primary manway cover, and diaphragm. The applicant stated that the divider plate and primary manway are not inspected under the inservice inspection program; however, the components are inspected each time the manway is opened. The staff reviewed the applicant's specification SP-21172, "Inservice Inspection of SGs," and determined that the applicant adequately manages the aging effect.

The staff finds that management of cracking in low-alloy steel and carbon steel exposed to treated water using water chemistry control verified by inservice inspection is acceptable, as recommended by the GALL Report.

The staff finds that management of cracking in stainless steel exposed to treated water using water chemistry control is acceptable, as recommended by the GALL Report.

All other AMRs assigned to the staff in LRA Tables 3.1.2-1 through 3.1.2-4 were evaluated. The staff finds them to be acceptable.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report or not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the of the reactor vessel, internals, reactor coolant system, and steam generator components and component types that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the reactor vessel, internals, and reactor coolant system components, as required by 10 CFR 54.21(d).

3.1B Unit 3 Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the reactor vessel, internals, and reactor coolant system components and component groups associated with the following systems:

- reactor vessel
- reactor vessel internals
- reactor coolant system
- steam generator

3.1B.1 Summary of Technical Information in the Application

In LRA Section 3.1, the applicant provided AMR results for reactor vessel, internals, and reactor coolant system components and component groups. In LRA Table 3.1.1, "Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Vessel, Internals, and Reactor Coolant System," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the reactor vessel, internals, and reactor coolant system components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1B.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluations are documented in the staff's MPS audit and review report and are summarized in Section 3.1B.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.1.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluation are documented in the MPS audit and review report and are summarized in Section 3.1B.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with or not addressed in the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluation is documented in the MPS audit and review report and summarized in Section 3.1B.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.1B.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the reactor vessel, internals, and reactor coolant system components.

Table 3.1B-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.1 that are addressed in the GALL Report.

Table 3.1B-1 Staff Evaluation for Reactor Vessel, Internals, and Reactor Coolant System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor coolant pressure boundary components (Item Number 3.1.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue
Steam generator shell assembly (Item Number 3.1.1-02)	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry	Chemistry control for secondary systems program (B2.1.6); Inservice inspection program: systems, components, and supports (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.2)
Pressure vessel ferritic materials that have a neutron fluence greater than 1.0E17 n/cm2 (E>1 MeV) (Item Number 3.1.1-04)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99	TLAA	This TLAA is evaluated in Section 4.2, Reactor Vessel Neutron Embrittlement.

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor vessel beltline shell and welds (Item Number 3.1.1-05)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Reactor vessel surveillance (B2.1.20)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.3)
Westinghouse and Babcock & Wilcox (B&W) baffle/former bolts (Item Number 3.1.1-06)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant-specific	Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.3)
Small-bore reactor coolant system and connected systems piping (Item Number 3.1.1-07)	Crack initiation and growth due to SCC, IGSCC, and thermal and mechanical loading	Inservice inspection; water chemistry; one-time inspection	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.4)
Vessel shell (Item Number 3.1.1-10)	Crack growth due to cyclic loading	TLAA		Not applicable (See Section 3.1.2.2.5)
Reactor internals (Item Number 3.1.1-11)	Changes in dimension due to void swelling	Plant-specific	Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.6)
PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains (Item Number 3.1.1-12)	Crack initiation and growth due to SCC and/or PWSCC	Plant-specific	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18); Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)
Cast austenitic stainless steel (CASS) reactor coolant system piping (Item Number 3.1.1-13)	Crack initiation and growth due to SCC	Plant-specific	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni alloys (Item Number 3.1.1-14)	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.7)
Westinghouse and B&W baffle former bolts (Item Number 3.1.1-15)	Crack initiation and growth due to SCC and irradiation-assisted stress corrosion cracking (IASCC)	Plant-specific	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.8)
Westinghouse and B&W baffle former bolts (Item Number 3.1.1-16)	Loss of preload due to stress relaxation	Plant-specific	Inservice Inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.9)
Steam generator feedwater impingement plate and support (Item Number 3.1.1-17)	Loss of section thickness due to erosion	Plant-specific		Not applicable (See Section 3.1.2.2.10)
(Alloy 600) Steam generator tubes, repair sleeves, and plugs (Item Number 3.1.1-18)	Crack initiation and growth due to PWSCC, ODSCC, and/or IGA or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry	Chemistry control for primary systems program (B2.1.5); Chemistry control for secondary systems program (B2.1.6); Steam generator structural integrity (B2.1.22)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.11)
Tube support lattice bars made of carbon steel (Item Number 3.1.1-19)	Loss of section thickness due to flow-accelerated corrosion	Plant-specific		Not applicable (See Section 3.1.2.2.12)
Carbon steel tube support plate (Item Number 3.1.1-20)	Ligament cracking due to corrosion	Plant-specific		Not applicable (See Section 3.1.2.2.13)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steam generator feedwater inlet ring and supports (Item Number 3.1.1-21)	Loss of material due to flow accelerated corrosion	Combustion Engineering steam generator feedwater ring inspection	Flow accelerated corrosion (B2.1.11) (for feedwater inlet ring)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.14) Although the Unit 3 steam generators are not CE System 80 steam generators, the feedwater inlet ring is included in the flow accelerated corrosion program.
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-22)	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
CASS pump casing and valve body (Item Number 3.1.1-23)	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1B.2.1.1)
CASS piping (Item Number 3.1.1-24)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1.1)
BWR piping and fittings; steam generator components (Item Number 3.1.1-25)	Wall thinning due to flow- accelerated corrosion	Flow- accelerated corrosion	Flow- accelerated corrosion (B2.1.11)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
RCPB valve closure bolting, manway and holding bolting, and closure bolting in high pressure and high temperature systems (Item Number 3.1.1-26)	Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting integrity	Consistent with GALL, (See Section 3.1.2.1.2)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
CRD nozzle (Item Number 3.1.1-35)	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting) (Item Number 3.1.1-36)	Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC	Inservice inspection; water chemistry	Chemistry control for primary systems program (B2.1.5); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor vessel internals CASS components (Item Number 3.1.1-37)	Loss of fracture toughness due thermal aging, neutron irradiation embrittlement, and void swelling	Thermal aging and neutron irradiation embrittlement	Inservice inspection program: reactor vessel internals (B2.1.17)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
External surfaces of carbon steel components in reactor coolant system pressure boundary (Item Number 3.1.1-38)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Steam generator secondary manways and handholds (carbon steel) (Item Number 3.1.1-39)	Loss of material due to erosion	Inservice inspection		Not applicable (See Section 3.1.2.3.4) The steam generators are recirculating-type steam generators.
Reactor internals, reactor vessel closure studs, and core support pads (Item Number 3.1.1-40)	Loss of material due to wear	Inservice inspection	Inservice inspection program: reactor vessel internals (B2.1.17); Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Pressurizer integral support (Item Number 3.1.1-41)	Crack initiation and growth due to cyclic loading	Inservice inspection	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Upper and lower internals assembly (Westinghouse) (Item Number 3.1.1-42)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring	Inservice inspection program: reactor vessel internals (B2.1.17)	Not consistent with GALL (See Section 3.0.3.2.12)
Reactor Vessel internals in fuel zone region (except Westinghouse B&W baffle former bolts) (Item Number 3.1.1-43)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	PWR vessel internals; water chemistry	Inservice inspection program: reactor vessel internals (B2.1.17); Chemistry control for primary systems program (B2.1.5)	Consistent with GALL (See Section 3.1.2.1.3)
Steam generator upper and lower heads, tubesheets, and primary nozzles and safe ends (Item Number 3.1.1-44)	Crack initiation and growth due to SCC, PWSCC, and/or IASCC	Inservice inspection; water chemistry	Inservice inspection program: systems, components and supports (B2.1.18); Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Vessel internals (except Westinghouse and B&W baffle former bolts) (Item Number 3.1.1-45)	Crack initiation and growth due to SCC and IASCC	PWR vessel internals; water chemistry	Inservice inspection program: reactor vessel internals (B2.1.17); Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends no further evaluation (See Section 3.1.2.1)
Reactor internals (B&W screws and bolts) (Item Number 3.1.1-46)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	Not applicable	Not applicable (reactor vessel internals were not designed by B&W)
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-47)	Loss of material due to wear	Reactor head closure studs		Not consistent with GALL (See Section 3.1.2.3)
Reactor internals (Westinghouse upper and lower internal assemblies, CE bolts and tie rods) (Item Number 3.1.1-48)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	Inservice inspection program: reactor vessel internals (B2.1.17)	Not consistent with GALL (See Section 3.0.3.2.12)

The staff's review of the MPS reactor vessel, internals, and reactor coolant system and associated components followed one of several approaches. One approach, documented in Section 3.1B.2.1, involves the staff's review of the AMR results for components in reactor vessel, internals, and reactor coolant system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.1B.2.2, involves the staff's review of the AMR results for components in the reactor vessel, internals, and reactor coolant system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.1B.2.3, involves the staff's review of the AMR results for components in the reactor vessel, internals, and reactor coolant system that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the reactor coolant system components is documented in Section 3.0.3 of this SER.

3.1B.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

In Section 3.1.2.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the reactor vessel, internals, reactor coolant system, and steam generator components:

- boric acid corrosion program
- chemistry control for primary systems program
- chemistry control for secondary systems program
- inservice inspection program: reactor vessel internals program
- inservice inspection program: systems, components and supports program
- reactor vessel surveillance program
- closed-cycle cooling water system program
- general condition monitoring program
- work control process program
- flow-accelerated corrosion program
- steam generator structural integrity program

Staff Evaluation. In Tables 3.1.2-1 through 3.1.2-4 of the LRA, the applicant provided a summary of AMRs for the reactor vessel, internals, reactor coolant system, and steam generator, and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.1B.2.1.1 Loss of Fracture Toughness Due to Thermal Aging Embrittlement

In the discussion section of Table 3.1.1, Item 3.1.1-24 of the LRA, the applicant stated that loss of fracture toughness is not an aging effect requiring management for applicable CASS piping and components. During the audit and review, the staff asked the applicant for clarification as to why loss of fracture toughness is not an aging effect requiring management. The applicant replied that loss of fracture toughness of the CASS piping is not an aging effect requiring management because the results of leak-before-break (LBB) analysis demonstrated that there was a large margin between detectable flaw size and flaw instability. The staff reviewed the applicant's TLAA report regarding LBB, and found that the LBB analysis is not a flaw tolerance evaluation as specified by the GALL Report. The applicant agreed that the LBB analysis cannot be used to manage the loss of fracture toughness due to thermal aging embrittlement. The applicant submitted an LRA supplement letter, dated July 7, 2004, and stated as follows:

Note "6" for Tables 3.1.2-1 through 3.1.2-4 (page 3-106), should state the following:

> For potentially susceptible CASS materials, either enhanced volumetric examinations or a unit or component specific flaw tolerance evaluation (considering reduced fracture toughness and unit specific geometry and stress information) will be used to demonstrate that the thermally embrittled material has adequate fracture toughness in accordance with NUREG-1801 Section XI.M12.
>
> 'Loss of Fracture Toughness' as an aging effect for component group 'Pipe (Hot and Cold Leg Piping and Fittings)' should be added in Unit 3 Table 3.1.2-3 (page 3-80). The 'Loss of Fracture Toughness' is managed by the inservice inspection program: systems, components and supports and corresponds to NUREG-1801 Item IV.C2.1-f. The Note for this entry is "A,6" and the 'Table 1 Item' is "3.1.1-24." NOTE: Only the 'Loss of Fracture Toughness' entry will have Note "6" listed for the above component group.

The "Discussion" column in Table 3.1.1, Item 24, (page 3-32), should read as follows:

> Consistent with NUREG-1801. Loss of fracture toughness is managed with the inservice inspection program: systems, components and supports and this program takes some exception to the NUREG-1801 AMP.

Additionally, a new commitment, Item 28, should be added to LRA Appendix A, Table A6.0-1 as follows and will be implemented prior to the period of extended operation:

> For potentially susceptible CASS materials, either enhanced volumetric examinations or a unit or component specific flaw tolerance evaluation (considering reduced fracture toughness and unit specific geometry and stress information) will be used to demonstrate that the thermally embrittled material has adequate fracture toughness in accordance with NUREG-1801 Section XI.M12.

The applicant modified the corresponding LRA to reflect the audit findings. The staff reviewed the applicant's LRA supplement and finds that the applicant appropriately addressed the aging mechanism with the abovementioned new commitment, as recommended in the GALL Report.

3.1B.2.1.2 Loss of Material Due to Wear; Loss of Preload Due to Stress Relaxation; Crack Initiation and Growth Due to Cyclic Loading and/or Stress Corrosion Cracking

In LRA Table 3.1.1, Item 26 (page 3-32), the applicant stated that cracking and loss of preload are managed using AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports." Also, the applicant stated that loss of material due to wear is not an aging effect requiring management for this bolting.

The staff noted that SRP-LR Table 3.1-1 recommended GALL AMP XI.M18, "Bolting Integrity," for managing closure bolting in high pressure or high temperature system for loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC.

The staff questioned the applicant on whether the resolution of all the generic safety issues for bolting, as stated in NUREG-1339, are addressed. By letter dated December 3, 2004, the applicant submitted an LRA supplement. In its supplement, the applicant stated that it has developed a specific bolting integrity aging management program that addresses degradation of bolting at MPS. The bolting integrity program is reviewed in Section 3.0.3.2.18 of this SER.

By letter dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaced the existing information in the "Discussion" column of LRA Table 3.1.1, Item 26 with "consistent with the NUREG-1801." The staff finds this acceptable since it is consistent with the GALL Report.

3.1B.2.1.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement, and Void Swelling

In LRA Table 3.1.1, Item 43 (page 3-37), the applicant stated that loss of fracture toughness is managed using MPS AMP B2.1.17, "Inservice Inspection Program: Reactor Vessel Internals." Also, the applicant stated that MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," is not credited to manage these aging effects, but is applied to all reactor vessel internals components as a corrosion mitigation program.

The staff reviewed the inservice inspection program: reactor vessel internals program and the chemistry control for primary systems program and its evaluation is documented in Sections 3.0.3.2.12 and 3.0.3.2.1 of this SER, respectively. On the basis of its review, the staff agreed with the applicant that the chemistry control for primary systems program is a corrosion mitigation program. The staff finds that the applicant's proposed program is adequate to manage loss of fracture toughness due to neutron irradiation embrittlement and void swelling.

On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its audit and review, the staff determined that for all other AMRs not requiring further evaluation, as identified in LRA Table 3.1.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In Section 3.1.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL

Report for reactor vessel, internals, reactor coolant system, and steam generator components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to pitting and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement
- crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking
- crack growth due to cyclic loading
- changes in dimension due to void swelling
- crack initiation and growth due to stress corrosion cracking or primary water stress corrosion cracking
- crack initiation and growth due to stress corrosion cracking or irradiation-assisted stress corrosion cracking
- loss of preload due to stress relaxation
- loss of section thickness due to erosion
- crack initiation and growth due to PWSCC, ODSCC, or integranular attack or loss of material due to wastage and pitting corrosion or loss of section thickness due to fretting and wear or denting due to corrosion of carbon steel tube support plate
- loss of section thickness due to flow-accelerated corrosion
- ligament cracking due to corrosion
- loss of material due to flow-accelerated corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.1.3.2 of the SRP-LR. Details of the staff's audit and review are documented in the staff's audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections of this SER.

3.1B.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.1B.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion

In LRA Section 3.1.2.2.2.1, the applicant addressed loss of material of steam generator assemblies due to pitting and crevice corrosion.

SRP-LR Section 3.1.2.2.2 states that loss of material due to pitting and crevice corrosion could occur in the steam generator shell assembly. The existing program relies on control of water chemistry to mitigate corrosion, and inservice inspection to detect loss of material. NRC IN 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," states that if general corrosion pitting of the shell exists, the existing program may not be sufficient. In that case, the GALL Report recommends augmented inspections to manage the aging effect.

The AMPs recommended by the GALL Report for managing the aging of steam generator assemblies due to pitting and crevice corrosion are GALL AMP XI.M1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD," to detect loss of material and GALL AMP XI.M2, "Water Chemistry," to mitigate corrosion. The GALL Report recommends a plant-specific program to conduct augmented inspections.

In the LRA, the applicant credited MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," and MPS AMP B2.1.6, "Chemistry Control for Primary Systems," for managing loss of material due to pitting and crevice corrosion for the internal surfaces of the steam generator shell. The staff evaluated these programs and its evaluation is documented in Section 3.0.3.2.13 and Section 3.0.3.32 of this SER, respectively.

The staff reviewed NRC IN 90-04, which identifies the need to perform augmented inspections beyond the requirements of ASME Section XI, if general corrosion pitting of the steam generator shell is known to exist, in order to differentiate isolated cracks from inherent geometric conditions. The staff reviewed operating experience which indicated that no pitting corrosion of the steam generator shell has been detected to date, and that water chemistry has been maintained for these steam generators per EPRI guidelines. The staff finds that the augmented inspections recommended by NRC IN 90-04 and referenced in the SRP-LR do not currently apply to the Unit 3 steam generators.

Also, since pitting corrosion has not been detected on the steam generator shell since installation, the staff finds that augmented inspections are not required and that the current water chemistry control and inservice inspection programs are consistent with the recommendations of the GALL Report and adequately manage this aging effect.

The staff finds that, based on the programs identified above, the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

In LRA Section 3.1.2.2.3, the applicant addressed (1) loss of fracture toughness due to neutron irradiation embrittlement for ferritic materials that have a neutron fluence of greater than 10^{17} n/cm^2 at the end of the license renewal term, (2) loss of fracture toughness due to irradiation embrittlement of the reactor vessel beltline materials, and (3) loss of fracture toughness due to irradiation embrittlement and void swelling of the Westinghouse baffle/former bolts.

SRP-LR Section 3.1.2.2.3 states that certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3 and that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). SRP-LR Section 3.1.2.2.3 also states that loss of fracture toughness due to neutron irradiation embrittlement could occur in the reactor vessel. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR 50, Appendix H, an applicant is required to submit its proposed capsule withdrawal schedule for approval prior to implementation. SRP-LR Section 3.1.2.2.3 states that loss of fracture toughness due to neutron irradiation embrittlement and void swelling could occur in Westinghouse baffle/former bolts.

The AMP recommended by the GALL Report for managing loss of fracture toughness due to neutron irradiation embrittlement in the reactor vessel is GALL AMP XI.M31, "Reactor Vessel Surveillance," which complies with the requirements of 10 CFR 50, Appendices G and H, and 10 CFR 50.61.

Certain aspects of neutron irradiation embrittlement are a TLAA as defined in 10 CFR 54.3. The TLAA is required to be evaluated in accordance with a 10 CFR 54.21(c)(1). The staff's evaluation of this TLAA can be found in Section 4.2 of this SER, following the guidance in Section 4.2 of the Standard Review Plan for License Renewal (SRP-LR).

Loss of fracture toughness due to neutron irradiation embrittlement could occur in the reactor vessel. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Thus, further staff evaluation is required for license renewal. NUREG-1801 recommends further evaluation of the reactor vessel materials surveillance program for the period of extended operation. The staff verifies that the applicant has proposed an adequate reactor vessel materials surveillance program for the period of extended operation. This staff evaluation is discussed in Section 3.0.3.1.3 of this SER.

The limiting beltline material for upper shelf energy (USE) at Millstone Unit 2 is the intermediate and lower shell beltline axial welds, heat no. A8746. The limiting beltline material for pressurized thermal shock (PTS) at Millstone Unit 2 is the Lower Shell Plate C-506-1 (Heat No. C5667-1). The Millstone Unit 2 reactor vessel surveillance program, in conjunction with TLAA analyses, effectively manages loss of fracture toughness in the beltline materials. The reactor vessel surveillance program provides adequate material property and neutron dosimetry data to predict fracture toughness in beltline materials at the end of the period of extended operation. The analyses (see TLAAs, SER Section 4.2) for the USE and PTS provide assurance that beltline material toughness values in the Millstone Unit 2 reactor vessel will remain at acceptable levels through the period of extended operation. The reactor vessel surveillance program is reviewed in SER Section 3.0.3.1.3 (AMP B2.1.20).

Loss of fracture toughness due to neutron irradiation embrittlement and void swelling could also occur in control element assembly (CEA) shroud bolts, core shroud tie rods, and core support barrel snubber assemblies. The staff reviewed the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for management of these aging effects. A combination of the ASME Section XI, Subsections IWB, IWC, and IWD inservice inspection program and the reactor vessel internals program (described in Appendix B) will be used to manage loss of fracture toughness due to neutron irradiation embrittlement and void swelling in CEA shroud bolts, core shroud tie rods and core support barrel snubber assemblies. Millstone will also participate in industry activities and monitor industry initiatives for the purpose of evaluating the significance of void swelling and fracture toughness on selected PWR reactor vessel internals components. As new information and technology becomes available, the plant-specific reactor vessel internals program will be modified to incorporate enhanced surveillance techniques. In addition, the applicant has identified the implementation of the industry initiatives as commitment 13 in Appendix A, Table A6.0-1 of the LRA. The evaluation of this program and the commitment to updating this program is addressed in Section 3.0.3.2.12 (AMP B2.1.17) of this SER.

The staff finds that the applicant's AMR results are consistent with the GALL Report and that the applicant has demonstrated that the programs to manage the effects of aging will be adequate to maintain the intended functions consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2.4 Crack Initiation and Growth Due to Thermal and Mechanical Loading or Stress Corrosion Cracking

In LRA Section 3.1.2.2.4.1, the applicant addressed the potential crack initiation and growth due to thermal and mechanical loading or SCC (including intergranular stress corrosion cracking) that could occur in small-bore RCS and connected system piping less than 4-inch nominal pipe size (NPS 4).

SRP-LR Section 3.1.2.2.4.1 states that the GALL Report recommends that a plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the period of extended operation. The applicant should verify that service-induced weld cracking is not occurring in small-bore piping less than NPS 4. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and the component's intended function will be maintained during the period of extended operation. Per ASME Section XI, 1995 edition, examination category B-J or B-F, small bore piping, defined as piping less than NPS 4, does not receive volumetric inspection.

The GALL Report recommended GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" to detect loss of material and GALL AMP XI.M2, "Water Chemistry" to mitigate SCC.

The staff reviewed LRA Section 3.1.2.2.4.1. The applicant credited MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," and MPS AMP B2.1.5, "Chemistry Control for Primary Systems," to mitigate cracking of reactor coolant piping. The staff evaluated these programs and its evaluation is documented in Sections 3.0.3.2.13 and 3.0.3.2.2 of this SER, respectively.

To address the GALL Report recommendation that a plant-specific destructive examination or an NDE that permits inspection of the inside surfaces of the piping be conducted, the applicant stated in the LRA that it has implemented an RI-ISI methodology to select RCS piping welds for inspection in lieu of the requirements specified in ASME Section XI. To address the GALL Report for a one-time inspection of small-bore piping less than NPS 4, the application indicated that small-bore pipe butt-welded connections are included in the final weld selection for performance of volumetric examination. The staff verified that the applicant used the RI-ISI process to determine the most susceptible locations for performing the volumetric examination and did not eliminate small-bore pipe welds from examination with the RI-ISI process.

The staff reviewed and verified that the applicant's RI-ISI plan will perform a volumetric examination, which is required to address cracking for small-bore Class 1 piping per ISG-12, "One-Time Inspection of Small-Bore Piping," on elements not currently required to be volumetrically examined. Based on the programs identified above, the staff finds that the applicant appropriately evaluated AMR results involving current inspection methods, as detailed in the inservice inspection program, and as supplemented by water chemistry control, for managing cracking of small-bore piping systems.

The staff finds that the applicant's AMR results are consistent with the GALL Report, and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2.5 Crack Growth Due to Cyclic Loading

NUREG-1801 recommends further evaluation of programs to manage crack growth due to cyclic loading in the reactor vessel shell. Crack growth due to cyclic loading in reactor vessel shells are evaluated as a TLAA. Growth of intergranular separations (underclad cracks) in low-alloy or carbon steel heat-affected zones under austenitic stainless steel cladding is a TLAA to be evaluated for the period of extended operation for all the SA 508-Class 2 forgings where the cladding was deposited with a high heat input welding process. Since Millstone Unit 3 does not use SA 508-Class 2 forgings in the beltline region, this evaluation is not applicable. In addition, the Millstone Unit 3 LRA, Section 3.1.2.2.5 states that there are no detected underclad cracks identified in the reactor vessel.

3.1B.2.2.6 Changes in Dimension Due to Void Swelling

In LRA Section 3.1.2.2.6, the applicant addressed changes in dimension due to void swelling that could occur in reactor internal components.

SRP-LR Section 3.1.2.2.6 states that the GALL Report recommends that changes in dimension due to void swelling in reactor internal components be evaluated to ensure that this aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated to manage the effects of changes in dimension due to void swelling and the loss of fracture toughness associated with swelling.

In general, the applicant has concluded that void swelling is an aging related effect for the reactor vessel internals, but currently only credits the ASME Section XI, Subsection IWB, Category B-N-3 inservice inspections to manage change in dimensions due to void swelling. In lieu of the implementation of augmented inspections, such as enhanced visual VT-1 examinations or enhanced volumetric examination; Millstone will follow industry efforts to determine the necessary steps for managing void swelling. Currently no augmented inspection will be performed. However, since the EPRI Materials Research Project - Reactor Internals Issue Task Group is currently addressing this issue, the applicant will follow the industry effort related to void swelling and will implement the appropriate recommendations resulting from this guidance. In addition, the applicant has identified the implementation of the industry initiatives as commitment 13 in Appendix A, Table A6.0-1 of the LRA. Further evaluation of this program and the commitment to updating this program is addressed in Section 3.0.3.2.12 (AMP B2.1.17) of this SER.

The staff finds the applicant's approach for managing changes in dimension due to void swelling acceptable because the approach will be based on the guidelines developed by the ongoing industry activities related to void swelling. The applicant has committed to implement the appropriate recommendations resulting from the industry efforts. The applicant also committed, through an LRA supplement letter dated July 7, that the revised program description, including a comparison to the 10 program elements of the GALL Report program, will be submitted to the NRC for approval prior to the period of extended operation.

On the basis of its review, the staff finds the applicant's approach for managing changes in dimension due to void swelling will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2.7 Crack Initiation and Growth Due to Stress Corrosion Cracking or Primary Water Stress Corrosion Cracking

In the LRA Section 3.1.2.2.7.1, the applicant addressed (1) crack initiation and growth due to SCC and PWSCC in the pressurizer (spray head assembly/nozzle assembly), core support pads, and instrumentation tubes (bottom head); (2) crack initiation and growth due to SCC in the hot leg and cold leg piping and fittings fabricated of CASS; and (3) crack initiation and growth due to PWSCC in nickel-based alloy material such as the pressurizer (safe-end welds, surge, spray, relief, and safety), reactor vessel (safe-end welds, primary inlet and outlet), and steam generator primary drain nozzle weld.

SRP-LR Section 3.1.2.2.7 states that:

- Crack initiation and growth due to SCC and PWSCC could occur in core support pads (or core guide lugs), instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC.

- Crack initiation and growth due to SCC could occur in CASS RCS piping and fittings and pressurizer surge line nozzles. The GALL Report recommends further evaluation of piping that does not meet either the reactor water chemistry guidelines of EPRI TR-105714 or material guidelines of NUREG-0313, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," Revision 2, January 1988.

- Crack initiation and growth due to PWSCC could occur in pressurizer instrumentation penetrations and heater sheaths and sleeves made of nickel alloys. The existing program relies on ASME Section XI inservice inspections and on control of water chemistry to mitigate PWSCC. However, the existing program should be augmented to manage the effects of SCC on the intended function of nickel-alloy components. The GALL Report recommends that the applicant provide a plant-specific AMP or participate in industry programs to determine appropriate AMPs for PWSCC of the Inconel 182 weld.

The applicant credited the following plant-specific programs for each of the three SRP-LR criteria:

- Cracking of nickel-based alloy components due to PWSCC is managed by the nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) aging management activities, which are part of MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," supplemented by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." Additionally, EPRI, through its MRP and in conjunction with the PWR owners groups, is developing a strategic plan to manage and mitigate cracking of nickel-based alloy items. The applicant stated that the guidance developed by the MRP will be used to identify the appropriate aging management activities and will implement the appropriate recommendations resulting from this guidance as described in license renewal Commitment, Item 15. Pressurizer spray head fabricated from stainless steel is not a reactor coolant pressure boundary component and is managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program."
- Crack initiation and growth due to SCC at weld connections, including the hot leg and cold leg piping and fittings, is managed by MPS AMP B2.1.5," Chemistry Control for Primary Systems Program," and MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports."
- The programs credited for the management of PWSCC of these nickel-based alloy items are the nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) aging management activities, which are part of MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," and MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." As described in Item 1 above, the applicant committed to participate in the nickel-based alloys industry programs to identify appropriate aging management activities and implement the appropriate recommendations from the guidance developed by industry programs.

The GALL Report recommends that a plant-specific aging management program be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR). The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

Crack initiation and growth due to SCC could occur in PWR CASS reactor coolant system piping and fittings and the pressurizer surge line nozzle. For PWR's, NUREG-1801 recommends further evaluation of piping that does not meet the reactor water chemistry guidelines of TR-105714, "PWR Primary Water Chemistry Guidelines, Revision 3," November 1995, or later. Since Millstone Unit 3 uses the guidelines of Revision 4 to TR-105714, no further evaluation of a plant-specific AMP is required since the applicant minimizes the potential for SCC by using the later revision of TR-105714 in accordance with NUREG-1801. In addition the applicant uses the inservice inspection program: systems, components and supports to manage cracking of CASS components. The applicant's AMP B2.1.18 includes the AMP recommendations for CASS in NUREG-1801, AMP XI.M12, Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS), and AMP XI.M1, ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD.

Crack initiation and growth due to PWSCC could occur in reactor vessel bottom head instrumentation penetrations, pressurizer instrumentation penetrations and heater sheaths and sleeves, and the pressurizer safe-ends for surge line, spray, relief and safety system lines made of nickel-based alloys. The pressurizer heater sheaths and sleeves in Millstone Unit 3 are made of stainless steel and therefore are not subject to PWSCC. The existing program relies on ASME Section XI Inservice Inspection (ISI) and on control of water chemistry to mitigate PWSCC. However, the existing program should be augmented to manage the effects of PWSCC on the intended function of components fabricated from nickel-based alloys. NUREG-1801 recommends that the applicant provide a plant-specific AMP or participate in industry programs to determine an appropriate AMP for PWSCC of Inconel 182 weld. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR). The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects. Millstone Unit 3 has nickel-based alloys (Alloy 600 and 82/182) in the reactor vessel bottom head instrumentation penetrations and the welds joining the pressurizer safe-ends to the surge, spray, relief and safety system lines. The Millstone Unit 3 LRA (Appendix A, Table A6.0-1, commitment 15) identifies that Millstone Unit 3 will participate in industry programs to determine appropriate measures to manage PWSCC and submit an appropriate AMP to the NRC staff for approval prior to entering the extended period of operation. The aging management program for PWSCC is discussed in AMP B2.1.18. Additional assurance of crack detection is through the boric acid corrosion program, which is described in AMP B2.1.3. In this program, leakage detection is utilized to detect cracks in Alloy 600 base metal and Alloy 82/182 weld metal components in the pressurizer, as specified in NRC Bulletin 2004-01.

The CASS pressurizer spray head assembly identified in Table 3.1.2-3 of the LRA specified the chemistry control AMP to manage cracking. NUREG-1801, Section IVC2.5-j identifies a plant-specific AMP to be used to manage cracking. Therefore, the applicant was requested in RAI 3.1.3-2 to provide this AMP to the NRC for evaluation as recommended by NUREG-1801, Section IVC2.5-j.

In response to RAI 3.1.3-2, in a letter dated December 3, 2004, the applicant stated that the plant-specific AMP specified in Millstone Unit 3 LRA, Table 3.1.2-3 for managing the aging effects associated with the CASS pressurizer spray head is the chemistry control for primary systems program. The RCS stainless steel materials, including the pressurizer spray head, are exposed internally to a high-quality primary water and/or steam environment that is not expected to result in significant stress corrosion cracking. Therefore, the applicant stated that the chemistry control for primary systems program AMP provides reasonable assurance that cracking resulting from SCC will not prevent the spray head from performing its intended function. The staff agrees that the water chemistry can be used to mitigate SCC, but an inspection is necessary to indicate whether the water chemistry has prevented SCC. Discussed in Section 3.1A.3. The aging management program for SCC, including the spray head is discussed in AMP B2.1.18 in SER Section 3.0.3.2.13.

The applicant stated in Section 4.3.1 of the Millstone Unit 3 LRA that the CASS pressurizer spray head assembly has been evaluated for susceptibility to thermal embrittlement using the guidance and information contained in EPRI Report TR-106092. In addition the applicant stated that acceptable results employing applicable loads (e.g., thermal cycles) and material properties have been calculated over the 60-year license renewal period. The staff notes that GALL AMP XI.M12 recommends the CASS material to be evaluated based on the criteria set forth in the May 19, 2000, NRC letter to determine susceptibility to thermal aging embrittlement. This letter provided the staff's position on thermal aging embrittlement. The staff requests that the applicant confirm that the evaluation performed meets the guidelines of the May 19, 2000, NRC letter and NUREG-1801. If the evaluation does not conform to these guidelines, the applicant is requested to provide the results of an evaluation that meets the guidelines of the May 19, 2000, NRC letter and the information (i.e., molybdenum content, casting method and percent ferrite) to confirm that the spray head satisfies the criteria set forth in the staff's letter dated May 19, 2000. The applicant is also requested to discuss how this evaluation meets the requirements of 10 CFR 54.21(c)(1)(i), (ii) or (iii).

In response to supplemental RAI 3.1.3-3, in a letter dated February 8, 2005, the applicant stated that the response to supplemental RAI 4.7.3-1(a) addresses supplemental RAI 3.1.3-3. The staff noted that the response to RAI 4.7.3-1(a) provides information on the evaluation of CASS reactor coolant pumps and not the CASS spray head assembly requested in supplemental RAI 3.1.3-3. Therefore, the applicant was requested to provide the information requested by supplemental RAI 3.1.3-3. This was identified as Confirmatory Item 3.1.3-3.

In a supplemental response to RAI 3.1.3-3, dated June 2, 2005, the applicant agreed that the guidance contained in the staff's letter to NEI, dated May 19, 2000, should be used when analyzing the pressurizer spray head through the extended period of operation. The applicant therefore initiated an evaluation of the Millstone, Unit 3 pressurizer spray head to determine the crack growth over the period of extended operation in accordance with NUREG-1801, Section XI.M12 "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," Item 6 (Acceptance Criteria) and the flaw evaluation section of the staff's letter to NEI, dated May 19, 2000. As stated in NUREG-1801, Section XI.M12, the flaw tolerance evaluation for CASS components with ferrite values up to 25 percent is performed according to the methodology associated with the ASME Code Subsection IWB-3640 procedure for submerged arc welds. The applicant, however, could not positively confirm that the ferrite content of the Millstone, Unit 3 pressurizer spray head was less than 25 percent based on the currently available data. Since the ferrite content could not be confirmed to be less than the 25 percent used in the ASME Code methodology, the applicant could not utilize the flaw tolerance evaluation to resolve this issue and decided to manage thermal aging embrittlement of the Millstone, Unit 3 pressurizer spray head by enhanced volumetric inspections performed under the aging management program, "Inservice Inspection Program: Systems, Components and Supports," in accordance with 10 CFR 54.21(a)(1)(iii). The applicant also stated that this program is consistent with NUREG-1801, Section XI.M12, which considers an enhanced volumetric inspection (ultrasonic examination) that meets the criteria of the ASME Code, Section XI, Appendix VIII, "Performance Demonstrations for Ultrasonic Examination Systems," acceptable. This commitment is contained in the Millstone, Unit 3 LRA, Appendix A, Section A6.0, Table A6.0-1 "License Renewal Commitments," Item 28, and states that either an enhanced volumetric examination or a component specific flaw tolerance evaluation (considering reduced fracture toughness and unit specific geometry and stress information) will be used to demonstrate that the thermally-embrittled material has adequate fracture toughness in accordance with NUREG-1801, Section XI.M12. The staff finds the applicant's management of thermal aging embrittlement through inspection in accordance with 10 CFR 54.21(c)(1)(iii) acceptable. The staff also finds that if the applicant can confirm the ferrite content in the future, a flaw tolerance evaluation in accordance with the guidelines of NUREG-1801, Section XI.M12 is an acceptable alternative to the volumetric examination in accordance with NUREG-1801. This evaluation would have to be submitted to the NRC for approval at least two years prior to the period of extended operation. This resolves Confirmatory Item 3.1.3-3.

The staff reviewed the chemistry control for primary systems program and the inservice inspection program: systems, components and supports program for these aging effects and its evaluations are in Section 3.0.3.2.2 and Section 3.0.3.2.13 of this SER, respectively.

The nickel-based alloy aging management activity is part of AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," and the staff's evaluation of the nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) aging management is documented in Section 3.0.3.2.13 of this SER.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to stress corrosion cracking or primary water stress corrosion cracking for components in the reactor systems, as recommended in NUREG-1801. On the basis of this finding, and the finding that the remainder of the applicant's program is consistent with NUREG-1801, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2.8 Crack Initiation and Growth Due to Stress Corrosion Cracking or Irradiation-Assisted Stress Corrosion Cracking

Crack initiation and growth due to SCC or IASCC could occur in baffle/former bolts in Westinghouse reactors. A combination of the water chemistry control program and the reactor vessel internals program will be used to manage this aging effect. In addition, Millstone Unit 3 will participate in Westinghouse Owners Group (WOG) activities and monitor industry initiatives for the purpose of evaluating the significance of cracking due to IASCC on selected PWR reactor vessel internals components. As new information and technology becomes available, the plant-specific reactor vessel internals program (described in Appendix B) will be modified to incorporate enhanced surveillance techniques.

The applicant has identified the implementation of the industry initiatives as commitment 13 in Appendix A, Table A6.0-1 of the LRA. Further evaluation of this program and the commitment to updating this program is addressed in Sections 3.0.3.2.12 (AMP B2.1.17) of this SER.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to stress corrosion cracking or irradiation-assisted stress corrosion cracking for components in the reactor systems, as recommended in NUREG-1801. On the basis of this finding, and the finding that the remainder of the applicant's program is consistent with NUREG-1801, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2.9 Loss of Preload Due to Stress Relaxation

Loss of preload due to stress relaxation could occur in baffle/former bolts in Westinghouse reactors. Loss of preload due to stress relaxation will be managed by the reactor vessel internals program. In addition, Millstone Unit 3 will continue to participate in industry investigations of aging effects applicable to reactor vessel internals as well as initiatives to develop advanced inspection techniques which will permit resolution and measurement of very small features of interest. Aging management activities or surveillance techniques resulting from these initiatives will be incorporated, as required, as enhancements to the reactor vessel internals program. The applicant has identified the implementation of the industry initiatives as commitment 13 in Appendix A, Table A6.0-1 of the LRA. Further evaluation of this program and the commitment to updating this program is addressed in Section 3.0.3.2.12 (AMP B2.1.17) of this SER.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of preload due to stress relaxation for components in the reactor systems, as recommended in NUREG-1801. On the basis of this finding, and the finding that the remainder of the applicant's program is consistent with NUREG-1801, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.2.10 Loss of Section Thickness Due to Erosion

In LRA Section 3.1.2.2.10, the applicant stated that the steam generators do not have feedwater impingement plates and that the discussion in this paragraph of the SRP-LR is not applicable.

SRP-LR Section 3.1.2.2.10 states that loss of section thickness due to erosion could occur in steam generator feedwater impingement plates and supports. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

On the basis that feedwater impingement plates are not part of the steam generator design, the staff finds that this aging effect is not applicable.

3.1B.2.2.11 Crack Initiation and Growth Due to Primary Water Stress Corrosion Cracking, Outside Diameter Stress Corrosion Cracking, or Intergranular Attack or Loss of Material Due to Wastage and Pitting Corrosion or Loss of Section Thickness Due to Fretting and Wear or Denting Due to Corrosion of Carbon Steel Tube Support Plate

In LRA Section 3.1.2.2.11, the applicant addressed crack initiation and growth due to PWSCC, SCC, or IGA, or loss of material due to wastage and pitting corrosion, or deformation due to corrosion that could occur in nickel-based alloy components of the steam generator tubes and tube plugs.

SRP-LR Section 3.1.2.2.11 states that crack initiation and growth due to PWSCC, outside diameter SCC, or IGA, or loss of material due to wastage and pitting corrosion, or deformation due to corrosion could occur in Alloy 600 components of the steam generator tubes, repair sleeves, and plugs. All PWR licensees have committed voluntarily to a steam generator degradation management program described in NEI 97-06; these guidelines are currently under NRC staff review. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or other regulatory bases for steam generator degradation management, should be developed to ensure that this aging effect is adequately managed.

The SRP-LR also states that crack initiation and growth due to PWSCC, SCC, or IGA, or loss of material due to wastage and pitting corrosion, or deformation due to corrosion could occur in nickel-based alloy components of the steam generator tubes and plugs.

To manage the effects of aging, the applicant credited AMP B2.1.23, "Steam Generator Structural Integrity," supplemented by AMP B2.1.5, "Chemistry Control for Primary Systems Program," and AMP B2.1.6, "Chemistry Control for Secondary Systems Program." The staff's evaluation of the steam generator structural integrity program is documented in Section 3.0.3.2.16 of this SER. The staff reviewed the chemistry control for primary systems and secondary systems programs, and its evaluations are documented in Sections 3.0.3.2.2 and 3.0.3.2.3 of this report, respectively. For general and pitting corrosion, assessment of tube integrity, and plugging or repair criteria of flawed tubes, the steam generator structural integrity program acceptance criteria are in accordance with NEI 97-06 guidelines.

On the basis of its review of the chemistry control for primary and secondary systems programs, the staff finds that the applicant appropriately evaluated AMR results involving plant-specific programs to address these aging mechanisms, as recommended in the GALL Report.

3.1B.2.2.12 Loss of Section Thickness Due to Flow-Accelerated Corrosion

In LRA Section 3.1.2.2.12, the applicant stated that the steam generator tube support lattice bars are constructed of stainless steel. Therefore, loss of section thickness of these bars is not an applicable aging effect.

SRP-LR Section 3.1.2.2.12 states the loss of section thickness due to FAC could occur in tube support lattice bars made of carbon steel. The GALL Report recommends that a plant-specific AMP be evaluated and, on the basis of the guidelines of NRC GL 97-06, an inspection program for steam generator internals be developed to ensure that this aging effect is adequately managed.

On the basis that carbon steel tube support lattice bars are not part of the steam generator design, the staff finds that this aging effect is not applicable.

3.1B.2.2.13 Ligament Cracking Due to Corrosion

In LRA Section 3.1.2.2.13, the applicant stated that the tube support plates are not used in the steam generators. Therefore, ligament cracking due to corrosion is not an applicable aging effect.

SRP-LR Section 3.1.2.2.13 states that ligament cracking due to corrosion could occur in carbon steel components in the steam generator tube support plate. All PWR licensees have committed voluntarily to a steam generator degradation management program described in NEI 97-06; these guidelines are currently under NRC staff review. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or other regulatory bases for steam generator degradation management, be developed to ensure that this aging effect is adequately managed.

On the basis that tube support plates are not used in the steam generators, the staff finds that this aging effect is not applicable.

3.1B.2.2.14 Loss of Material Due to Flow-Accelerated Corrosion

In LRA Section 3.1.2.2.14, the applicant addressed loss of material due to FAC.

SRP-LR Section 3.1.2.2.14 states that loss of material due to FAC could occur in the feedwater inlet ring and supports. As noted in Combustion Engineering (CE) IN 90-04, NRC IN 91-19 and LER 50-362/90-05-01, this form of degradation has been detected only in certain CE System 80 SGs. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting loss of material due to FAC.

The staff noted that, in LRA Table 3.1.2-4 (page 3-95), for loss of material of feedwater inlet ring and support component type of carbon steel exposed internally to a treated water environment, the applicant credited the chemistry control for secondary systems program. During the audit, the staff asked the applicant to clarify why the FAC program is not assigned to this component.

In its LRA supplement letter dated July 7, 2004, the applicant stated that the FAC program should be added for the feedwater inlet ring and support component type. In addition, the GALL Report item match for this entry should be "IV.D1.3-a" with "Note B." Also, the "Table 1 Item" entry should be "3.1.1-21." Furthermore, the applicant stated that in LRA Section 3.1.2.2.14 (page 3-21) and LRA Table 3.1.1, the discussion column for Item 3.1.1-21 (page 3-31) should state:

> Although the Unit 3 steam generators are not CE System 80 steam generators, the feedwater inlet ring is included in the Flow Accelerated Corrosion program.

During the audit, the staff further requested that the applicant clarify how the FAC inspection of the steam generator feedwater ring would be performed. The applicant responded that the FAC inspection of the feedwater inlet is performed using the program generic FAC inspection techniques for gridding and UT.

On the basis of its review, the staff finds that the applicant has demonstrated that the effect of aging will be adequately managed so that the intended function will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1A.2.2.15 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's quality assurance program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determined that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent, and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.1.2-1 through 3.1.2-4 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-4, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Staff Evaluation. For component type, material, and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation..

The staff's evaluation is discussed below.

3.1B.2.3.1 Reactor Vessel - Aging Management Evaluation - Table 3.1.2-1

In Section 3.1.2.1.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the reactor vessel and associated pressure boundary components:

- boric acid corrosion
- chemistry control for primary systems program
- inservice inspection program: reactor vessel internals
- inservice inspection program: systems, components and supports
- reactor vessel surveillance

In Table 3.1.2-1 of the LRA, the applicant provided a summary of AMRs for the reactor vessel and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

The staff reviewed Table 3.1.2-1 of the LRA, which summarizes the results of AMR evaluations for the reactor vessel component groups. The staff has reviewed the information in this table and agrees that the applicant has identified the applicable aging effects because the aging effects are appropriate for these materials and environment and are consistent with industry operating experience, except for the following components, which are discussed below.

NUREG-1801, Section IVA2.8-b states that the pressure vessel skirt support, cantilever/column support, and neutron shield tank are subject to loss of material due to boric acid corrosion. The applicant was requested in RAI 3.1.1-1 to include this aging effect and the necessary AMPs for these components concerning loss of material due to boric acid corrosion in Table 3.1.2-1 of the LRA or provide justification for concluding that boric acid corrosion is not an aging effect.

In response to RAI 3.1.1-1, in a letter dated December 3, 2004, the applicant stated that the structural supports for major reactor coolant system components are evaluated separately from the component and its integral parts, as NSSS equipment supports. There are no skirt support or cantilever/column support components for the Millstone Unit 3 reactor vessel support system. The Millstone Unit 3 reactor pressure vessel supports are included as structural members in LRA Table 3.5.2-35. Therefore, loss of material due to boric acid corrosion is identified for these structural members consistent with NUREG-1801 item III.B1.1.1-b, and is managed with the boric acid corrosion and general condition monitoring aging management programs.
This resolves RAI 3.1.1-1.

Table 3.1.2-1 of the LRA does not specify loss of material/wear for the closure head stud assembly as identified by NUREG-1801, Section IVA.2.1-d. The applicant was requested in RAI 3.1.1-2 to include this aging effect and the corresponding aging management program (AMP XI.M3 of NUREG-1801 "Reactor Head Closure Studs") in Table 3.1.2-1 of the LRA or provide justification for concluding that loss of material/wear is not an aging effect.

In response to RAI 3.1.1-2, in a letter dated December 3, 2004, the applicant stated that the closure head stud assembly does not experience relative motion other than normal stud removal and installation during refueling activities. These activities are closely monitored by procedures and any degradation is dispositioned by supplemental examination, corrective measures or repairs, analytical evaluation of the component function, or replacement of the component to ensure continued structural integrity and function of the component. There is no significant continuing wear to the reactor vessel closure studs that would lead to a loss of component function and require monitoring by an aging management program. Therefore, the applicant did not consider loss of material due to wear as an applicable aging effect for the closure head stud assembly. However, AMP XI.M3 of NUREG-1801 and RG 1.65 indicates that reactor closure studs are susceptible to loss of material due to wear. In addition, RG 1.65 recommends, and the applicant uses, coatings and lubrication which are used to reduce wear. Therefore, the staff requested that the LRA specify loss of material due to wear as an aging effect for the closure head stud assembly and specify the AMP to be applied.

In its response dated February 8, 2005 to supplemental RAI 3.1.1-2, the applicant stated that although wear of the reactor closure studs is not expected to affect the intended function of the bolting, loss of material due to wear will be considered as an aging effect consistent with NUREG-1801, item IV.A2.1-d. The aging effect will be managed by the inservice inspection program: systems, components and supports AMP. The staff finds this response acceptable since it has identified the applicable aging effect and provides an aging management program which requires inspection of the closure studs in accordance with the ASME Code requirements that are capable of detecting loss of material. This resolves RAI 3.1.1-2.

Table 3.1.2-1 of the LRA does not specify loss of fracture toughness/neutron irradiation embrittlement for the upper shell as identified by NUREG-1801, Section IVA.2.5-c. The applicant was requested in RAI 3.1.1-3 to include this aging effect and the corresponding aging management program (AMP XI.M31 of NUREG-1801 "Reactor Vessel Surveillance") in Table 3.1.2-1 of the LRA or provide justification for concluding that fracture toughness/neutron irradiation embrittlement is not an aging effect.

In response to RAI 3.1.1-3, in a letter dated December 3, 2004, the applicant stated loss of fracture toughness due to neutron irradiation embrittlement is an applicable aging effect for those reactor pressure vessel subcomponents exposed to a neutron fluence greater than $1x10^{17}$ n/cm^2 (E>1MeV). This threshold level of fluence is experienced by the beltline region subcomponents identified in LRA Table 3.1.2-1 as susceptible to loss of fracture toughness. Based on a supplemental evaluation performed by the applicant, the upper shell and primary inlet nozzles and their associated welds are subjected to loss of fracture toughness due to neutron irradiation embrittlement and will be managed with the reactor vessel surveillance AMP. However, the staff notes that the applicant did not provide the USE and PTS evaluations for these reactor pressure vessel subcomponents as required by Appendix G to10 CFR Part 50, and 10 CFR 50.61, respectively. Therefore to confirm that the USE and PTS evaluations for these subcomponents meet regulatory requirements at the end of the period of extended operation, the staff requests the applicant to include the USE and PTS evaluation (similar to the data currently in Tables 1 and 2 of the FSAR for the other reactor vessel subcomponents) for the upper shell and primary nozzles and their associated welds into Tables 1 and 2 of the Millstone Unit 3 FSAR supplement and determine the effect on the limiting materials. This is issue is discussed in Section 3.1A.2.3.1.

Table 3.1.2-1 of the LRA did not specify loss of material/wear for the vessel flange and core support ledge as identified by NUREG-1801, Section IVA.2.5-f. Therefore, the applicant was requested in RAI 3.1.3-1 to include the aging effect and the corresponding aging management program recommended by NUREG-1801 (AMP XI.M1, "Inservice inspection") in the LRA or provide justification for concluding that loss of material/wear is not an aging effect.

In its response to RAI 3.1.2-1, dated December 3, 2004, the applicant stated that loss of material due to wear was not considered an applicable aging effect for the reactor vessel flange and core support ledge since they do not experience relative motion other than normal reactor disassembly and reassembly during refueling activities. These activities are closely monitored by procedure and any degradation is dispositioned by supplemental examination, corrective measures or repairs, analytical evaluation of the component function, or replacement of the component to ensure continued structural integrity and function of the component. There is no significant continuing wear to the reactor vessel flange and core support ledge that would lead to a loss of component function that would require monitoring by an aging management program. However, the staff considers wear to be an aging effect as identified by NUREG-1801, Section IVA.2.5-f, because the reactor vessel flange and support ledge do experience relative motion during reactor disassembly and reassembly during refueling activities. This aging effect should then be monitored. Since the applicant stated this refueling activity is monitored by procedures, some type of inspection must be performed to monitor wear of these components. Therefore, the staff requested that the LRA specify loss of material due to wear as an aging effect for the reactor vessel flange and core support ledge. In addition the applicant was requested, in RAI 3.1.2-1 to discuss the inspections performed by the refueling activity procedures that monitors wear for these components or include the corresponding aging management program recommended by NUREG-1801 (AMP XI.M1, "Inservice Inspection").

In its response dated February 8, 2005, to supplemental RAI 3.1.2-1, the applicant stated that although wear of the reactor vessel flange and core support ledge is not expected to affect the intended function of these components, loss of material due to wear will be considered as an aging effect consistent with NUREG-1801, Item IV.A2.5-f. The aging effect will be managed by the Millstone inservice inspection program: reactor vessels internals AMP. The staff finds this response acceptable since it has identified the applicable aging effect along with an appropriate aging management program that is consistent with NUREG-1801 for these components. This resolves RAI 3.1.2-1.

NUREG-1801, Section IVB2.6-b specifies void swelling as an aging effect for the BMI guide tubes. Therefore, the applicant was requested in RAI 3.1.1-4 to modify Table 3.1.2-1 of the LRA to specify void swelling as an aging effect for the BMI guide tubes and provide a plant-specific aging management program as recommended by NUREG-1801 or provide justification for concluding that void swelling is not an aging effect.

In response to RAI 3.1.1-4 in a letter dated December 3, 2004, the applicant stated that the flux thimble guide tubes referred to in NUREG-1801 are a part of the reactor vessel internals instrumentation support structure. This subcomponent is included in the Millstone Unit 3 LRA Table 3.1.2-2 as "BMI Columns." Void swelling has been identified for the BMI columns in accordance with NUREG-1801, Section IVB2.6-b, and is managed by the inservice inspection program: reactor vessel internals. The BMI guide tubes listed in Millstone Unit 3 LRA, Table 3.1.2-1, are external to the reactor vessel and are not subject to void swelling. The staff accepts this response, since the applicant has differentiated the BMI guide tube to be the external component, and the BMI columns as the internal component. Since the BMI columns are internal to the reactor vessel, void swelling is applicable and is identified in the LRA. Also, since the BMI guide tube is external to the reactor vessel, void swelling is not an applicable aging effect. Therefore, the applicant has specified the applicable aging effects and their corresponding AMPs for the BMI guide tubes and flux thimble tubes. This resolves RAI 3.1.1-4.

In Table 3.1.2-1, the applicant identified cracking as an aging effect requiring management for the CRDM pressure boundary components and the vessel head penetration components manufactured from stainless steel and nickel-based alloys that are exposed to treated water. The aging effect is managed by the inservice inspection program: systems, components and supports, and the chemistry control for primary systems program. The aging effect, material, and environment is consistent with NUREG 1801, Item IV.A2.2-a and Item IV.A2.2-b and no further evaluation is required. The staff notes that the inservice inspection program: systems, components and supports includes nickel-alloy nozzles and penetrations program. This program is used to manage PWSCC of nickel alloys. The staff concludes the inservice inspection program: systems, components and supports (which includes the nickel-alloy nozzles and penetrations program) and the chemistry control for primary systems program will be effective in managing cracking for the CRDM pressure boundary components and the vessel head penetrations.

Based on the above information, the staff finds the applicant's management of cracking to be acceptable.

In Table 3.1.2-1, the applicant also identified loss of material as an aging effect requiring management for the CRDM pressure boundary components and the vessel head penetration components manufactured from stainless steel and nickel-based alloys that are exposed to treated water. The applicant stated the aging effect is managed by the chemistry control for primary systems program. The aging effect, material, and the environment is not addressed in NUREG 1801 for Item IV.A2.2-a and Item IV.A2.2-b. In RAI 3.1-B-1, the staff requested that the applicant provide justification on why the chemistry control for primary systems program alone is sufficient to manage loss of material without the need to credit an inspection-based AMP to verify that the chemistry control program is accomplishing its mitigative aging management function.

In response to RAI 3.1-B-1, in a letter dated December 3, 2004, the applicant stated that the stainless steel and nickel-based alloy materials exposed internally to primary treated water are not expected to be subject to significant loss of material as a result of corrosion. In addition, NUREG-1801 does not identify loss of material due to corrosion as an aging effect requiring management for these materials in the RCS. However, loss of material was conservatively considered in the Millstone LRA for the RCS components in the primary water environment. The chemistry control for primary systems program provides reasonable assurance that loss of material resulting from corrosion will not prevent these components from performing their intended functions.

Verification of the effectiveness of the chemistry control for primary systems program is provided by the work control process as described in LRA Appendix B, Section B2.1.5. The work control process provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process provides input to the corrective action program if aging effects are identified. The corrective actions program evaluates the cause and extent of the condition and, if required, recommends enhancements to ensure continued effectiveness of the chemistry control for primary systems program. This resolves RAI 3.1-B-1.

In LRA Table 3.1.2-1, the applicant identified no aging effects for the following stainless steel, and nickel-based alloy reactor vessel component types exposed externally to air: CRDM pressure housings, instrument tubes extension (top head), instrumentation tubes (bottom head), primary nozzle safe-end, seal table and fitting, and instrument tubes. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. These components are exposed to high temperature internal flow, which causes a dry air environment. Stainless steel and nickel-based alloy are not susceptible to general corrosion that would affect the intended function of components in an air environment. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In LRA Table 3.1.2-1, the applicant proposed to manage loss of material for the following stainless steel, nickel-based alloy, and low-alloy steel clad with stainless steel component types of the reactor vessel - core support pads, bottom-mounted instrumentation (BMI) flux thimble tube, CRDM pressure housings, instrument tubes extension (top head), instrumentation tubes (bottom head), primary nozzles (and cladding), primary nozzle safe-end, seal table and fitting, instrument tubes, bottom head (and cladding), closure head dome (and cladding), closure head flange (and cladding), intermediate and lower shell (and cladding), and vessel flange and core support ledge (and cladding) - exposed internally to treated, borated water using the AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. On the basis of its review, the staff finds this program acceptable for managing loss of material for the above component types.

In LRA Table 3.1.2-1, for each of these same component and material combinations, the applicant is also managing cracking using AMP B2.1.5, "Chemistry Control for Primary Systems Program," and AMP B2.1.18, "Inservice Inspection Program: Systems, Component and Supports." AMP B2.1.18 is also credited with managing the effects of PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals. The staff accepted the chemistry control for primary systems program and the inservice inspection program: systems, components and supports program and its evaluation of these programs is documented in Sections 3.0.3.2.2 and 3.0.3.2.13 of this SER, respectively. The staff's evaluation of the Alloy 600 base metal and Alloy 82/182 weld metals portion of the MPS AMP is discussed in Section 3.0.3.2.13 of this SER. The staff finds that the applicant manages cracking in a manner consistent with the GALL Report.

On the basis that cracking of stainless steel, nickel-based alloy, and low-alloy steel clad with stainless steel is being managed by the water chemistry control and inservice inspection programs, and the effects of pitting and crevice corrosion on stainless steel and nickel-based alloy components are not significant in chemically treated, borated water, the staff finds that the water chemistry control program is acceptable for managing loss of material.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.3.2 Reactor Vessel Internals - Aging Management Evaluation - Table 3.1.2-2

In Section 3.1.2.1.2 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the reactor vessel internals and associated pressure boundary components:

- chemistry control for primary systems program
- inservice inspection program: reactor vessel internals

In Table 3.1.2-2 of the LRA, the applicant provided a summary of AMRs for the reactor vessel internals and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the reactor vessel internals component groups.

LRA Section 3.1.2.2.7.1 states that the reactor vessel flange leak detection line is not within the scope of license renewal because it does not meet the criteria of 10 CFR 54.4(a) as an intended function. However, NUREG-1801, Section IV A.2.1-f specifies this component is in scope and is subject to a crack initiation and growth/stress corrosion cracking aging mechanism. Therefore, the applicant was requested in RAI 3.1.2-6 to provide a plant-specific aging management program as recommended by NUREG-1801 for cracking of this component.

In response to RAI 3.1.2-6, in a letter dated December 3, 2004, the applicant stated the reactor vessel leak detection system, including the leak detection line, is not within the scope of license renewal. As stated on page 3-18 in the Millstone Unit 3 LRA, the reactor vessel closure head and shell flanges are sealed by inner and outer hollow metallic O-rings. Any leakage through this seal arrangement is directed to the leakage detection system through a 3/16-inch hole in the vessel flange.

Leakage flow past the inner reactor vessel flange O-ring is limited in the event of seal failure by the 3/16-inch diameter hole in the reactor vessel flange which is smaller than the inside diameter of the leak detection line. Additionally, the potential flowrate through the 3/16-inch diameter hole in the flange is within the normal make-up capability of the chemical and volume control system such that the leak detection system doses not constitute the RCS pressure boundary. The failure of the leak detection system components has been evaluated and cannot affect the function of safety-related systems, structures or components. As such, the reactor vessel flange seal leak detection system, including the leak detection line does not meet the criteria of 10 CFR 54.4(a) and is not within the scope of license renewal. Therefore, the applicant stated that the system is not subject to aging management review and there is no aging management program applicable to the leak detection line. The staff review to determine if this is acceptable is not yet complete. This is Open Item 3.1.2-6.

In LRA Table 3.1.2-2, the applicant proposed to manage loss of material for the following stainless steel component types of the reactor vessel internals system - baffle/former plates, BMI columns, core barrel, core barrel flange, core barrel outlet nozzles, head and vessel alignment pins, hold-down spring, lower fuel alignment pins, lower support forging, lower support plate column bolts, lower support plate columns, neutron panel, radial support keys, rod cluster control assembly (RCCA) guide tube support pins, RCCA guide tubes, secondary core support, upper core plate, upper core plate alignment pins, upper fuel alignment pins, upper instrumentation columns, upper support column, and upper support plate - exposed internally to treated, borated water using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff accepted the chemistry control for primary systems program and its evaluation of this program is documented in Section 3.0.3.2.2 of this SER.

In LRA Table 3.1.2-2, for each of these same component and material combinations, the applicant is also managing cracking using AMP B2.1.5, "Chemistry Control for Primary Systems Program," and AMP B2.1.17, "Inservice Inspection Program: Reactor Vessel Internals." AMP B2.1.17 credits the ASME Section XI, Subsection IWB, Category B-N-3 inservice inspections and additional examinations based on future industry developments. The staff reviewed the embrittlement effects of CASS portion of the inservice inspection program: reactor vessel internals program and its evaluation of this part of the program is documented in Section 3.0.3.2.12 of this SER. The staff's evaluation of the PWR internals aging effects management regarding such issues as void swelling (change in dimensions), stress corrosion cracking (PWSCC and IGSCC), and loss of preload is documented in Section 3.0.3.2.12 of the SER. The staff finds that the applicant manages cracking in a manner consistent with the GALL Report. In addition, the staff reviewed the applicable part of MPS AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," which discusses the ASME Section XI, Subsection IWB, Category B-N-3 inservice inspection activities. The staff accepted this program and its evaluation is documented in Section 3.0.3.2.13 of this SER.

On the basis that cracking of stainless steel is being managed by the water chemistry control and inservice inspection programs, and the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated, borated water, the staff finds that management of loss of material using water chemistry control is acceptable.

The GALL Report recommends a loose parts monitoring program to manage loss of mechanical closure integrity for the following reactor vessel internals component types - CEA shroud extension shaft guides, cylinders, and bases; shroud base; shroud flow channel; shroud flow channel cap; shroud shaft retention pin; shroud retention block; spanner nuts; shroud fasteners; guide tubes; ICI thimble support plate assembly; ICI support plate, grid, lifting support, lifting plate, column, plates, and funnel; pad, ring, nipple, hex bolt, and spacer; threaded rod, hex jam nut, thimble support nut, and cap screws.

In the LRA, the applicant proposed to manage this aging effect using MPS AMP B2.1.17, "Inservice Inspection Program: Reactor Vessel Internals." The staff reviewed and accepted this program and its evaluation is documented in Section 3.0.3.2.12 of this SER.

On the basis that the reactor vessel internals programs detect aging effects prior to the loss of mechanical integrity of these components, the staff finds that its use in lieu of a loose parts monitoring program is acceptable.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.B2.3.3 Reactor Coolant - Aging Management Evaluation - Table 3.1.2-3

In Section 3.1.2.1.3 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the reactor coolant system and associated pressure boundary components:

- boric acid corrosion
- chemistry control for primary systems program
- closed-cycle cooling water system
- general condition monitoring
- inservice inspection program: systems, components and supports
- work control process

In Table 3.1.2-3 of the LRA, the applicant provided a summary of AMRs for the reactor coolant system and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

The staff reviewed LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the RCS component groups.

In Table 3.1.2-3, the applicant also identified loss of material as an aging effect requiring management for the RCS components manufactured from stainless steel and nickel-based alloys that are exposed to treated water. The applicant stated the aging effect is managed by the chemistry control for primary systems program. The aging effect, material, and the environment is not addressed in NUREG 1801 for the subject material/environment combination. In RAI 3.1-A-1 the staff requested that the applicant provide justification on why the chemistry control for primary systems program alone is sufficient to manage loss of material without the need to credit an inspection-based AMP to verify that the chemistry control program is accomplishing its mitigative aging management function.

In response to RAI 3.1-A-3, in a letter dated December 3, 2004, the applicant stated that the stainless steel and nickel-based alloy materials exposed internally to primary treated water are not expected to be subject to significant loss of material as a result of corrosion. In addition, NUREG-1801 does not identify loss of material due to corrosion as an aging effect requiring management for these materials in the RCS. However, loss of material was conservatively considered in the Millstone LRA for the RCS components in the primary water environment. The chemistry control for primary systems program provides reasonable assurance that loss of material resulting from corrosion will not prevent these components from performing their intended functions.

Verification of the effectiveness of the chemistry control for primary systems program is provided by the work control process as described in LRA Appendix B, Section B2.1.5. The work control process provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process provides input to the corrective action program if aging effects are identified. The corrective actions program evaluates the cause and extent of the condition and, if required, recommends enhancements to ensure continued effectiveness of the chemistry control for primary systems program.

In LRA Table 3.1.2-3, the applicant identified no aging effects for the following stainless steel, nickel-based alloy, and carbon steel component types of the RCS exposed externally to air: flow elements, flow indicators, flow orifices, piping, tubing, valve; pressurizer nozzles, safe-ends, and instruments and heaters (wells and sheathes), manway cover and insert; reactor coolant pressurizer relief tank, RCP seal coolers, RCP thermal barriers, RCP casing, RCP rupture disks. Air is not identified in the GALL Report as an environment for these components and materials.

In the LRA, the applicant stated that the RCS stainless steel components are externally insulated. The applicant's FSAR concludes (page 5-6) that the use of external thermal insulation of RCS in conformance with RG 1.36 provides reasonable assurance that the reactor coolant pressure boundary material will be adequately protected from conditions that would lead to loss of integrity from stress corrosion. Based on its review of the applicant's FSAR, the staff agrees with the applicant that the RCS stainless steel components are adequately protected from conditions that could lead to loss of integrity from stress corrosion.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. These RCS components are exposed to high temperature internal flow, which creates a high temperature dry air environment, and general corrosion is not likely to occur under such an environment. Additionally, stainless steel and nickel-based alloys in a dry air environment are not susceptible to general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In LRA Table 3.1.2-3 (page 3-90), the applicant stated that cracking of the CASS RCP thermal barrier exposed to treated water is to be managed by the chemistry control for primary systems program and the inservice inspection program: systems, components and supports program. During the audit, the staff asked the applicant to clarify which part of the inservice inspection program is being credited with managing the aging effect for the RCP thermal barrier. The applicant responded as follows:

> It was confirmed with the inservice inspection coordinator that the inservice inspection program does not perform examinations associated with the thermal barriers. The work control process program is credited for managing the effects of aging for the reactor coolant pump thermal barriers. The reactor coolant pumps are refurbished, designated as spares, and reinstalled during future outages. Examples of work orders are identified where through the work control process program the thermal barriers associated with spare RCPs are blown down of the closed cooling water and a sample of the closed cooling water is taken. (See automated work orders M3-97-17720 through M3-97-17723.)

The applicant, in an LRA supplement dated July 7, 2004, also stated that:

> Note 6 should be added for Unit 3 LRA Table 3.1.2-3 (page 3-90) for the RCS component group 'RCP Thermal Barriers' and aging effect 'Loss of Fracture Toughness.' The Note for this item is revised by Item 42-1 of this clarification letter and is applicable to this component because it is CASS material.
>
> The "Inservice Inspection Program: Systems, Components and Supports" should be replaced by the "Work Control Process" for Unit 3 Table 3.1.2-3 (page 3-90), for the RCS component group 'RCP Thermal Barriers' and aging effect 'Cracking.' The Note for this item should be "E" in the Unit 3 LRA. Also, the "Discussion" column in Unit 3 Table 3.1.1, Item 3.1.1-36 (page 3-34), should read as follows:
>
>> Not consistent with NUREG-1801. Cracking is managed with the chemistry control for primary systems program and the inservice inspection program: systems, components and supports except for the RCP thermal barriers, which are managed with chemistry, and the work control process. These programs take some exceptions to the NUREG-1801 AMPs.

The staff reviewed the work control process program and the applicant's RRN-129 document, "Reactor Coolant Pump Motor Refurbishment Report for Millstone Unit," and determined that the applicant has demonstrated that the effects of aging of RCP thermal barriers will be adequately managed.

The staff reviewed thermal sleeves for the pressurizer surge nozzle and spray nozzle, LRA Table 3.1.2-3 (page 3-92), and identified that the weld material is of nickel-based alloy 82/182 material and that these locations are not covered by the nickel-based alloy aging management activities. The applicant stated that it will evaluate this area as part of extent of condition when responding to NRC Inspections and Enforcement Bulletin 2004-1, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors," dated May 28, 2004, as part of the CLB. This commitment is identified on the applicant's license renewal commitment list in the LRA, Appendix A, Table A6.0-1, Item 15.

On the basis of its review of the LRA commitment and Bulletin 2004-1, the staff determined that this issue is part of the CLB to be resolved with the applicant's response to Bulletin 2004-1.

Table 3.1.2-3 of the LRA specifies the use of AMP B2.1.18, "Inservice Inspection Program: Systems, Components and Supports," for closure bolting in the reactor coolant pump, valves, and pressurizer manways. In addition, Section B2.0 of Appendix B of the LRA states that the aging management review did not identify the need for the AMP. However, NUREG-1801, sections IVC2.3-e, IVC2.3-g, IVC2.4-e, IVC2.4-g, IVC2.5-n, and IVC2.5-p, specifies the use of AMP XI.M18 for these components. AMP XI.M18 of NUREG-1801 incorporates the requirements and guidelines of NUREG-1339, EPRI NP-5769, and EPRI TR-104213 concerning material selection, bolting preload control, inservice inspections, plant operation and maintenance, and evaluation of the structural integrity of bolted joints. Therefore, the applicant was requested in RAI 3.1.3-1 to provide the AMP as recommended by NUREG-1801, or include all of the necessary information discussed above in AMP B2.1.18 of the LRA.

In response to RAI 3.1.3-1, in a letter dated December 3, 2004, the applicant stated that it has developed a specific AMP to manage the aging effects for closure bolting in the reactor coolant pump, valves and pressurizer manway. This response is acceptable since the applicant will manage the closure bolting of these components with an AMP, as specified in NUREG-1801. The AMP is evaluated in Section 3.0.3.2.18 of this SER.

For the CASS spray head assembly identified in Table 3.1.2-3 of the LRA, the applicant specified the chemistry control AMP to manage cracking. NUREG-1801, Section IVC2.5-j, identifies a plant-specific AMP to be used to manage cracking. Therefore, the applicant was requested in RAI 3.1.3-2 to provide this AMP to the NRC for evaluation as recommended by NUREG-1801, Section IVC2.5-j.

In response to RAI 3.1.3-2, in a letter dated December 3, 2004, the applicant stated that material for the Millstone Unit 3 pressurizer spray head is CASS. The plant-specific aging management program for managing the aging effects associated with the pressurizer spray head is the chemistry control for primary systems program.

The reactor coolant system stainless steel materials, including the pressurizer spray head, are exposed internally to a high-quality primary water and/or steam environment that is not expected to result in significant SCC.

Therefore, the applicant stated that the chemistry control for primary systems program AMP provides reasonable assurance that cracking resulting from SCC will not prevent the spray head from performing its intended function. In Section 3.1.2.2.7 of NUREG-1800, the staff recommended that a plant-specific aging management program be proposed to manage crack initiation and unacceptable crack growth in pressurizer spray heads because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC. This inspection should be capable of detecting and resolving cracks in the pressurizer spray heads. Therefore, the staff agreed that the water chemistry can be used to mitigate SCC, but an inspection was necessary to indicate whether the water chemistry has prevented SCC and to characterize any cracking in the CASS pressurizer spray heads.

In its response to supplemental RAI 3.1.3-2B, dated February 8, 2005, the applicant committed to either replace the Millstone Unit 3 pressurizer spray head assembly or inspect it utilizing the best available inspection techniques (at the time of inspection) for detecting SCC, prior to entering the period of extended operation. This commitment has been identified in the Millstone LRA, Appendix A, Table A6.0-1 as Item 37 in the License Renewal Commitments Table. The staff finds this response acceptable because the applicant will either verify that its water chemistry program is effective in preventing SCC by performing an inspection of the assembly, or replace the CASS pressurizer spray head assembly prior to entering the period of extended of operation. This resolves RAI 3.1.3-2B.

The staff requested additional information from the applicant in order to determine which components are susceptible to PWSCC and the appropriate AMP as recommended by NUREG-1801, Section IVC.2.5-k. Therefore, the applicant was requested in RAI 3.1.3-3 to specify which of these components (safe-ends for surge, spray, relief and safety) in Table 3.1.2-3 of the LRA are nickel-based and which are stainless steel. In addition, the applicant was asked if the surge line nozzle and safe-end cast austenitic steel (CASS). If the component is CASS, then provide a plant-specific aging management program for cracking as recommended by NUREG-1801, Section IVC2.5-l.

In response to RAI 3.1.3-3, in a letter dated December 3, 2004, the applicant stated that the safe-ends for the Millstone Unit 3 pressurizer surge, spray, relief, and safety nozzles are fabricated from stainless steel. The transition welds between these stainless steel safe-ends and the low-alloy steel of the pressurizer nozzles are nickel-based alloy. Neither the surge line nozzle nor the safe-end is fabricated from CASS. The aging effect of cracking for these components is managed by the chemistry control for primary systems program and the inservice inspection program: systems, components, and supports. The Millstone Unit 3 LRA (Appendix A, Table A6.0-1, commitment 15) states that Millstone Unit 3 will participate in industry programs to determine appropriate measures to manage PWSCC and submit an appropriate AMP to the NRC staff for approval prior to entering the extended period of operation. This resolves RAI 3.1.3-3.

Table 3.1.2-3 of the Millstone Unit 3 LRA does not specify the pressurizer integral support that is subject to fatigue, cracking/IASCC, and boric acid corrosion. The applicant was requested in RAI 3.1.3-4 to include these aging effects and provide the necessary aging management programs in the LRA for this component as identified by NUREG-1801, item IV.C.2.5.12.

In response to RAI 3.1.3-4, in a letter dated December 3, 2004, the applicant stated that the integral supports identified in NUREG-1801 are considered to be the same as the component type "Pressurizer (Seismic Lugs)" and "Pressurizer (Support Skirt and Flange)" in the Millstone Unit 3 LRA, Table 3.1.2-3. The aging effects of loss of material due to boric acid corrosion and cracking are identified for these components consistent with NUREG-1801, Item IV.C.2.5.12. Fatigue is addressed as a TLAA and is identified in LRA Table 3.1.1, item 3.1.1-10.

Because the pressurizer seismic lugs, support skirt and flange are the integral supports, and are identified in the LRA, along with the applicable AMPs consistent with NUREG-1801, the staff finds this response acceptable. This resolves RAI 3.1.3-4.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.2.3.4 Steam Generators - Aging Management Evaluation - Table 3.1.2-4

In Section 3.1.2.1.4 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects requiring management for the steam generator and associated pressure boundary components:

- boric acid corrosion
- chemistry control for primary systems program
- chemistry control for secondary systems program
- flow-accelerated corrosion
- inservice inspection program: systems, components and supports
- steam generator structural integrity

In Table 3.1.2-4 of the LRA, the applicant provided a summary of AMRs for the steam generator and associated pressure boundary components and identified which AMRs it considered to be consistent with the GALL Report.

Millstone Unit 3 has four Westinghouse Model F steam generators. Each SG contains 5626 thermally treated Alloy Inconel 600 tubes. Each tube has a nominal outside diameter of 0.688 inch and a nominal wall thickness of 0.040 inch. The tubes were hydraulically expanded at both ends for the full length of the tubesheet and are supported by a number of stainless steel Type 405 tube support plates with quatrefoil-broached holes and upper support anti-vibration bars.

The staff reviewed the LRA Table 3.1.2-4, which summarizes the results of AMR evaluations for the steam generator component groups.

In LRA Table 3.1.2-4, the applicant identified cracking as an aging effect and the inservice inspection as the AMP for the primary manway bolting in the air environment. In RAI 3.1.2-4-3, the staff asked the applicant to clarify the aging mechanism for cracking and to explain how the Inservice Inspection AMP is used to manage this aging effect similar to the recommended AMP in the GALL.

By letter dated December 3, 2004, the applicant responded that consistent with GALL, the aging mechanism for the primary manway bolting is stress corrosion cracking, which can result from flaw initiation and growth. The applicant stated that it will implement a program to manage the aging effect of stress corrosion cracking as stated in GALL IV.D1.1-I. The staff finds the applicant's response acceptable because it is consistent with GALL.

In LRA Table 3.1.2-4, the applicant identified the only aging effect as cracking and the inservice inspection program as the AMP for the secondary manway and handhole bolting in the air environment. In RAI 3.1.2-4-4, the staff asked the applicant to justify why loss of preload and stress relaxation are not applicable aging effects as stated in GALL IV.D1.1-f.

By letter dated December 3, 2004, the applicant responded that loss of preload due to stress relaxation is not an applicable aging effect for the ASME Class 2 secondary manway and handhole bolting. The applicant uses SA-193, Grade B7 bolting for these applications. The applicant stated that, according to ASME Section II, Part D, Table 4, stress relaxation may occur at temperatures of 700 °F or higher for Grade B7 bolting materials. The applicant's normal operating RCS hot leg temperature, which bounds the maximum temperature for the SG secondary side components, is 600.5 °F for Unit 2 and 618 °F for Unit 3.

The applicant stated that since these temperatures are below the 700 °F, loss of preload due to stress relaxation is not an aging effect requiring aging management. The staff reviewed the operating thresholds and footnotes for stress relaxation in Section II of the ASME Boiler and Pressure Vessel Code for these bolting materials and confirmed that the applicant's determination is valid. The staff finds the applicant's response acceptable because the bolts will not be exposed to temperatures in excess of the threshold for stress relaxation in the bolting materials.

In LRA Table 3.1.2-4, the applicant identified loss of material as the aging effect for the tube supports lattice rings. In RAI 3.1.2-4-5, the staff stated that cracking is also a potential aging effect and therefore asked the applicant to justify why cracking is not considered as an aging effect for the tube support lattice rings under treated water and steam.

By letter dated December 3, 2004, the applicant responded that only high-strength carbon steels are susceptible to this stress corrosion cracking in this environment. Since the tube support lattice rings are made of carbon steel and not high strength carbon steel, they are not susceptible to stress corrosion cracking under the steam generator secondary-side environment. The staff finds the applicant's response acceptable because based on operating experience, carbon steel is not likely to be susceptible to stress corrosion cracking under the steam generator secondary-side environment.

In LRA Table 3.1.2-4, the applicant identified no aging effects for the following stainless steel and low-alloy steel component types of the steam generator exposed externally to air: feedwater nozzle and safe-end, lower head drain nozzle, primary manway cover and diaphragm, secondary manway and handhole covers, secondary-side nozzles (except main steam and feedwater), steam nozzle and safe-end, top head, transition cone, and upper and lower shell. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that dry air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air which is the reactor building air environment. Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a dry air environment.

In LRA Table 3.1.2-4, the applicant proposed to manage loss of material for the following stainless steel, carbon steel, low-alloy steel, and nickel-based alloy component types of steam generator - anti-vibration bars, divider plate, feedwater inlet ring and support, feedwater nozzle and safe-end, lower head (and cladding), lower head drain nozzle, primary manway cover and diaphragm, primary nozzle and safe-end, secondary manway and handhole covers, secondary-side nozzles (except main steam and feedwater), stay rod (including spacer pipes and nuts), steam nozzle and safe-end, steam nozzle flow restrictor, top head, tube plugs, tube support plates, tube sheet (and cladding), upper and lower shell, and wrapper (includes jacking blocks, jacking block studs, anti-rotation block, and cone) - exposed to treated water/steam, borated water using the water chemistry control programs. Additionally, the tube sheet and steam generator U-tubes are managed by the steam generator structural integrity program. The staff accepted AMP B2.1.5, "Chemistry Control for Primary Systems Program," and AMP B2.1.6,"Chemistry Control for Secondary Systems Program," and its evaluation of these AMPs is documented in Sections 3.0.3.2.2 and 3.0.3.2.3 of this SER, respectively. The steam generator structural integrity program is reviewed and evaluated in Section 3.0.3.1 of this SER.

On the basis of industry operating experience with this material and use of water chemistry control programs consistent with the GALL Report, the staff finds this to be acceptable.

In LRA Table 3.1.2-4 (page 3-98), the applicant stated that cracking of the nickel-based alloy steam generator primary manway cover and diaphragm is managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." During the audit and review, the staff asked the applicant to provide justification for using the chemistry control for primary systems program to prevent PWSCC. In its response, the applicant stated that:

> Based on a review of the Bill of Materials (BOM) database, part number information, and the vendor technical manual (figure 8-3 sheet 2 of 2, Detail C), it was determined that Unit 3 has stainless steel diaphragms (inserts) as part of the steam generator primary manway cover assemblies. The Unit 3 LRA AMR Table currently identifies the diaphragm as a nickel-based alloy. The AMR Table needs to be revised to identify stainless steel in lieu of a nickel-based alloy for the diaphragms, and also clarify that the diaphragm is also referred to as an insert.

In an LRA supplement dated July 7, 2004, the applicant stated as follows:

> The material "Nickel-based Alloy" should be "Stainless Steel" for the 'Primary Manway Cover and Diaphragm' component group in Unit 3 Table 3.1.2-4 (page 3-98).

The applicant also stated that the primary manway is not included in the inservice inspection program; however, the component is inspected each time the manway is opened. On the basis of its review, the staff finds this to be acceptable.

In LRA Table 3.1.2-4 (page 3-95), the applicant proposed to manage cracking for the nickel-based alloy divider plate exposed to borated water using water chemistry control programs. During the audit and review, the staff asked the applicant to provide justification for using the chemistry control for primary systems program to prevent PWSCC. In its response during the audit, the applicant stated that:

> The steam generator divider plate is located in the steam generator channel head and functions to direct reactor coolant flow through the steam generator tubes (flow distribution). The plate is welded to the primary side of the tube sheet and to the inside of the steam generator channel head. The divider plate material is ASTM SB-168 (Alloy 600) and the weld material is Alloy 82/182. The divider plate, and associated welds, do not penetrate the steam generator

pressure-retaining boundary. Since the steam generator divider plates, and associated attachment welds, are not pressure retaining these components are not included within the scope of the Unit 3 response to the generic issue related to Alloy 600 degradation (PWSCC). Cracking of the welds cannot result in leakage of borated water onto carbon steel pressure-retaining material, such that wastage due to boric acid corrosion will not occur. The intended function identified for the divider plate is flow distribution. Gross failure of the welds would be required before divider plate deflection that is sufficient to affect the intended function could occur. Additionally, there is no known industry operating experience with failures of steam generator divider plates or welds from PWSCC.

During the audit, the applicant also stated that this component is inspected under the steam generator inspection program. The staff reviewed the applicant's program as documented in the audit and review report and finds that the applicant adequately manages this aging effect.

On the basis of its review, the staff finds that management of cracking in low-alloy steel and carbon steel exposed to treated water using water chemistry control verified by inservice inspection is acceptable as recommended by the GALL Report.

The staff also finds that management of cracking in stainless steel exposed to treated water using the chemistry control for secondary systems program is acceptable as recommended by the GALL Report.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

All other AMRs assigned to the staff in Tables 3.1.2-1 through 3.1.2-4 were evaluated. The staff finds them to be acceptable.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1B.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the of the reactor vessel, internals, and reactor coolant system components and component types that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the reactor vessel, internals, and reactor coolant system components, as required by 10 CFR 54.21(d).

3.2 <u>Aging Management of Engineered Safety Features Systems</u>

3.2A <u>Unit 2 Aging Management of Engineered Safety Features Systems</u>

This section of the SER documents the staff's review of the applicant's AMR results for the engineered safety features (ESF) systems components and component groups associated with the following systems:

- containment spray system
- safety injection system
- refueling water storage tank and containment sump system
- shutdown cooling system
- spent fuel pool cooling system

3.2A.1 Summary of Technical Information in the Application

In LRA Section 3.2, the applicant provided AMR results for ESF systems components and component groups. In LRA Table 3.2.1, "Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the ESF systems components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2A.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the ESF systems components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did confirm that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. The staff's audit evaluation are documented in the MPS audit and review report and are summarized in Section 3.2A.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.2.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear

Power Plants," dated July 2001. The staff's audit evaluation are documented in the MPS audit and review report and are summarized in and summarized in Section 3.2A.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with or not address in the GALL Report. The review included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluation are documented in the MPS audit and review report and are summarized in Section 3.2A.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.2A.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the ESF system components.

Table 3.2A-1 provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.2 that are addressed in the GALL Report.

Table 3.2A-1 Staff Evaluation for Engineered Safety Features System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping, fittings, and valves in emergency core cooling system (Item Number 3.2.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3A, Metal Fatigue
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling system (Item Number 3.2.1-03)	Loss of material due to general corrosion	Plant-specific		Not applicable (See Section 3.2A.2.2.2)
Components in containment spray (PWR only), standby gas treatment (BWR only), and emergency core cooling systems (Item Number 3.2.1-05)	Loss of material due to pitting and crevice corrosion	Plant-specific	Chemistry control for primary systems program (B2.1.5); Tank inspection program (B2.1.24)	Consistent with GALL, which recommends further evaluation (See Section 3.2A.2.2.3)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Containment isolation valves and associated piping (Item Number 3.2.1-06)	Loss of material due to MIC	Plant-specific	Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends further evaluation (See Section 3.2A.2.2.4)
High pressure safety injection (charging) pump mini-flow orifice (Item Number 3.2.1-08)	Loss of material due to erosion	Plant-specific		Not applicable (See Section 3.2A.2.2.5) The HPSI pumps are not used for normal charging.
External surface of carbon steel components (Item Number 3.2.1-10)	Loss of material due to general corrosion	Plant-specific	General condition monitoring (B2.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.2A.2.2.2)
Piping and fittings of CASS in emergency core cooling systems (Item Number 3.2.1-11)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.2A.2.1)
Components serviced by open-cycle cooling system (Item Number 3.2.1-12)	Loss of material due to general pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system		Not applicable There are no ESF components in open-cycle cooling water environments.
Components serviced by closed-cycle cooling system (Item Number 3.2.1-13)	Loss of material due to general pitting, and crevice corrosion	Closed-cycle cooling water system	Closed-cycle cooling water system (B2.1.7)	Consistent with GALL, which recommends no further evaluation (See Section 3.2A.2.1)
Pumps, valves, piping, and fittings, and tanks in containment spray and emergency core cooling systems (Item Number 3.2.1-15)	Crack initiation and growth due to SCC	Water chemistry	Chemistry control for primary systems program (B2.1.5); Chemistry control for secondary systems program (B2.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.2A.2.1)
Carbon steel components (Item Number 3.2.1-17)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3); General condition monitoring (B2.1.13)	Consistent with GALL (See Section 3.2A.2.1.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Closure bolting in high-pressure or high-temperature systems (Item Number 3.2.1-18)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting integrity (B2.1.26)	Consistent with GALL (See Section 3.2A.2.1.2)

The staff's review of the Millstone ESF systems and associated components followed one of several approaches. One approach, documented in Section 3.2A.2.1, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.2A.2.2, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.2A.2.3, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the ESF systems components is documented in Section 3.0.3 of this SER.

3.2A.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In LRA Section 3.2.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the ESF systems components:

- boric acid corrosion program
- chemistry control for primary systems program
- closed-cycle cooling water system program
- general condition monitoring program
- inservice inspection program: systems, components and supports program
- tank inspection program
- work control process program
- bolting integrity program

Staff Evaluation. In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the applicant provided a summary of AMRs for the ESF systems and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to confirm consistency with the GALL Report. The staff confirmed that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to confirm consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to confirm consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect; but a different aging management program is credited. The staff audited these line items to confirm consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.2A.2.1.1 Loss of Material Due to Boric Acid Corrosion

In LRA Table 3.2.1, Item 3.2.1-17, the applicant stated that loss of material due to boric acid corrosion is managed by MPS AMP B2.1.3, "Boric Acid Corrosion Program," and MPS AMP B2.1.13, "General Condition Monitoring Program." The boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting system components. The boric acid corrosion program is evaluated in Section 3.0.3.1.2 of this SER.

The general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. During the audit, the staff asked the applicant for clarification regarding how loss of material for components not normally visible, or in infrequently accessed areas are managed by this program. During the audit, further clarification was requested on how identification, documentation, evaluation, and trending of boric acid leakage is performed under this program. During the audit, the applicant stated that the general condition monitoring program is an extension of the boric acid corrosion program in that general condition monitoring program inspections identify borated water leakage and then, through the corrective action program, the leak is assigned and evaluated by the boric acid corrosion program. When borated water leakage is identified by the general condition monitoring program, a condition report is written to identify the leak. During the daily review of the new condition reports, the leak is assigned to the boric acid corrosion program where it gets fully evaluated and repaired as required. This is the same process used to identify leaks in the boric acid corrosion program.

In the LRA, the applicant stated that for those areas identified as infrequently accessed areas, for the purposes of detecting boric acid leakage, entry into the area is performed often enough (at least once per refueling interval) to credit the general condition monitoring program. No infrequently accessed areas with systems containing borated water are identified for Unit 2. The staff's evaluation of the general condition monitoring program is documented in Section 3.0.3.3.2 of this SER. Based on the applicant's response and review of the general condition monitoring program, the staff concluded that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns performed by plant personnel to look for boron buildup and/or boric acid leaks.

3.2A.2.1.2 Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and/or Stress Corrosion Cracking

In LRA Table 3.2.1, Item 3.2.1-18, the applicant stated that bolting in the ESF systems is not subject to wetted conditions; therefore, loss of material due to general corrosion is not expected. Additionally, cracking for bolting in ESF systems is not identified as an aging effect requiring management.

The staff noted that Standard Review Plan for License Renewal (SRP-LR) Table 3.2-1 recommended GALL AMP XI.M18," for managing closure bolting in a high-pressure or high-temperature system for loss of material due to general corrosion, crack initiation and growth due to cyclic loading and/or stress corrosion cracking (SCC).

The staff questioned the applicant on whether all of the resolutions of the generic safety issue for bolting, as stated in NUREG-1339, are addressed. By letter dated December 3, 2004, the applicant submitted an LRA supplement. in which it stated that it has developed a specific aging management program that addresses degradation of bolting at MPS. The program is addressed in Section 3.0.3.2.18 of this SER.

By letter dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaced the existing information in the "Discussion" column of LRA Table 3.2.1, Item 18, with "consistent with the NUREG-1801."

The staff reviewed the applicant's response, and finds this acceptable since it is consistent with the GALL Report.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required. On the basis of its audit and review, the staff concluded that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2A.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.2.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for ESF systems. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general corrosion
- local loss of material due to pitting and crevice corrosion
- local loss of material due to microbiologically influenced corrosion(MIC)
- local loss of material due to erosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.2.2.2 of the SRP-LR. Details of the staff's audit and review are documented in the staff's MPS audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.2A.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.2A.2.2.2 Loss of Material Due to General Corrosion

The staff reviewed LRA Section 3.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.

In LRA Section 3.2.2.2.2, the applicant addressed loss of material due to general corrosion that could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components.

SRP-LR Section 3.2.2.2.2.2 states that loss of material due to general corrosion could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components. The GALL Report recommends further evaluation on a plant-specific basis to ensure that the aging effect is adequately managed.

The applicant stated in the LRA, that for loss of material from internal surfaces, this SRP-LR item applies to carbon steel containment spray headers, nozzles, and valves; and to carbon steel containment isolation piping and valves. The containment spray headers, nozzles, and valves and containment isolation components in the ESF systems, are constructed of stainless steel and are not subject to loss of material due to general corrosion. Containment isolation components associated with other plant systems are evaluated for the effects of aging along with the host system to which they are assigned.

For loss of material from external surfaces, this item applies to carbon steel ESF components. Loss of material from external surfaces due to general corrosion is applicable to carbon steel (including cast iron and low-alloy steel) components in an air environment when exposed to intermittent wetting conditions. For these components, loss of material from external surfaces is managed by MPS AMP B2.1.13, "General Condition Monitoring Program."

The staff concluded that loss of material due to general corrosion does not apply to stainless steel components.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to general corrosion on external surfaces of carbon steel components since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

On the basis of its review of the general condition monitoring program, the staff finds that the applicant has appropriately evaluated AMR results involving management of the loss of material due to general corrosion, as recommended in the GALL Report.

3.2A.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.3.2 against the criteria in SRP-LR Section 3.2.2.2.3.

In LRA Section 3.2.2.2.3.2, the applicant addressed local loss of material from pitting and crevice corrosion that could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water storage tank (RWST) external surface.

SRP-LR Section 3.2.2.2.3.2 states that local loss of material from pitting and crevice corrosion could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water tank external surface. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

The applicant stated, in the LRA, that containment isolation components are potentially subject to a loss of material due to pitting and crevice corrosion. Loss of material for these components is managed by AMP B2.1.5, "Chemistry Control for Primary Systems Program."

Also, the external bottom surface of the RWST is potentially subject to a loss of material due to pitting and crevice corrosion. Loss of material of the external surface of the RWST bottom is managed by AMP B2.1.24, "Tank Inspection Program."

The applicant stated, in the LRA, that the chemistry control for primary systems program is consistent with the GALL Report with an exception. The staff reviewed the chemistry control for primary systems program, with the exception, and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to a later revision of the Electric Power Research Institute (EPRI) guidelines. On the basis of its review, the staff finds the chemistry control for primary systems program acceptable for managing this aging effect for the above components.

The staff reviewed the tank inspection program, which includes an enhancement to measure wall thickness to detect significant loss of material of the RWST bottom surface; and its evaluation is documented in Section 3.0.3.2.17 of this SER. On the basis of its review, the staff finds the program acceptable for managing loss of material due to pitting and crevice corrosion.

3.2A.2.2.4 Local Loss of Material Due to Microbiologically Influenced Corrosion

The staff reviewed LRA Section 3.2.2.2.4 against the criteria in SRP-LR Section 3.2.2.2.4.

In LRA Section 3.2.2.2.4, the applicant addressed local loss of material due to microbiologically influenced corrosion (MIC). SRP-LR Section 3.2.2.2.4 states that containment isolation valves and associated piping in systems could incur a local loss of material due to MIC that is not addressed in other chapters of the GALL Report. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

The applicant stated, in the LRA, that the containment isolation components are potentially subject to a loss of material due to MIC. Loss of material for these components is managed by AMP B2.1.5, "Chemistry Control for Primary Systems Program."

The applicant stated, in the LRA, that the chemistry control for primary systems program is consistent with the GALL Report with an exception. The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to a later revision of the EPRI guidelines. On the basis of its review, the staff finds the chemistry control for primary systems program acceptable for managing this aging effect.

3.2A.2.2.5 Local Loss of Material Due to Erosion

The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6.

In LRA Section 3.2.2.2.6, the applicant addressed local loss of material due to erosion that could occur in the HPSI miniflow orifice.

SRP-LR Section 3.2.2.2.6 states that local loss of material due to erosion could occur in the high-pressure safety injection (HPSI) pump miniflow orifice. This aging mechanism and its effect will apply only to pumps that are normally used as charging pumps in the chemical and volume control systems. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

The applicant stated, in the LRA, that the normal charging function is accomplished with positive displacement charging pumps. The centrifugal HPSI pumps are not used for normal charging. Therefore, this issue is not applicable to Unit 2.

Since this aging effect would apply to high head charging pumps only, the staff finds that loss of material due to erosion is not applicable to positive displacement charging pumps.

3.2A.2.2.6 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's Quality Assurance Program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2A.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, aging effects requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

In Tables 3.2.2-1 through 3.2.2-5, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report, and it provided information concerning how the aging effect will be managed.

Staff Evaluation. For component type, material and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

3.2A.2.3.1 Containment Spray - Aging Management Evaluation - Table 3.2.2-1

The staff reviewed LRA Table 3.2.2-1, which summarized the results of AMR evaluations for the containment spray system component groups.

The applicant has not identified in the LRA any aging effect for low-alloy and stainless steel components exposed to air, including bolting, orifice, piping, pump casing, tubing, spray nozzles, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on low-alloy and stainless steel components will not result in aging that will be of concern during the period of extended operation. The external environments being referred to is typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant amounts of corrosion of low-alloy steel require an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, therefore, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concludes that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposes to manage loss of material of the stainless steel orifice, piping, pump casing, tubing, and valve component types exposed to treated water (chemically treated borated water) using only MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to a later revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to confirm the absence of loss of material is not required. On the basis of its review, the staff finds the chemistry control for primary systems program acceptable for managing this aging effect.

3.2A.2.3.2 Safety Injection - Aging Management Evaluation - Table 3.2.2-2

The staff reviewed LRA Table 3.2.2-2, which summarizes the results of AMR evaluations for the safety injection system component groups.

The applicant identified no aging effect for carbon steel, stainless steel, and CASS components exposed to air, including flow elements, flow orifices, pipe, pumps, tubing, valves, and safety injection tanks (carbon steel with SS clad) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environment being referred to is typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant amounts of corrosion of carbon steel require an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in an ambient air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel and CASS are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concludes that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for stainless steel (SS) components exposed internally to gas, including pipe and safety injection tanks (carbon steel with SS clad) component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in a gas environment.

3.2A.2.3.3 Refueling Water Storage Tank and Containment Sump - Aging Management Evaluation - Table 3.2.2-3 and Table 3.2.2-3a

The staff reviewed Table 3.2.2-3 of the LRA and Table 3.2.2-3a in the applicant's letter dated January 11, 2005, which summarizes the results of AMR evaluations for the refueling water storage tank (RWST) and containment sump component groups.

In the LRA and in the applicant's letter, the applicant identified no aging effect for carbon steel, low-alloy steel, and stainless steel components exposed to air, including bolting, encapsulation piping and valves, pipe, rupture discs, trisodium phosphate dodecahydrate (TSP) basket, tubing, valves, RWST circulating pump, RWST heat exchanger (channel head), and RWST heat exchanger (shell) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant amounts of corrosion of carbon or low-alloy steel require an electrolytic environment and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in an ambient air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon or low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concluded that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel vortex breakers component types exposed to treated water (chemically treated borated water) using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to a later revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to confirm the absence of loss of material is not required. On the basis of its review, the staff finds the chemistry control for primary systems program acceptable for managing this aging effect.

In the LRA, the applicant proposes to manage loss of material of stainless steel pipe, tubing, and valve component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring Program." The applicant stated that this is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation of this program is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposes to manage loss of material of carbon steel encapsulation piping and valve component group exposed internally to moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process." The applicant stated that this is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff concluded that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

3.2A.2.3.4 Shutdown Cooling - Aging Management Evaluation - Table 3.2.2-4

The staff reviewed Table 3.2.2-4 of the LRA, which summarizes the results of AMR evaluations for the shutdown cooling system component groups.

In the LRA, the applicant identified no aging effect for carbon steel, stainless steel, and CASS components exposed to air, including carry-over tank, filters/strainers, flexible hose, flow elements, pipe, restricting orifice, tubing, vacuum flask, vacuum pump, valves, shutdown cooling heat exchangers component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant amounts of corrosion of carbon steel require an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in an ambient air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steels, and cast austenitic stainless steel (CASS) are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concluded that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effect for stainless steel components exposed internally to air, including carry-over tank, filter/strainer, flexible hoses, vacuum flask, vacuum pump component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. Wrought austenitic stainless steels are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concluded that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel shutdown cooling heat exchangers (tubing) component types exposed to treated water using MPS AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff concluded that the work control process program is acceptable for managing the aging effects of loss of materials.

3.2A.2.3.5 Spent Fuel Pool Cooling - Aging Management Evaluation - Table 3.2.2-5 and Table 3.2.2-5a

The staff reviewed Table 3.2.2-5 of the Millstone LRA and Table 3.2.2-5a of the applicant's letter dated January 11, 2005, which summarized the results of AMR evaluations for the spent fuel pool cooling system component groups.

In the LRA and in the applicant's letter dated January 11, 2005, the applicant identified no aging effect for low-alloy and stainless steel components exposed to air, including expansion joints, flow elements, pipe, pumps, spent fuel pool heat exchangers (channel head), tubing, valves, filters, and mixing tank component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on low-alloy and stainless steel components will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant amounts of corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, therefore, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group.

Wrought austenitic stainless steels are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concluded that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel expansion joints, flow elements, pipe, pumps, spent fuel pool heat exchangers (channel head) component types exposed to treated water (chemically treated borated water) using only MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to a later revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to confirm the absence of loss of material is not required. On the basis of its review, the staff concluded that the chemistry Control for primary systems program is acceptable for managing this aging effect.

However, for other stainless steel components exposed to treated water, the applicant considered them consistent with the GALL Report, since a different component type was referenced with a different program, identifying it in LRA Table Note E. During the site audit, the staff asked the applicant to provide the basis for considering some components with the same material, environment, and aging effect combination as consistent with the GALL Report, referencing LRA Table Note E, and others as not consistent with GALL Report, referencing LRA Table Note H. For example, in the LRA Table 3.2.2-5, page 3-138, the applicant stated that for a pipe component type exposed to treated water and subject to loss of material, this component, material and environment combination is not consistent with the GALL Report (i.e., LRA Table Note H). On the other hand, in LRA Table 3.2.2-5, page 3-140, the applicant stated that for tubing and valve component types exposed to treated water and subject to loss of material (same material, environment, and aging effect combination), this is consistent with the GALL Report Item VII.C2.2-a (i.e., LRA Table Note E). The applicant submitted an LRA supplement letter, dated July 7, 2004, and stated that the note should have been Note H for all of these component types, and references to the GALL Report item and Table 1 item should be removed from Table 2. The staff reviewed the applicant's response and concludes that it is acceptable.

All other AMRs assigned to the staff in Tables 3.2.2-1 through 3.2.2-5 were evaluated. The staff finds them to be acceptable.

<u>Conclusion</u>. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2A.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the ESF systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the engineering safety features systems, as required by 10 CFR 54.21(d).

3.2B Unit 3 Aging Management of Engineered Safety Features Systems

This section of the SER documents the staff's review of the applicant's AMR results for the ESF systems components and component groups associated with the following systems:

- containment recirculation system
- quench spray system
- safety injection system
- residual heat removal system
- fuel pool cooling and purification system

3.2B.1 Summary of Technical Information in the Application

In LRA Section 3.2, the applicant provided AMR results for ESF systems components and component groups. In LRA Table 3.2.1, "Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the ESF systems components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2B.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the ESF system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did confirm that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. The staff's audit evaluation are documented in the staff's MPS audit and review report and summarized in Section 3.2B.2.1 of this SER.

The staff also performed an audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. Te staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.2.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluation are documented in the staff's MPS audit and review report and summarized in Section 3.2B.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with or not address in the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluation are address in the MPS audit and review report and summarized in Section 3.2B.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.2B.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the ESF system components.

Table 3.2B-1 provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.2 that are addressed in the GALL Report.

Table 3.2B-1 Staff Evaluation for Engineered Safety Features System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping, fittings, and valves in emergency core cooling system (Item Number 3.2.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3B, Metal Fatigue
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling system (Item Number 3.2.1-03)	Loss of material due to general corrosion	Plant-specific		Not applicable (See Section 3.2B.2.2.2)
Components in containment spray (PWR only), standby gas treatment (BWR only), and emergency core cooling systems (Item Number 3.2.1-05)	Loss of material due to pitting and crevice corrosion	Plant-specific	Chemistry control for primary systems program (B2.1.5); Work control process (B2.1.25); Tank inspection program (B2.1.24)	Consistent with GALL, which recommends further evaluation (See Section 3.2B.2.2.3)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Containment isolation valves and associated piping (Item Number 3.2.1-06)	Loss of material due to MIC	Plant-specific	Chemistry control for primary systems program (B2.1.5); Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.2B.2.2.4)
HPSI (charging) pump mini-flow orifice (Item Number 3.2.1-08)	Loss of material due to erosion	Plant-specific	Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.2B.2.2.5)
External surface of carbon steel components (Item Number 3.2.1-10)	Loss of material due to general corrosion	Plant-specific	General condition monitoring (B2.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.2B.2.2.2)
Piping and fittings of CASS in emergency core cooling systems (Item Number 3.2.1-11)	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Inservice inspection program: systems, components and supports (B2.1.18)	Consistent with GALL, which recommends no further evaluation (See Section 3.2B.2.1)
Components serviced by open-cycle cooling system (Item Number 3.2.1-12)	Loss of material due to general pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system		Not applicable, no further evaluation (there are no ESF components in open-cycle cooling water environments)
Components serviced by closed-cycle cooling system (Item Number 3.2.1-13)	Loss of material due to general pitting, and crevice corrosion	Closed-cycle cooling water system	Closed-cycle cooling water system (B2.1.7)	Consistent with GALL, which recommends no further evaluation (See Section 3.2B.2.1)
Pumps, valves, piping, and fittings, and tanks in containment spray and emergency core cooling systems (Item Number 3.2.1-15)	Crack initiation and growth due to SCC	Water chemistry	Chemistry control for primary systems program (B2.1.5); chemistry control for secondary systems program (B2.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.2B.2.1)
Carbon steel components (Item Number 3.2.1-17)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3); General condition monitoring (B2.1.13)	Consistent with GALL (See Sections 3.2B.2.1.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Closure bolting in high-pressure or high-temperature systems (Item Number 3.2.1-18)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting Integrity	Bolting Integrity (B2.1.26)	consistent with GALL (See Section 3.2B.2.1.2)

The staff's review of the Millstone ESF systems and associated components followed one of several approaches. One approach, documented in Section 3.2B.2.1, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.2B.2.2, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.2B.2.3, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the ESF systems components is documented in Section 3.0.3 of this SER.

3.2B.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Sections 3.2.2.1.1 through 3.2.2.1.5 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the ESF systems components:

- boric acid corrosion
- chemistry control for primary systems program
- general condition monitoring
- service water system (open-cycle cooling)
- work control process
- buried pipe inspection program
- tank inspection program
- closed-cycle cooling water system
- inservice inspection program: systems, components and supports
- bolting integrity program

Staff Evaluation. In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the applicant provided a summary of AMRs for the ESF systems and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to confirm consistency with the GALL Report. The staff confirmed that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to confirm consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to confirm consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to confirm consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.2B.2.1.1 Loss of Material Due to Boric Acid Corrosion

In the discussion section of LRA Table 3.2.1, Item 3.2.1-17, the applicant stated that loss of material due to boric acid corrosion is managed by MPS AMP B2.1.3, "Boric Acid Corrosion Program," and MPS AMP B2.1.13, "General Condition Monitoring Program." The boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components. The boric acid corrosion program and general condition monitoring program are evaluated in Sections 3.0.3.1 and 3.0.3.3.2 of this SER, respectively.

The general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. During the audit, the staff asked the applicant for clarification regarding how loss of material for components not normally visible, or in infrequently accessed areas are managed by this program. During the audit clarification was requested on how identification, documentation, evaluation, and trending of boric acid leakage is performed under this program. During the audit, the applicant stated that the general condition monitoring program is an extension of the boric acid corrosion program in that the general condition monitoring program inspections identify borated water leakage and then, through the corrective action program, the leak is assigned and evaluated by the boric acid corrosion program. When borated water leakage is identified by the general condition monitoring program, a condition report is written to identify the leak. During the daily review of the new condition reports, it is assigned to the boric acid corrosion program where it gets fully evaluated and repaired as required. This is the same process used to identify leaks in the boric acid corrosion program.

In the LRA, the applicant stated that for those areas identified as infrequently accessed areas, for the purposes of detecting boric acid leakage, entry into the area is performed often enough (at least once per refueling interval) to credit the general condition monitoring program. The one exception is the Unit 3 demineralizer cubicles area. However, for this area, a video inspection is performed at least once every 10 years to confirm the integrity of the equipment. There is reasonable assurance that this inspection interval will detect borated water leakage prior to the loss of intended function of the affected equipment. In addition, the inspection opportunities for these cubicles will probably be more frequent than once every 10 years due to the need to perform corrective maintenance, filter changeout, etc. The Unit 3 areas accessed at least once per refueling interval are typically observed by operations personnel during tagouts, health physics during general area surveys or a survey performed for upcoming work in the area, or during containment walkdowns as part of the boric acid corrosion program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. Based on the audit and review of the general condition monitoring program, the staff finds that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns performed by plant personnel to look for boron buildup and/or boric acid leaks.

3.2B.2.1.2 Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and/or Stress Corrosion Cracking

In LRA Table 3.2.1, Item 3.2.1-18, the applicant stated that bolting in the ESF systems is not subject to wetted conditions, therefore, loss of material due to general corrosion is not expected. Additionally, cracking for bolting in ESF systems is not identified as an aging effect requiring management.

The staff noted that SRP-LR Table 3.2-1 recommended GALL AMP XI.M18, for managing closure bolting in high pressure or high temperature system for loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC.

During the audit, the staff questioned the applicant whether all of the resolutions of the generic safety issue for bolting, as stated in NUREG-1339, are addressed. By letter dated December 3, 2004, the applicant submitted its LRA supplement. in which it stated that it has developed a specific aging management program that addresses degradation of bolting at MPS. The program is addressed in Section 3.0.3.2.18 of this SER.

By letter dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaced the existing information in the "Discussion" column of LRA Table 3.2.1, Item 18 with "consistent with the NUREG-1801."

The staff reviewed the applicant's response and finds this acceptable since it is consistent with the GALL Report.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2B.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In Section 3.2.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for ESF systems. Specifically, the applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general corrosion
- local loss of material due to pitting and crevice corrosion
- local loss of material due to microbiologically influenced corrosion
- local loss of material due to erosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.2.2.2 of the SRP-LR). Details of the staff's audit and review are documented in the staff's MPS audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.2B.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.2B.2.2.2 Loss of Material Due to General Corrosion

In LRA Section 3.2.2.2.2, the applicant addressed loss of material due to general corrosion that could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components.

SRP-LR Section 3.2.2.2.2 states that loss of material due to general corrosion could occur in the containment spray, containment isolation valves and associated piping, and the external surfaces of carbon steel components. The GALL Report recommends further evaluation on a plant-specific basis to ensure that the aging effect is adequately managed.

The applicant stated, in the LRA, that for loss of material from internal surfaces, this SRP-LR item applies to carbon steel containment spray headers, nozzles, and valves and to carbon steel containment isolation piping and valves. The containment spray headers, nozzles, and valves and containment isolation components in the ESF systems are constructed of stainless steel and are not subject to loss of material due to general corrosion. Containment isolation components associated with other plant systems are evaluated for the effects of aging along with the host system to which they are assigned.

For loss of material from external surfaces, this item applies to carbon steel ESF components. Loss of material from external surfaces due to general corrosion is applicable to carbon steel (including cast iron and low-alloy steel) components in an air environment when exposed to intermittent wetting conditions. For these components, loss of material from external surfaces is managed by MPS AMP B2.1.13, "General Condition Monitoring Program."

The staff finds that loss of materials due to general corrosion does not apply to stainless steel components.

The staff reviewed the general condition monitoring program, and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to general corrosion on external surfaces of carbon steel components since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

On the basis of its review of the general condition monitoring program, the staff finds that the applicant has appropriately evaluated AMR results involving management of the loss of material due to general corrosion, as recommended in the GALL Report.

3.2B.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion

In LRA Section 3.2.2.2.3, the applicant addressed local loss of material from pitting and crevice corrosion that could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the RWST external surfaces.

SRP-LR Section 3.2.2.2.3.2 states that local loss of material from pitting and crevice corrosion could occur in the containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water tank external surface. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In the LRA, the applicant stated that containment isolation components are potentially subject to loss of material due to pitting and crevice corrosion. Loss of material for these components is managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," or, for those components in a raw water environment, by MPS AMP B2.1.25, "Work Control Process."

Also, the external bottom surface of the RWST is potentially subject to loss of material due to pitting and crevice corrosion. Loss of material of the external surface of the RWST bottom is managed by MPS AMP B2.1.24, "Tank Inspection Program."

The applicant stated, in the LRA, that the chemistry control for primary systems program is consistent with GALL with an exception. The staff reviewed the chemistry control for primary systems program, with the exception, and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. On the basis of its review, the staff finds the chemistry control for primary systems program acceptable for managing this aging effect for the above components.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program also provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that the work control process program is acceptable for managing the aging effect of loss of materials.

The staff reviewed the tank inspection program, which includes an enhancement to measure wall thickness to detect significant loss of material of the RWST bottom surface, and its evaluation is documented in Section 3.0.3.2.17 of this SER. On the basis of its review, the staff finds the program to be acceptable for managing loss of material due to pitting and crevice corrosion.

3.2B.2.2.4 Local Loss of Material Due to Microbiologically Influenced Corrosion

In LRA Section 3.2.2.2.4, the applicant addressed local loss of material due to MIC.

SRP-LR Section 3.2.2.2.4 states that local loss of material due to MIC could occur in containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL Report. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

The applicant stated, in the LRA, that containment isolation components are potentially subject to loss of material due to MIC. Loss of material for these components is managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," or, for those components in a raw water environment, by MPS AMP B2.1.25, "Work Control Process."

The applicant stated, in the LRA, that the chemistry control for primary systems program is consistent with GALL with an exception. The staff reviewed the chemistry control for primary systems program, with the exception, and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. On the basis of its review, the staff finds the chemistry control for primary systems program to be acceptable for managing this aging effect for the above components.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program also provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that the work control process program is acceptable for managing the aging effect of loss of materials.

3.2B.2.2.5 Local Loss of Material Due to Erosion

In LRA Section 3.2.2.2.6, the applicant addressed local loss of material due to erosion that could occur in the HPSI miniflow orifice.

SRP-LR Section 3.2.2.2.6 states that local loss of material due to erosion could occur in the HPSI pump miniflow orifice. This aging mechanism and its effect will apply only to pumps that are normally used as charging pumps in the chemical and volume control systems. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

The applicant stated, in the LRA, that loss of material due to erosion of the charging pump miniflow recirculation orifices is managed by MPS AMP B2.1.25, "Work Control Process."

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. It also provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that the work control process program is acceptable for managing the aging effects of loss of material due to erosion, as recommended in the GALL Report.

3.2B.2.2.6 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's Quality Assurance Program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2B.2.3 AMR Results That are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.2.2-1 through 3.2.2-5 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report. The staff also reviewed additional systems and components, provided in the applicant's letter dated January 11, 2005.

In Tables 3.2.2-1 through 3.2.2-5, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Staff Evaluation. For component type, material and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation.

3.2B.2.3.1 Containment Recirculation - Aging Management Evaluation - Table 3.2.2-1

The staff reviewed Table 3.2.2-1 of the LRA, which summarizes the results of AMR evaluations for the containment recirculation component groups.

The applicant has not identified in the LRA any aging effects for low-alloy and stainless steel components exposed to air, including bolting, expansion joints, flow elements, flow indicators, hoses, pipe, pump seal coolers, pump seal head tanks, pumps, restricting orifices, spray nozzles, TSP baskets, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on low-alloy and stainless steel components will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, therefore, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steels are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel flow indicators, hoses, piping, tubing, and valve component types exposed to chemically treated borated water using only MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the chemistry control for primary systems program, with an exception, and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to confirm the absence of loss of material is not required. On the basis of its review, the staff finds the chemistry control for primary systems program to be acceptable for managing this aging effect.

In the LRA, the applicant proposed to manage loss of material of stainless steel containment recirculation coolers (shell) component types exposed to a moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.13, "General Condition Monitoring." This is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of copper alloy containment recirculation coolers (tubes) component types exposed externally to a moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process." This is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal and external surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on external surfaces of components to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of stainless steel containment recirculation coolers (shell), expansion joints, flow elements, pipe, and restricting orifices component types exposed internally to a moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process." This is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal and external surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of copper alloy containment recirculation coolers (tubes) component types exposed internally to a moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.21, "Service Water System (Open-Cycle Cooling)," with exceptions. The applicant stated, in the LRA, that the tube side and the shell side of the containment recirculation coolers are in dry lay-up except when testing. The applicant's exception to this line item relates to flushing and testing "infrequently used cooling loops," which is recommended in the GALL Report. Since these coolers are maintained in a dry lay-up condition, no mechanism exists for tube-side fouling. This does not have any impact on loss of material. In addition, the applicant stated that this program is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System," which includes routine inspection and a maintenance program to ensure that corrosion cannot degrade the performance of safety-related systems serviced by open-cycle cooling water. The staff reviewed the service water system (open-cycle cooling) program and its evaluation is documented in Section 3.0.3.2.15 of this SER. On the basis of its review, the staff finds that this program is acceptable for managing this aging effect.

In the LRA, the applicant proposed to manage loss of material of stainless steel pipe, pump, and valve component types exposed internally to raw water using MPS AMP B2.1.25, "Work Control Process." The applicant stated, as documented in the technical report for the work control process, that the system drains going into the containment sump are assumed to contain raw water because of the potential contaminants and lack of chemistry control. The staff noted that this is different from the raw water used in open-cycle cooling systems. The applicant stated per Note H that the aging effect is not in NUREG-1801 for this component, material, and environment combination. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

LRA Table 3.2.2-1 for the containment recirculation components identify loss of material as an aging affect applicable to nickel based alloys and copper alloys exposed to internal and external air environments. The LRA does not identify the alloy zinc content for these materials. The LRA credits the work control process for managing loss of material of the nickel based alloy containment recirculation cooler tubesheets and copper alloy tubes in an external air environment and the AMP "Service Water System" for managing loss of material on the interior of copper alloy channel heads and tubes and nickel based alloy tubesheets. Industry documents such as EPRI Report 1003056 identify various corrosion mechanisms causing loss of material in an air environment subject to moisture. Aging mechanisms such as selective leaching, crevice corrosion and galvanic corrosion are material and location dependent. In RAI 3.2-1 the applicant was requested to identify the alloy zinc content and clarify if selective leaching is an applicable aging mechanism. If selective leaching is an applicable aging mechanism, clarify if hardness testing and one-time inspection required by GALL AMP XI.M33 will be used. Also clarify how visual inspections required by the aging management programs are effective in managing loss of material by providing for inspections at locations that are susceptible to the aging mechanism such as the [the] tubesheet and channel head interiors which may be inaccessible for visual inspection. The applicant was also requested to provide the following additional information (a) frequency of the inspections including the bases. (b) Inspection methods which verify the loss of material in the recirculation cooler channel heads, tube sheets and tubes (c) Identify any operating experience to demonstrate the effectiveness of the work control process and the service water program to manage loss of material in nickel based alloys and copper alloys exposed to an external air environment.

In its response dated November 9, 2004, the applicant stated:

> The containment recirculation cooler tubes and channel head lining are copper-nickel material and the tubesheet is nickel-copper (Monel) material. Zinc is not an alloying element for any of these materials. Therefore, selective leaching is not an applicable aging mechanism for these components.
>
> The containment recirculation coolers are maintained in a dry lay-up condition and loss of material due to corrosion is not expected. However, since the coolers are flushed and flow tested on a periodic basis, the aging management review conservatively considered the environment for the coolers to be intermittently wetted. As a result, loss of material due to corrosion was determined to be an applicable aging effect for the containment recirculation coolers. The coolers are accessed and the tubesheets and channel head interiors are inspected as part of the Service Water System (Open-Cycle Cooling AMP described in LRA Appendix B, Section B2.1.21. In addition, components that are opened or disassembled for maintenance activities are visually inspected as part of the Work Control Process aging management program as described in Appendix B, Section B2.1.25. For containment recirculation cooler locations that are not readily accessible for visual inspection, the Work Control Process AMP remains effective in that other work activities which are associated with components representative of the specific materials and environments of the coolers provided an indication of the condition of the cooler components.
>
> The containment recirculation coolers are inspected every other refueling outage in accordance with the Service Water System (Open-Cycle Cooling) AMP. The containment recirculation cooler inlet ends are accessed and a visual inspection is performed.
>
> Demonstration of the effectiveness of the Service Water System (Open-Cycle Cooling) AMP is addressed in the discussion of operating experience provided in the LRA Section B2.1.21. Operating experience related to the Work Control Process AMP is addressed in LRA Section B2.1.25.

The staff finds the applicant's response reasonable and acceptable because the applicant has clarified why selective leaching is not an applicable aging mechanism for these components. The applicant has also identified inspection activities to appropriately manage the aging effects.

The applicant stated in the LRA "The Millstone Unit 3 containment recirculation coolers and service water supply piping to these heat exchangers are infrequently used loops but are not flushed in accordance with GL 89-13. The containment recirculation coolers are maintained in a dry lay up condition. Thus, no mechanism exist for tube side fouling and the ability of the coolers to perform their intended function is maintained. The service water supply piping to these heat exchangers is flushed on a semi-annual basis to displace any mussel or hydroid colonies onto screens installed on the tubesheets of these heat exchangers. The accumulated debris on the screens is then removed after the flushing evolution. In RAI 3.2-2 the applicant was requested to provide information based on inspections and applicant's self-assessment programs which assure that with the present state of fouling the recirculation coolers in Unit 3 will be able to perform to their intended function during the period of extended operation. For example are visual inspections performed and correlated to an acceptable degree of fouling to determine the effectiveness of the dry lay up program?

In its response dated November 9, 2004, the applicant stated:

> Review of the last three years of inspection data for the Unit 3 A, B, C and D containment recirculation coolers and discussion with the system engineer indicate that the degree of fouling is minor and did not affect the operability of the heat exchangers. The semi-annual service water inlet piping flush and inspection did not identify foreign debris in most cases. Some inspections did identify small amounts of mussel shell pieces and evaluations in accordance with plant procedures were performed to determine if the heat exchanger operation could have been impacted; however, no concerns were identified. Based on the results of the current flushing and inspection frequency, the dry lay up program is effective in maintaining the degree of fouling at a level that supports plant operation. Any substantial change in the effectiveness of the flush and inspection surveillance results would be addressed through the corrective action program.

The staff finds the applicant's response reasonable and satisfactory because the applicant's operating experience and piping flush and inspection activities indicate that the operability of the heat exchangers is not affected.

3.2B.2.3.2 Quench Spray - Aging Management Evaluation - Table 3.2.2-2 and Table 3.2.2-2a

The staff reviewed Table 3.2.2-2 of the LRA and Table 3.2.2-2a in the applicant's letter dated January 11, 2005, which summarized the results of AMR evaluations for the quench spray system component groups.

The applicant, in the LRA, has identified no aging effect for low-alloy and stainless steel components exposed to air, including bolting, flow elements, pipe, pumps, spray nozzles, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, therefore, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concurs with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel flow elements, pipe, pump, tubing, and valve component types exposed to chemically treated borated water using only MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the chemistry control for primary systems program, and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to confirm the absence of loss of material is not required. On the basis of its review, the staff finds this program to be acceptable for managing the aging effects for the above components.

In the LRA, the applicant proposed to manage loss of material of stainless steel pipe exposed externally to a damp soil environment using MPS AMP B2.1.4, "Buried Piping Inspection Program." The applicant stated that this program is consistent with GALL AMP XI.M28, "Buried Piping and Tanks Surveillance," and GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with exceptions and enhancements. The staff reviewed the Buried Piping Inspection Program, with the exceptions and enhancements, and its evaluation is documented in Section 3.0.3.2.1 of this SER. The staff finds that this program includes a baseline inspection of a representative sample of piping with different protective measures and inspections of buried components when piping is excavated during maintenance or for any other reason. On the basis of its review, the staff finds that the program is acceptable for managing loss of material of stainless steel pipe in a damp soil external environment.

In the LRA and the LRA supplement letter dated January 11, 2005, the applicant proposed to manage (1) loss of material of stainless steel restricting orifice component types exposed externally to a moisture-laden air and/or intermittently wetted environment and (2) loss of loss of material of stainless steel refueling water coolers (channel head) using MPS AMP B2.1.13, "General Condition Monitoring." This is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

3.2B.2.3.3 Safety Injection - Aging Management Evaluation - Table 3.2.2-3 and Table 3.2.2-3a

The staff reviewed Table 3.2.2-3 of the LRA and Table 3.2.2-3a in the applicant's letter dated January 11, 2005, which summarized the results of AMR evaluations for the safety injection (SI) system component groups.

The applicant, in the LRA and in the applicant's letter dated January 11, 2005, identified no aging effect for carbon steel, cast iron, stainless steel, and CASS components exposed to air, including filters/strainers, flow elements, pipe, pumps, restricting orifices, SI accumulator tanks (carbon steel with stainless steel cladding), SI pump lube oil coolers (shell), SI pump lube oil reservoirs, tubing, valve, and hydro test pump component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in an ambient air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel and CASS are not susceptible to significant general corrosion that would affect the intended function of components. The staff finds that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel pipe exposed externally to a damp soil environment using MPS AMP B2.1.4, "Buried Piping Inspection Program." The applicant stated that this program is consistent with GALL AMP XI.M28, "Buried Piping and Tanks Surveillance," and GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with exceptions and enhancements. The staff reviewed the Buried Piping and Tanks Inspection, with the exceptions and enhancements, and its evaluation is documented in Section 3.0.3.2.1 of this SER. The staff finds that this program includes a baseline inspection of a representative sample of piping with different protective measures and inspections of buried components when piping is excavated during maintenance or for any other reason. On the basis of its review, the staff finds that this program is acceptable for managing loss of material of stainless steel pipe exposed externally to a damp soil environment.

The applicant, in the LRA, has identified no aging effect for carbon and stainless steel components exposed internally to gas, including pipe, SI accumulator tanks (carbon steel with stainless steel cladding), and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff concurs with the applicant's conclusion that there are no applicable aging effects requiring management for metal in a gas environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel SI pump lube oil coolers (channel head) component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring." This is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of carbon steel, cast iron, and stainless steel filter/strainer, SI pump lube oil coolers (shell), SI pump lube oil coolers (tubes), SI pump lube oil coolers (tube sheet), and SI pump lube oil reservoirs component types exposed internally to oil, and in some cases externally to oil, using MPS AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of internal surfaces of components are performed during the performance of maintenance to determine the presence of loss of material. Oil samples are analyzed periodically for contaminants that would indicate degradation. On the basis of its review, the staff finds that the program is acceptable for managing loss of materials for the above components.

In the LRA, the applicant proposed to manage loss of materials of copper alloy SI pump lube oil coolers (tubes) component types in an environment of treated closed-cycle cooling water using MPS AMP B2.1.7, "Closed-Cycle Cooling Water System." The Closed-Cycle Cooling Water (CCCW) system program is consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water Systems," with an exception. The staff reviewed the CCCW system program, with the exception, and its evaluation is documented in Section 3.0.3.2.4 of this SER. On the basis of its review, the staff finds that this program, with the exception, is acceptable for managing loss of material of components in the treated water environment that are serviced by the CCCW system.

3.2B.2.3.4 Residual Heat Removal - Aging Management Evaluation - Table 3.2.2-4

The staff reviewed Table 3.2.2-4 of the LRA, which summarizes the results of AMR evaluations in the SRP-LR for the residual heat removal system component groups.

The applicant, in the LRA, identified no aging effect for carbon steel, stainless steel, and CASS components exposed to air, including flow elements, pipe, pumps, residual heat removal (RHR) heat exchangers (channel head), tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in an ambient air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel and CASS are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concurs with the applicant's conclusion that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel residual heat removal heat exchanger (tubes) component types exposed internally to treated water using MPS AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

3.2B.2.3.5 Fuel Pool Cooling and Purification - Table 3.2.2-5 and Table 3.2.2-5a

The staff reviewed Table 3.2.2-5 of the LRA and Table 3.2.2-5a in the applicant's letter dated January 11, 2005, which summarized the results of AMR evaluations for the fuel pool cooling and purification system component groups.

The applicant, in the LRA and the applicant's supplement dated January 11, 2005, identified no aging effect for low-alloy and stainless steel components exposed to air, including bolting, flow elements, fuel pool coolers (channel head), pipe, pumps, tubing, valve, fuel pool demineralizer, fuel pool post filter, and strainers component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Therefore, the staff concurred with the applicant's conclusion that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel flow elements and fuel pool coolers (channel head) component types exposed to chemically treated borated water using only MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the Chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to confirm the absence of loss of material is not required. On the basis of its review, the staff finds this program to be acceptable for managing the aging effects for the above components.

All other AMRs in Tables 3.2.2-1 through 3.2.2-5 were evaluated. The staff finds them to be acceptable.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report or not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2B.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the ESF systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the engineering safety features systems, as required by 10 CFR 54.21(d).

3.3 Aging Management of Auxiliary Systems

3.3A Unit 2 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the Unit 2 auxiliary systems components and component groups associated with the following systems:

- circulating water system
- screen wash system
- service water system
- sodium hypochlorite system
- reactor building closed cooling water system

- chilled water system
- instrument air system
- nitrogen system
- station air system
- chemical and volume control system
- sampling system
- primary makeup water system
- access control area air conditioning system
- main condensers evacuation system
- containment air recirculation and cooling system
- containment and enclosure building purge system
- containment penetration cooling system
- containment post-accident hydrogen control system
- control room air conditioning system
- control element drive mechanism cooling system
- diesel generator ventilation system
- engineered safety features (ESF) room air recirculation system
- enclosure building filtration system
- fuel handling area ventilation system
- main exhaust ventilation system
- non-radioactive area ventilation system
- process and area radiation monitoring system
- radwaste area ventilation system
- turbine building ventilation system
- vital switchgear ventilation system
- Unit 2 fire protection system
- Unit 3 fire protection system
- domestic water system
- diesel generator system
- diesel generator fuel oil system
- station blackout (SBO) diesel generator system
- security system
- clean liquid waste processing system
- gaseous waste processing system
- post-accident sampling system
- station sumps and drains system
- turbine building closed cooling water system

3.3A.1 Summary of Technical Information in the Application

In LRA Section 3.3, the applicant provided AMR results for auxiliary systems components and component groups. In LRA Table 3.3.1, "Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems," the applicant provided a summary comparison of its aging management reviews (AMRs) with the AMRs evaluated in the Generic Aging Lessons Learned (GALL) report for the auxiliary systems components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3A.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL aging management programs (AMPs). The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Detail of the staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.3A.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff verified that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.3.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluation are documented in the staff's MPS audit and review report and summarized in Section 3.3A.2.2 of this SER.

The staff performed an onsite audit conducted a technical review of the remaining AMRs that were not consistent with or not addressed in the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.3A.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.3A.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the auxiliary system components.

Table 3.3A-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.3A-1 Staff Evaluation for Auxiliary System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in spent fuel pool cooling and cleanup	Loss of material due to general, pitting, and crevice	Water chemistry and one time inspection		Not applicable (See Section 3.3A.2.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Linings in spent fuel cooling and cleanup system; seals and collars in ventilation systems (Item Number 3.3.1-02)	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant-specific	Work control process (B2.1.25); General condition monitoring (B2.1.13)	Consistent with GALL (See Section 3.3A.2.2.2)
Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) (Item Number 3.3.1-03)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 52.21(c)	TLAA	This TLAA is evaluated in Section 4.3A, Metal Fatigue
Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR) (Item Number 3.3.1-04)	Crack initiation and growth due to SCC or cracking	Plant-specific		Consistent with GALL (See Section 3.3A.2.2.4)
Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components (Item Number 3.3.1-05)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant-specific	General condition monitoring (B2.1.13); Fire protection program (B2.1.10); Work control process (B2.1.25); Tank inspection program (B2.1.24); Structures monitoring program (B2.1.23); Infrequently accessed areas inspection program (B2.1.15)	Consistent with GALL, which recommends further evaluation (See Section 3.3A.2.2.5)
Components in reactor coolant pump oil collection system of fire protection (Item Number 3.3.1-06)	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	Tank inspection program (B2.1.24); Work control process (B2.1.25)	Consistent with GALL (See Section 3.3A.2.2.6)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system (Item Number 3.3.1-07)	Loss material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Fuel oil chemistry program (B2.1.12), Work control process (B2.1.25), Tank inspection program (B2.1.24)	Consistent with GALL, which recommends further evaluation (See Section 3.3A.2.2.7)
Heat exchangers in chemical and volume control system (Item Number 3.3.1-09)	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and plant-specific verification program	Chemistry control for primary systems program (B2.1.5), Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.3A.2.2.9)
Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-10)	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant-specific		Not applicable (See Section 3.3A.2.2.10)
New fuel rack assembly (Item Number 3.3.1-11)	Loss of material due to general, pitting and, crevice corrosion	Structures monitoring		Not consistent with GALL (See Section 3.5A.2.3.4) The new fuel rack assembly is fabricated from stainless steel. No aging effect management is required for the stainless steel fuel rack assembly.
Neutron absorbing sheets in spent fuel racks (Item Number 3.3.1-12)	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring	Boraflex monitoring (B2.1.2)	Consistent with GALL, which recommends no further evaluation (See Section 3.3A.2.1)
Spent fuel storage racks and valves in spent fuel pool cooling and cleanup (Item Number 3.3.1-13)	Crack initiation and growth due to stress corrosion cracking	Water chemistry		Not consistent with GALL. The spent fuel pool water temperature is maintained below the threshold temperature of 140 degree F for SCC.
Closure bolting and external surfaces of carbon steel and low-alloy steel components (Item Number 3.3.1-14)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.2); General condition monitoring (B2.1.13)	Consistent with GALL (See Section 3.3A.2.1.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in or serviced by closed-cycle cooling water system (Item Number 3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	Closed-cycle cooling water system (B2.1.7); Work control process (B2.1.25); Chemistry control for primary systems program (B2.1.5); Chemistry control for secondary systems program (B2.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.3A.2.1)
Cranes, including bridge and trolleys, and rail system in load handling system (Item Number 3.3.1-16)	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling systems	Inspection activities: load handling cranes and devices (B2.1.19)	Consistent with GALL, which recommends no further evaluation (See Section 3.3A.2.1)
Components in or serviced by open-cycle cooling water systems (Item Number 3.3.1-17)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and boifouling; buildup of deposit due to biofouling	Open-cycle cooling water system	Service water system (open-cycle cooling) (B2.1.19); Work control process (B2.1.25); Closed-cycle cooling water system (B2.1.7)	Consistent with GALL, which recommends no further evaluation (See Section 3.3A.2.1.3)
Buried piping and fittings (Item Number 3.3.1-18)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tank surveillance or Buried piping and tanks inspection	Buried piping inspection (B2.1.4)	Consistent with GALL, which recommends further evaluation (See Section 3.3A.2.2.11)
Components in compressed air system (Item Number 3.3.1-19)	Loss of material due to general and pitting corrosion	Compressed air monitoring	Work control process (B2.1.25)	Consistent with GALL (See Section 3.3A.2.1)
Components (doors and barrier penetration seals) in concrete structures in fire protection (Item Number 3.3.1-20)	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	Fire protection program (B2.1.10); Work control process (B2.1.25)	Consistent with GALL (See Section 3.3A.2.1.4)
Components in water-based fire protection (Item Number 3.3.1-21)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	Fire protection program (B2.1.10); Work control process (B2.1.25) ; Tank inspection program (B2.1.24)	Consistent with GALL (See Section 3.3A.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in diesel fire system (Item Number 3.3.1-22)	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	Fuel oil chemistry (B2.1.12)	Consistent with GALL (See Section 3.3A.2.1)
Tanks in diesel fuel oil system (Item Number 3.3.1-23)	Loss of material due to general, pitting, and crevice corrosion	Above ground carbon steel tanks	Tank inspection program (B2.1.24)	Consistent with GALL, which recommends no further evaluation (See Section 3.3A.2.1)
Closure bolting (Item Number 3.3.1-24)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	Bolting integrity	Consistent with GALL (See Section 3.3A.2.1)
Components (aluminum, bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink (Item Number 3.3.1-29)	Loss of material due to selective leaching	Selective leaching of materials	Work control process (B2.1.25); Buried piping inspection (B2.1.4)	Consistent with GALL (See Section 3.3A.2.1.5)
Fire barriers, walls, ceilings, and floors in fire protection (Item Number 3.3.1-30)	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel	Fire protection and structures monitoring		Not consistent with GALL (See Section 3.5A.2.3.26)

The staff's review of the MPS auxiliary systems and associated components followed one of several approaches. One approach, documented in Section 3.3A.2.1, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.3A.2.2, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.3A.2.3, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the auxiliary systems components is documented in Section 3.0.3 of this SER.

3.3A.2.1 AMR Results That are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Sections 3.3.2.1.1 through 3.3.2.1.41 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the auxiliary systems components:

- general condition monitoring program
- work control process program
- boric acid corrosion program
- buried pipe inspection program
- infrequently accessed areas inspection program
- service water system (open-cycle cooling) program
- closed-cycle cooling water system program
- chemistry control for primary systems program
- chemistry control for secondary systems program
- inservice inspection program: systems, components and supports program
- fire protection program
- tank inspection program
- fuel oil chemistry program
- bolting integrity program

Staff Evaluation. In Tables 3.3.2-1 through 3.3.2-41 of the LRA, the applicant provided a summary of AMRs for the auxiliary systems components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.3A.2.1.1 Loss of Material Due to Boric Acid Corrosion

In the discussion section of LRA Table 3.3.1, Item 3.3.1-14, the applicant stated that loss of material due to boric acid corrosion is managed by MPS AMP B2.1.3, " Boric Acid Corrosion Program;" and MPS AMP B2.1.13, "General Condition Monitoring Program." The boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components. The boric acid corrosion program is evaluated in Section 3 of this SER.

In the LRA, the applicant stated that the general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. During the audit, the staff asked the applicant for clarification on how loss of material for components not normally visible, or in infrequently accessed areas are managed by this program. During the audit, further clarification was requested on how identification, documentation, evaluation, and trending of boric acid leakage is performed under this program. During the audit, the applicant stated that the general condition monitoring program is an extension of the boric acid corrosion program in that the general condition monitoring program identifies borated water leakage during inspections and then, through the corrective action program, the leak is assigned and evaluated by the boric acid corrosion program. When borated water leakage is identified by the general condition monitoring program, a condition report is written to identify the leak. During the daily review of the new condition reports, it is assigned to the boric acid corrosion program where it gets fully evaluated and repaired as required. This is the same process used to identify leaks in the boric acid corrosion program.

For those areas identified as infrequently accessed areas, for the purposes of detecting boric acid leakage, entry into the area is performed often enough (at least once per refueling interval) to credit the general condition monitoring program. No infrequently accessed areas with systems containing borated water are identified by the applicant.

The staff's evaluation of the general condition monitoring program is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns performed by plant personnel to look for boron buildup and/or boric acid leaks.

3.3A.2.1.2 Loss of Material Due to General, Pitting, and Crevice Corrosion, and MIC

In LRA Table 3.3.2-30 (page 3-274), the applicant listed both MPS AMP B2.1.25, "Work Control Process," and MPS AMP B.2.1.7, "Closed Water Cooling Systems," for loss of material exposed internally to treated water for the DC switchgear cooling coils. During the audit and review, the applicant was asked to clarify which AMP is credited. In LRA supplement dated July 7, 2004, the applicant stated that AMP B2.1.25, "Work Control Process," was inadvertently listed as an AMP for managing loss of material in treated water environment for the DC switchgear air conditioning unit cooling coils component group. The staff reviewed the applicant's response and based on the clarification provided, finds it acceptable.

3.3A.2.1.3 Loss of Material Due to General, Pitting, and Galvanic Corrosion, MIC, and Biofouling; Buildup of Deposit Due to Biofouling

In the discussion section of LRA Table 3.3.1, Item 3.3.1-17 (page 3-195), the applicant stated that loss of material for components in an open-cycle cooling water environment is managed by AMP B2.1.21, "Service Water System (Open-Cycle Cooling) Program." However, Item 3.3.1-17 does not address buildup of deposits as an aging effect managed by the service water system (open-cycle cooling) program for the heat exchanger tubes and lined piping in a seawater environment. In an LRA supplement dated July 7, 2004, the applicant stated that in LRA Table 3.3.1, Item 3.3.1-17, the first sentence in the discussion should include "and Buildup of Deposits" after "Loss of Material." The staff reviewed the applicant's response and finds it acceptable.

3.3A.2.1.4 Loss of Material Due to Wear, Hardening and Shrinkage

In the discussion section of LRA Table 3.3.1, Item 3.3.1-20, the applicant stated that loss of material due to wear is not an applicable aging effect for components (doors and barrier penetration seals) in the fire protection system. Fire doors could see wear on hinges, locks, etc., due to periodic opening and closing. This could cause loss of material and impact on the intended function of fire doors. During the audit and review, the staff asked the applicant to provide justification as to why this aging effect was not included. The applicant stated that fire doors are passive features to seal passageways through fire-rated barriers. Fire doors are equipped with hardware and attachment/closure devices that perform their intended function with moving parts and/or change of configuration and are considered to be active components. As such, wear of the hardware, appurtenances, and attachment/closure mechanisms is not considered to be an aging effect, but rather a consequence of frequent or rough usage. The applicant restated that the conclusions in the LRA remain valid and unchanged. However, the applicant initiated revisions to the technical report for miscellaneous structural commodities to incorporate the above evaluation for wear of the hinges and locks for the fire doors. Based on the fact that these components are active components, the staff finds the response acceptable.

3.3A.2.1.5 Loss of Material Due to Selective Leaching

In the discussion section of LRA Table 3.3.1, Item 3.3.1-29, the applicant stated that loss of material due to selective leaching is managed using MPS AMP B2.1.25, "Work Control Process," and MPS AMP B2.1.4, "Buried Pipe Inspection Program." The applicant stated that these two programs are not consistent with GALL AMP XI.M33, "Selective Leaching," in that the GALL program recommends a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching to determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function for the period of extended operation. However, the work control process program and the buried pipe inspection program perform only routine visual inspection (which is more than a one-time inspection) when the opportunity arises, but do not perform hardness testing.

Since selective leaching generally does not cause changes in dimension and is difficult to detect by visual inspection alone, the staff asked the applicant to justify the use of visual inspection only, or provide other means of detection (Brinnell hardness, destructive testing) or other mechanical means (scraping, chipping, etc.). The staff's evaluation of the applicant's response is documented in the evaluation of the work control process program and the buried pipe inspection program in Sections 3.0.3.3.4 and 3.0.3.2.1 of this SER, respectively.

In the AMP technical report for the work control process program, the applicant stated that selective leaching is an aging mechanism that causes an aging effect of change in material properties. However, in the technical report of AMR results for the closed water system, the applicant stated that selective leaching is an aging mechanism under the aging effect of loss of material. The technical report for material aging effects considers selective leaching under loss of material. The staff noted there is a discrepancy as to how selective leaching is considered between the AMP and the AMR technical reports.

During the audit and review, the applicant was requested by the staff to provide a rationale for considering selective leaching as causing change in material properties, which is generally an aging effect associated with non-metallic, elastomer type materials. The applicant concurred that all technical reports should have associated selective leaching with the aging effect of loss of material. The staff reviewed the change document to the affected technical reports, which identified the change to include selective leaching under the "loss of material" aging effect. On the basis of its review, the staff finds this acceptable.

In an LRA supplement dated July 7, 2004, the applicant stated that LRA Table 3.3.2-32 (pages 3-286 through 3-297) should state, "3.3.1-29" for the second 'Table 1 Item' listed for components with cast iron/raw water and copper alloy/raw water material/environment combinations. The 'NUREG-1801 Volume 2 Item' column for the affected component groups should be "VII.C1.2-a" except for the 'Pipe' and 'Tubing' component groups, which should be "VII.C1.1-a." The staff reviewed the applicant's response and finds that it is acceptable.

In LRA Table 3.3.2-41(page 3-333), for the station sumps and drains system, and for loss of material of cast iron pumps and copper alloy valve components in a raw water environment, the applicant referenced LRA Table 3.3.1, Item 3.3.1-17. Item 3.3.1-17 only addressed loss of material due to miscellaneous corrosion, but not selective leaching. During the audit and review, the applicant was requested to provide a rationale for not considering loss of material due to selective leaching. In an LRA supplement dated July 7, 2004, the applicant stated that Unit 2 LRA Table 3.3.2-41 should contain additional information for the component groups 'pumps' (cast iron/raw water) and 'valves' (copper alloy/raw water). Specifically, each component group should have an additional entry for the 'Aging Management Program,' 'NUREG-1801 Volume 2 Item,' 'Table 1 Item,' and 'Notes' columns which adds the entries "Work Control Process," "VII.C1.5-a" for pumps and "VII.C1.2-a" for valves, "3.3.1-29," and "E," respectively. Because the applicant concurred that LRA Table 3.3.1, Item 3.3.1-29 is applicable, the staff finds the response acceptable.

During the audit and review, the staff questioned why various portions of the fire protection system and diesel generator system were not included within the scope of license renewal and subject to an AMR. In its LRA supplement letter dated July 7, 2004, the applicant added several components in the fire protection system and diesel generator system that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the fire protection system and diesel generator system AMR. The staff finds this material/environment/aging effect/AMP combination to be acceptable. The staff's evaluation of the scope of the fire protection system and diesel generator system is documented in Section 2.3A.3.32 and Section 2.3A.3.34, respectively, of this SER.

3.3A.2.1.6 Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and Stress Corrosion Cracking

In the discussion section of LRA Table 3.3.1, Item 3.3.1-24, the applicant stated that closure bolting in the auxiliary systems is not subject to wetted conditions, therefore, loss of material due to general corrosion is not expected. Additionally, cracking for bolting in auxiliary systems is not identified as an AERM.

During the review, the staff noted that SRP-LR Table 3.3-1 recommended GALL AMP XI.M18, "Bolting Integrity," for managing closure bolting for loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC.

The staff questioned the applicant whether all of the resolutions of the generic safety issue for bolting, as stated in NUREG-1339, are addressed. By letter dated December 3, 2004, the applicant submitted its LRA supplement. In its response, the applicant stated that it has developed a specific bolting integrity aging management program that addresses degradation of bolting at MPS. The bolting integrity program is reviewed in Section 3.0.3.2.18 of this SER.

By letter dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaces the existing information in the "Discussion" column of LRA Table 3.3.1, Item 24 with "consistent with NUREG-1801."

The staff reviewed the applicant's response and finds this acceptable since it is consistent with the GALL Report.

Staff RAIs Pertaining to Recent Operating Experience and Emerging Issues. Because the GALL Report and SRP-LR were issued in July 2001, these documents do not reflect the most current recommendations for managing certain aging effects that have been the subject of recent operating experience or the topic of an emerging issue. As a result, the staff determined that additional information was required related to the boric acid corrosion. The applicant's responses and the staff evaluation of the responses are described below.

The LRA identifies a borated water leakage environment for various mechanical components in auxiliary systems. Both the boric acid corrosion program and general condition monitoring program are credited with managing loss of material from external surfaces of these components. The LRA states that the general condition monitoring program is performed in accessible plant areas. The applicant was requested to clarify how loss of material is managed for auxiliary system components not normally visible, such as under insulation or in normally inaccessible areas. In addition, the LRA states that the boric acid corrosion program is consistent with GALL AMP XI.M10. The scope of GALL AMP XI.M10 is limited to components in the vicinity of the reactor coolant pressure boundary. However, it appears that the MPS boric acid corrosion program is credited with managing loss of material caused by borated water leakage in systems that may not be in the vicinity of the reactor coolant pressure boundary, such as the radwaste area ventilation system. The applicant was requested to clarify this potential discrepancy. If the scope of the Millstone Units 2 and 3 boric acid corrosion program is different from the GALL XI.M10 program, the applicant was requested to revise the Millstone Units 2 and 3 program description accordingly in the AMP and FSAR supplement. Also the applicant was requested in RAI 3.3-A-1 to identify the basis for applying the boric acid corrosion program to manage boric acid corrosion in copper alloy and cast iron materials that are not addressed in GALL AMP XI.M10 and may require a different inspection frequency.

In a response dated December 3, 2004, the applicant clarified that general equipment (or materials) inspections are performed as often as daily. The applicant indicated that an independent assessment was performed by the Institute of Nuclear Power Operations (INPO) in August 2003 and boric acid leaks are captured in the station corrective action program. INPO noted that the computer based training module has increased awareness of station employees with regard to boric acid corrosion and minor program enhancements are being addressed through the corrective action program.

The applicant stated that the following clarification will be added to Section A2.1.3, Boric Acid Corrosion Program, of the LRA:

> The Boric Acid Corrosion program provides both detection and analysis of leakage of borated water inside containment. The General Condition Monitoring program is the primary method for detecting borated water leakage outside containment. The analysis of the leakage is performed through the boric acid corrosion program. Any necessary corrective actions are implemented through the corrective action program.

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant credits a combination of the general condition monitoring program and the boric acid corrosion program to detect and evaluate borated water leakage and boric acid corrosion to maintain the intended function of the auxiliary system components. For areas outside containment, general equipment (or materials) inspections are performed frequently. The inspections would be expected to identify any borated water leakage and any required subsequent evaluation. The applicant has agreed to include a clarification in the FSAR supplement to indicate that the general condition monitoring program is the primary method for detecting borated water leakage outside containment and the analysis of the leakage is performed through the boric acid corrosion program with corrective actions implemented through the corrective action program.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in LRA Table 3.3.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further project team review is required.

The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3A.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.3.2.2, the applicant provides further evaluation of aging management as recommended by the GALL Report for auxiliary systems. The applicant provided information concerning how it will manage the following aging effects:

- loss of material due to general, pitting, and crevice corrosion
- hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear
- cumulative fatigue damage
- crack initiation and growth due to cracking or stress corrosion cracking
- loss of material due to general, microbiologically influenced, pitting, and crevice corrosion
- loss of material due to general, galvanic, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and biofouling
- quality assurance for aging management of non-safety-related components
- crack initiation and growth due to stress corrosion cracking and cyclic loading
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.3.3.2 of the SRP-LR. Details of the staff's audit and review are documented in the staff's MPS audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections:

3.3A.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.1 against the criteria in SRP-LR Section 3.3.2.2.1. In LRA Section 3.3.2.2.1, the applicant addressed loss of material in components of the spent fuel pool system.

SRP-LR Section 3.3.2.2.1 states that loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tube sheets of the heat exchanger in the spent fuel pool cooling and cleanup system. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI TR-105714 guidelines for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material from general, pitting, or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, verification of the effectiveness of the water chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of selected components at susceptible locations is an acceptable method for ensuring that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

Further, SRP-LR Section 3.3.2.2.1 states that loss of material due to pitting and crevice corrosion could occur in the filter housing, valve bodies, and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI TR-105714 guidelines for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material from pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program.

The AMP recommended by the GALL Report is GALL AMP XI.M2, "Water Chemistry," for management of loss of material due to general, pitting, and crevice corrosion.

The applicant stated in the LRA that as set forth in the GALL Report, this item applies to spent fuel pool cooling and cleanup carbon steel components with elastomer linings. The spent fuel pool cooling system does not contain carbon steel components with elastomer linings. Therefore, this item is not applicable. The applicant included the spent fuel pool cooling system in Unit 2 LRA Section 3.2, "Engineered Safety Features Systems." The staff reviewed the LRA Table 3.2.2-5 AMR for the spent fuel pool cooling system and verified that the system did not contain carbon steel components with elastomer linings. On the basis of its review, the staff finds this line item not applicable for components in the spent fuel pool cooling system.

However, these components are fabricated from stainless steel material. As stated in Section 3.2A.2.3.5 of this SER, the applicant proposed to manage loss of material of stainless steel expansion joints, flow elements, pipe, pumps, and spent fuel pool heat exchangers (channel head) component types exposed to chemically treated borated water using only MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception related to use of a later, non-NRC-approved revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to verify the absence of loss of material is not required. On the basis of its review, the staff finds that the chemistry control for primary systems program is acceptable for managing this aging effect.

3.3A.2.2.2 Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material Due to Wear

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2. In LRA Section 3.3.2.2.2, the applicant addressed the potential for degradation of elastomers in collars and seals in spent fuel pool cooling system and ventilation systems.

SRP-LR Section 3.3.2.2.2 states that hardening and cracking due to elastomer degradation could occur in elastomer linings of the filter, valve, and ion exchangers in spent fuel pool cooling and cleanup systems. Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the duct and in the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating and ventilation systems, and in the collars and seals of the duct in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the duct in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated in the LRA that the spent fuel pool cooling system does not contain carbon steel components with elastomer linings. Therefore, this item is not applicable. The applicant has included the spent fuel pool cooling system in LRA Section 3.2, "Engineered Safety Features Systems." The staff reviewed the Table 3.2.2-5 AMR for spent fuel pool cooling system and verified that the system did not contain carbon steel components with elastomer linings. On the basis of its review, the staff finds that this line item is not applicable for components in spent fuel pool cooling system.

The applicant stated in the LRA that elastomers are used in ventilation systems components and are evaluated for cracking and change of material properties due to thermal and radiation exposure. The applicant credited AMP B2.1.25, "Work Control Process," and AMP B2.1.13, "General Condition Monitoring Program," for managing age-related degradation of elastomers used in ventilation systems components. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Also, this program provides input to the corrective action program if aging effects are identified. The staff accepted the work control process program for managing the aging effects of cracking and change in material properties and its evaluation of this program is documented in Section 3.0.3.3.4 of this SER. The staff also accepted the general condition monitoring program for managing cracking and change of material properties since visual inspections will be performed on external surfaces to identify any sign of aging degradation. The staff's evaluation of the general condition monitoring program is documented in Section 3.0.3.3.2 of this SER.

In LRA Section 3.2.2.2.2, the applicant stated that loss of material due to wear is not an AERM for the elastomers in the ventilation systems. During the audit and review, the staff reviewed the applicant's basis and determined that the elastomers in the ventilation systems are not subject to motions which could result in wear. Based on the lack of motion, the staff finds that the loss of material due to wear is not an aging effect requiring management for the elastomers in the ventilation system.

3.3A.2.2.3 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.3A.2.2.4 Crack Initiation and Growth Due to Cracking or Stress Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4. In LRA Section 3.3.2.2.4, the applicant addressed the potential for cracking in the high-pressure pumps of the chemical and volume control system (CVCS).

SRP-LR Section 3.3.2.2.4 addresses crack initiation and growth due to cracking in the high-pressure pumps in the CVCS. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated in the LRA that cracking is not identified as an AERM for the CVCS high-pressure pump casing. The high-pressure pump casing is constructed of stainless steel and operates at temperatures less than 140 °F. SCC is applicable to stainless steel components in aqueous environments that experience operating temperatures greater than 140 °F.

The applicant stated that based on industry experience, a temperature criterion of greater than 140 °F is used as the threshold for susceptibility of austenitic stainless steels to SCC. No instances were identified that would bring this temperature threshold into question. On the basis of its review, the staff finds the applicant's statement reasonable and acceptable because the applicant's bases for excluding the aging effects of cracking in the CVCS high-pressure pump casing are consistent with industry and site operating experience.

3.3A.2.2.5 Loss of Material Due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5. In LRA Section 3.3.2.2.5, the applicant addressed the loss of material from corrosion that could occur on internal and external surfaces of components exposed to air and the associated range of atmospheric conditions.

SRP-LR Section 3.3.2.2.5 states that loss of material due to general, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, auxiliary and radwaste area, primary containment heating and ventilation systems, piping of the diesel generator building ventilation system, aboveground piping and fittings, valves, and pumps in the diesel fuel oil system and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the emergency diesel generator system. Loss of material due to general, pitting, and crevice corrosion, and MIC could occur in the duct fittings, access doors and closure bolts, equipment frames, and duct housing. Loss of material due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler units, and due to general corrosion could occur on the external surfaces of all carbon steel SCs, including bolting, exposed to operating temperatures less than 212°F in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated that AMP B2.1.10, "Fire Protection Program;" AMP B2.1.24, "Tank Inspection Program;" and AMP B2.1.25, "Work Control Process," managed loss of material due to general corrosion, MIC, pitting, and crevice corrosion for the internal surfaces of ducts, piping, filter housings, compressed air systems components, and fuel oil systems components. Loss of material for external surfaces of carbon steel components is effectively managed by AMP B2.1.3, "General Condition Monitoring;" AMP B2.1.10, "Fire Protection Program;" AMP B2.1.23, "Structures Monitoring Program;" and AMP B2.1.24, "Tank Inspection Program." Also, the applicant stated that AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," managed this aging effect for components in infrequently accessed areas.

The staff identified a discrepancy between LRA Table 3.3.2-31, "Auxiliary Systems - Unit 2 Fire Protection," and LRA Table 3.3.2-32, "Auxiliary Systems - Unit 3 Fire Protection." In LRA Table 3.3.2-31(page 3-281), the applicant stated, for carbon steel pipe exposed internally to moist air, that the fire protection program is used for managing the aging effects of loss of material. In LRA Table 3.3.2-32 (page 3-291), the applicant credited the work control process program to manage loss of material and references Table 3.3.1, Item 3.3.1-05. During the audit and review, the applicant was requested to clarify which is correct. In an LRA supplement dated July 7, 2004, the applicant stated that LRA Table 3.3.2-32, the "Work Control Process" AMP for the carbon steel 'Pipe' component group exposed internally to an air environment, should be replaced with the "Fire Protection Program" AMP. The "NUREG-1801" item should be "VII.H2.3-a" and the "Notes" should be "C, 2." The staff reviewed the applicant's response and finds it to be acceptable.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds the work control process program acceptable for managing the aging effects of loss of materials due to general corrosion, MIC, pitting, and crevice corrosion for the internal surfaces of ducts, piping, filter housings, compressed air systems components, and fuel oil systems components.

The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The fire protection program is consistent with GALL AMPs XI.M.26, "Fire Protection," and XI.M.27, "Fire Water System." On the basis of its review, the staff finds that the fire protection program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces to detect any sign of aging degradation when the system is opened for maintenance and/or repair.

The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. The tank inspection program is consistent with GALL AMP XI.M.29, "Aboveground Carbon Steel Tanks." On the basis of its review, the staff finds that the tank inspection program is acceptable for managing loss of material due to general corrosion since wall thickness measurements will be performed on the lower portion of the tank.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The general condition monitoring program uses visual inspections to detect evidence of degradation or adverse conditions in accessible plant areas. System engineers perform comprehensive visual inspections during walkdowns of plant systems and components during normal operation and during refueling outages; plant equipment operators perform equipment and structures inspections twice a day to maintain awareness of system and plant operation and material condition during normal operation and refueling outages. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of materials since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The structures monitoring program manages the aging effects of cracking, loss of material, and change of material properties by monitoring structures and structural support systems that are within the scope of license renewal. The majority of these structures and structural support systems are monitored under 10 CFR 50.65 as addressed in RG 1.160, Revision 2, and NUMARC 93-01, Revision 2. These two documents provide guidance for development of licensee-specific programs to monitor the condition of structures and structural components within the scope of the Maintenance Rule, such that there is no loss of structure or structural component intended function. The remaining structures within the scope of license renewal (such as non-safety-related buildings and enclosures, duct banks, valve pits and trenches, high-energy line break barriers, and flood gates) are also monitored to ensure there is no loss of intended function. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. On the basis of its review, the staff finds that the structures monitoring program is acceptable for managing loss of material since visual inspections will be performed on external surfaces for any sign of aging degradation.

The staff reviewed the infrequently accessed areas inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The infrequently accessed areas inspection program is a new, plant-specific program that manages the aging effects of loss of material using visual inspections of the external surfaces of SCs. The program encompasses infrequently accessed areas of the plant which contain in-scope equipment. All areas not normally accessible for inspection and evaluation, and that contain SCs subject to aging management, have been identified for inclusion in the program. On the basis of its review, the staff finds that the infrequently accessed areas inspection program is acceptable for managing loss of material due to general corrosion on external surfaces of carbon steel components, since visual inspections will be performed on external surfaces to detect any sign of aging degradation in the service water system.

During the audit and review, the staff questioned why various portions of the diesel generator system were not included within the scope of license renewal and subject to an AMR. In its LRA supplement dated July 7, 2004, the applicant added several components in the diesel generator system to those that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the diesel generator system AMR for components addressed by LRA Section 3.3.2.2.5. Based on the applicant's addition of diesel generator system components as subject to AMR, the staff finds this material/environment/aging effect/AMP combination to be acceptable. The staff's evaluation of the scope of the diesel generator system is documented in Section 2.3A.3.35 of this SER.

3.3A.2.2.6 Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6. In LRA Section 3.3.2.2.6, the applicant addressed further evaluation of programs to manage loss of material in the RCP oil collection system to verify the effectiveness of the fire protection program.

SRP-LR Section 3.3.2.2.6 states that loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the RCP oil collection system in fire protection. The fire protection program relies on a combination of visual and volumetric examinations, in accordance with the guidelines of 10 CFR 50 Appendix R and Branch Technical Position 9.5-1, to manage loss of material from corrosion. However, corrosion may occur at locations where water from wash downs may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, galvanic, pitting, and crevice corrosion to verify the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the RCP oil collection system tank is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The applicant stated in the LRA that loss of material is managed for the components associated with the RCP oil collection system by MPS AMP B2.1.24, "Tank Inspection Program," which subjects the RCP oil collection tanks to periodic internal and external inspections. Additionally, during containment close-out activities, the RCP oil collection tanks are visually inspected and verified to be empty.

The staff reviewed the tank inspection program, which is consistent with GALL AMP XI.29, "Aboveground Carbon Steel Tanks," and its evaluation is documented in Section 3.0.3.2.17 of this SER. Since the tank inspection program includes volumetric examinations for wall thickness measurement of the RCP oil collection tank, the staff finds the program acceptable for managing loss of material due to general, galvanic, pitting, and crevice corrosion.

The applicant referenced LRA Table 3.3.1, Item 3.3.1-06 (page 3-190), for components exposed internally to lube oil (Note 14) and loss of material aging effect combination in LRA Table 3.3.2-32, and credited the work control process program. In LRA Table 3.3.1, Item 3.3.1- 06, the applicant stated that the loss of material aging effect is managed by the tank inspection program. The staff noted that there is no mention in the table about the work control process program. During the audit, the staff requested the applicant clarify the omission. In its LRA supplement, dated July 7, 2004, the applicant stated that LRA Table 3.3.1, Item 3.3.1-06, should include the following words between the second and third sentences:

> For the non-tank components, loss of material is managed by the work control process program.

Additionally, the applicant stated in the LRA supplement that LRA Section 3.3.2.2.6 (page 3-184) should include the following words at the end of the first sentence:

> For the non-tank components, loss of material is managed by the work control process program.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. It also provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds the work control process program acceptable for managing the aging effects of loss of material.

3.3A.2.2.7 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

The staff reviewed LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3A.2.2.7. In LRA Section 3.3.2.2.7, the applicant addressed further evaluation of programs to manage loss of material in the diesel fuel oil system to verify the effectiveness of the diesel fuel monitoring activities.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in the internal surface of tanks in the diesel fuel oil system and due to general, pitting, and crevice corrosion and MIC in the tanks of the diesel fuel oil system in the emergency diesel generator system. The existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D4057, D1796, D2709, and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion/biofouling to verify the effectiveness of the program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The AMPs recommended by the GALL Report are GALL AMP XI.M30, "Fuel Oil Chemistry," and GALL AMP XI.M32, "One Time Inspection," for management of this aging effect.

The applicant stated in the LRA that MPS AMP B2.1.12, "Fuel Oil Chemistry," manages loss of material for diesel fuel oil tanks and other components in the diesel generator fuel oil system, the security system, and the station blackout diesel generator system. In lieu of a one-time inspection program as described in SRP-LR Section 3.3.2.2.7, the applicant stated in LRA Section 3.3.2.2.7 that MPS AMP B2.1.25, "Work Control Process," will be used to provide confirmation of the effectiveness of the fuel oil chemistry program, and that tank inspections performed under the applicant's MPS AMP B2.1.24, "Tank Inspection Program," provide additional confirmation that the fuel oil chemistry program is effective for managing aging effects for applicable tanks.

The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction, and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2) establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment within the scope of license renewal. On the basis of its review, the staff finds the fuel oil chemistry program to be acceptable.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that the work control process program is acceptable for use in providing confirmation of the effectiveness of the fuel oil chemistry program.

The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. The tank inspection program is consistent with GALL AMP XI.M.29, "Aboveground Carbon Steel Tanks." On the basis of its review, the staff finds that the tank inspection program is acceptable for providing additional confirmation that the fuel oil chemistry program is effective for managing aging effects for applicable tanks.

3.3A.2.2.8 Quality Assurance for Aging Management of Non-safety-related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's Quality Assurance Program.

3.3A.2.2.9 Crack Initiation and Growth Due to Stress Corrosion Cracking and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9. In LRA Section 3.3.2.2.9, the applicant addressed further evaluation of programs to manage cracking in the chemical and volume control system (CVCS) to verify the effectiveness of the water chemistry control program.

SRP-LR Section 3.3.2.2.9 states that crack initiation and growth due to SCC and cyclic loading could occur in the channel head and access cover, tube sheet, tubes, shell and access cover, and closure bolting of the regenerative heat exchanger and in the channel head and access cover, tube sheet, and tubes of the letdown heat exchanger in the CVCS. The water chemistry program relies on monitoring and control of water chemistry based on the EPRI TR-105714 guidelines for primary water chemistry to manage the effects of crack initiation and growth due to SCC and cyclic loading. Verification of the effectiveness of the chemistry control program should be performed to ensure that crack initiation and growth are not occurring. The GALL Report recommends further evaluation to manage crack initiation and growth from SCC and cyclic loading for these systems to verify the effectiveness of the water chemistry program. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that crack initiation and growth are not occurring and that the component's intended function will be maintained during the period of extended operation.

The AMPs recommended by the GALL Report are GALL AMP X1.M2, "Water Chemistry," and a plant-specific verification program for management of this aging effect.

The applicant stated in the LRA that cracking due to SCC for the regenerative and letdown heat exchangers is managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." Verification of the effectiveness of the chemistry control program is provided by MPS AMP B2.1.25, "Work Control Process." The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The corrective action program would evaluate the cause and extent of a condition and, if required, recommend enhancements to ensure continued effectiveness of the chemistry control for primary systems program.

The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The chemistry control for primary systems program is consistent with GALL AMP XI.M2, "Water Chemistry," with an acceptable exception. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. On the basis of its review, the staff finds that the chemistry control for primary systems program is acceptable for managing this aging effect.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of crack initiation and growth. On the basis of its review, the staff finds that the work control process program is acceptable for managing crack initiation and growth since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

3.3A.2.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

SRP-LR Section 3.3.2.2.10 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage pool. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated in the LRA 3.3.2.2.10 that Boral is not used in the spent fuel pool for neutron absorption. Since Boral is not used at Unit 2, the staff agrees that this line item is not applicable.

3.3A.2.2.11 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11. In LRA Section 3.3.2.2.11, the applicant addressed the potential for loss of material in buried piping of the service water and diesel fuel oil systems.

SRP-LR Section 3.3.2.2.11 states that loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (service water system) and in the diesel fuel oil system. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

The AMP recommended by the GALL Report is GALL AMP XI.M34, "Buried Piping and Tanks Inspection."

The applicant stated in the LRA that loss of material for buried piping and valves in the service water system, and in the Unit 2 fire protection system, Unit 3 fire protection system, and enclosure building filtration system, is managed by AMP B2.1.4, "Buried Pipe Inspection Program."

In the LRA, the applicant stated that as part of the buried pipe inspection program, a baseline inspection of representative in-scope buried piping is performed, which provides an effective method for detection of aging effects. In addition, inspections are performed when the buried components are excavated for maintenance or any other reason and provide an effective method to evaluate the condition of the buried piping and protective coatings. Operating experience with age-related degradation of buried piping is limited and no failures of in-scope buried piping have been identified.

Also, the applicant stated that there is no buried piping in the diesel fuel oil systems.

The staff reviewed the buried pipe inspection program and its evaluation is documented in Section 3.0.3.2.1 of this SER. The staff finds that the buried pipe inspection program is consistent with GALL AMP XI.M28, "Buried Piping and Tanks Surveillance," and GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with exceptions and enhancements. The staff also finds the exceptions and enhancements to be acceptable. The staff reviewed the plant operating experience and found that the program is effective in identifying age-related degradation, implementing repairs, and maintaining the integrity of buried pipe. On the basis of its review, the staff finds that the buried pipe inspection program is acceptable for managing the aging effects of loss of material in buried piping and fittings.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3A.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.3.2-1 through 3.3.2-41 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

In Tables 3.3.2-1 through 3.3.2-41, the applicant indicated, via Notes F through J, that neither the identified component nor the material/environment combination is evaluated in the GALL Report and provided information concerning how the AERM will be managed.

Staff Evaluation. For component type material/environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff requested the applicant to provide additional information on the issues described in the following general RAIs. These RAIs, the applicant's response, and the staff's evaluation of the responses are described below.

Cracking in Dux Seal Joint Seals (RAI 3.3-A-2). The LRA identifies cracking in ductwork joint seals using Dux Seal material for various ventilation system components in the auxiliary systems. The general condition monitoring program is credited with managing this aging effect through the use of visual inspections of external surfaces and the LRA tables do not identify aging effects for ductwork seals exposed to the internal environment. In some cases, drying and cracking of seals from the internal environment with continuous air flow could potentially be more severe than the external environment. The general condition monitoring AMP, described in LRA Section B2.1.13, did not identify specific criteria, including the inspection frequency and its technical basis, unique to managing ductwork joint seals; and it was not clear how external visual inspections will manage internal degradation. The applicant was requested to clarify how visual inspection of the external surfaces of ductwork joint seals is adequate to detect internal cracking prior to loss of the component pressure boundary function. In addition, the general condition monitoring program is limited to accessible plant areas. The applicant was requested to clarify how ductwork joint seals in inaccessible areas are inspected and/or tested for cracking. The applicant was also requested to provide the inspection frequency, including its technical basis, and the operational history to demonstrate the effectiveness of the general condition monitoring program to manage cracking in ductwork joint seals.

By letter dated November 9, 2004, the applicant responded as follows:

> Dux Seal is an adhesive/sealant-saturated fabric cloth that is applied to the external surface of the ductwork at the crimped and rivited joints in order to provide a leak-tight seal. The material (also termed Hardcast) cures hard and rigid, and is not similar to duct tape. Since it is applied to the ouside surface of the duct, the primary exposure environment is ambient air. No aging effects are expected to originate from inside the ductwork due to the limited exposure to the ductwork internal environment. Therefore,

the cracking aging effect has been determined to require management due to the external environment.

Ductwork is generally not routed through inaccessible areas of the plant, and no inaccessible ductwork joint seals were identified as part of the aging management review.

The cracking aging effect for the ductwork joint seals is visually observable during the inspections performed as part of the general condition monitoring aging management program as described in LRA Appendix B, Section B2.1.13. Inspections are performed by the systems engineers as part of the comprehensive system evaluations performed quarterly, and by the plant equipment operators during daily rounds of plant areas to verify proper component and system operation. Significant degradation of the ductwork joint seals has not been identified, however, the effectiveness of the General Condition Monitoring AMP is demonstrated by operating experience associated with other plant components as cited in Appendix B, Section B2.1.13.

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant provided sufficient information to conclude that cracking in ductwork joint seals will be adequately managed by the general condition monitoring program during the period of extended operation. The applicant clarified that Dux Seal is an adhesive/sealant-saturated fabric cloth that cures hard and rigid. Since this material is applied to the outside surface of ductwork joints, there is limited exposure to the internal environment and cracking is applicable to the external environment. The applicant also identified that no inaccessible ductwork joint seals were identified as part of the aging management review and significant degradation of the ductwork joint seals has not been identified. Further, the applicant clarified that cracking in ductwork joint seals is visually observable during the comprehensive system evaluations performed by system engineers quarterly and by plant equipment operators during daily rounds of plant areas to verify proper component and system operation. On the basis of the applicant's response, all issues related to RAI 3.3-A-2 are resolved.

<u>Selective Leaching in Copper Alloys (RAI 3.3-A-3)</u>. LRA Tables 3.3.2-34 and 3.3.2-36 for the diesel generator and station blackout diesel generator respectively identify loss of material as an aging effect applicable to nickel-based alloys and copper alloys exposed to a moisture-laden air and/or intermittently wetted environment. The LRA did not identify the alloy zinc content for these materials. The LRA credited the work control process program for managing loss of material in the interior of nickel-based alloy valves and the general condition monitoring program for managing loss of material on the exterior of copper alloy radiators. These AMPs primarily rely on visual inspections. Industry documents, such as EPRI report 1003056, "Non-Class-1 Mechanical Implementation Guideline and Mechanical Tools," Rev. 3, identify various corrosion mechanisms, including selective leaching, that cause loss of material in copper alloys with greater than 15 percent zinc content in an air environment subject to moisture. Loss of material from selective leaching is specifically addressed in GALL AMP XI.M33, but page B-7 of the LRA states that the AMRs did not identify the need for this AMP. The applicant was requested to identify the alloy zinc content for these materials and clarify if selective leaching is an applicable aging mechanism. If selective leaching is an applicable aging mechanism, the applicant was requested to clarify if hardness measurement and one-time inspection required by GALL AMP XI.M33 will be used to manage the aging effect.

By letter dated November 9, 2004, the applicant responded as follows:

> Dominion conservatively assumed that all copper alloys were of a material composition that could be susceptible to selective leaching. Accordingly, the zinc content for copper alloys was not identified in the LRA since it was not used as an input to the evaluation of aging mechanisms. Selective leaching was not considered to be an applicable aging mechanism for nickel-based alloys.
>
> Selective leaching of copper alloys was not considered to be significant in a moisture-laden air and/or an intermittently wetted environment unless conditions were conducive to water collection or pooling which would cause wetting for a significant period of time. If water collection or pooling was present for a component, the component was evaluated for a raw water environment as defined in LRA Table 3.0-1.
>
> The copper alloy components in the diesel generator system associated with moisture-laden air are the pipes and tubes of the turbocharger and intercooler air systems. Wetting is possible during the operation of these components which normally occurs only during monthly Technical Specification surveillance testing. Wetted conditions would dissipate after use due to the elevated temperatures of operation. Therefore wetting for a significant time period would not occur.
>
> The copper alloy component in the diesel generator system associated with intermittent wetting is the level indicator (sight glass) on the jacket cooling water expansion tanks. Portions of this component are normally dry but may occasionally become wetted. Wetting for a significant time period is not expected.
>
> The copper alloy component in the station blackout diesel generator system associated with intermittent wetting is the radiator that is exposed to an atmosphere/weather environment. Atmosphere/weather environments and selective leaching are discussed in the response to RAI 3.3-B-2.
>
> Based on the above, loss of material due to selective leaching was not identified as an aging effect for these components and the work control process and the general condition monitoring AMPs provide management of this aging effect.

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant provided sufficient information to conclude that selective leaching is not a significant aging mechanism causing loss of material in copper alloy materials in the diesel generator and station blackout diesel generator systems exposed to periodic moisture. This conclusion is in part based on the applicant's clarified environmental conditions that copper alloy components in these systems exposed to moisture-laden air and/or intermittently wetted conditions are not exposed to wetted conditions for a significant period of time. The staff agrees that selective leaching of nickel alloys is not considered to be a concern in this environment. In addition, the applicant has agreed in its letter, dated July 7, 2004, to include appropriate inspection criteria for selective leaching to its work control process AMP. On the basis of the applicant's response, all issues related to RAI 3.3-A-3 are resolved.

The systems specific staff evaluation is discussed below.

3.3A.2.3.1 Circulating Water - Aging Management Evaluation - Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the circulating water system component groups. In the LRA, the applicant proposed to manage loss of material of stainless steel pipe and valve component types exposed to air using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to air. The applicant stated, in the technical report of AMR results for open water, that change of material properties due to thermal exposure and irradiation and cracking due to irradiation of rubber components in air are aging effects that do not require aging management for the components in this system.

The staff reviewed the current industry research and operating experience. On the basis of its review, the staff finds the applicant correctly identified that no aging effects for rubber expansion joints in air, since these components are not exposed to high levels of ultraviolet radiation, ozone, or temperatures greater than 95 °F.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to seawater. The applicant stated in the technical report of AMR results for open water, that change of material properties and cracking due to thermal exposure of rubber components in seawater are aging effects that do not require aging management for the components in this system.

On the basis of current industry research and operating experience, the threshold temperature for applying the aging effects of cracking and change of material properties to elastomers is 95 °F. For, the surface temperature of the rubber expansion joints in the open water systems will never exceed 95 °F, since the internal water (raw water from the Long Island Sound) is significantly less than 95 °F. On the basis of its review, the staff finds that the applicant correctly identified no aging effect for this component, since they are not exposed to temperatures greater than 95 °F.

3.3A.2.3.2 Screen Wash - Aging Management Evaluation - Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the screen wash system component groups.

In the LRA, the applicant proposes to manage loss of material of stainless steel tubing and valves and copper alloys strainers and valve component types exposed to air using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material on external surfaces of the stainless steel components (due to pitting and crevice corrosion) and copper alloys components (due to general corrosion), since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for fiberglass piping component types exposed to air. The applicant stated in the technical report for AMR results for open water, that reduced strength due to ozone exposure of non-metallic is possible in an air environment. The applicant explains that the fiberglass components exposed to air in this system are not located near high-voltage electrical equipment. Therefore, ozone exposure is not a potential aging mechanism, and review of operating experience has identified no concerns related to the occurrence of ozone exposure in the open water systems for this evaluation.

On the basis of its review of the applicant's technical report, current industry research, and operating experience, the staff finds that reduced strength due to ozone for fiberglass components in air environment is not an aging effect that requires aging management.

In the LRA, the applicant identified no aging effects for fiberglass piping component types exposed to seawater. The applicant stated in the technical report for AMR results for open water, that exposure to ultraviolet radiation and ozone can cause damage to the chemical structure of the epoxy matrix of fiberglass. The earliest signs of this effect can be changes in color, and surface cracking or crazing. Fiberglass exposed to direct sun or high levels of ozone that might be found in conjunction with high-voltage electrical equipment would be most prone to this effect.

On the basis of its review of the applicant's technical report, current industry research, and operating experience, the staff concurs that the fiberglass components in a seawater environment are not exposed to high levels of ultraviolet radiation or ozone. Therefore, the staff finds that cracking in fiberglass components in seawater is not an aging effect that requires aging management.

In the LRA, the applicant identified no aging effects for polyvinyl chloride (PVC) valve component types exposed to air and seawater. Current industry research and operating experience reviews have identified instances of PVC degradation resulting from exposure to direct sunlight and exposure to ozone from high voltage. The material aging effect report (MAER) identifies the aging effect of reduced strength due to ozone exposure for PVC components exposed to seawater, and reduced strength due to ozone exposure or ultraviolet exposure for PVC components exposed to air. The AMR evaluated PVC components for the above aging effects and concluded that no aging management was required. This conclusion was based on the fact that the PVC components are not exposed to direct sunlight and are not exposed to high levels of ozone, since they are not in close proximity to high-voltage electrical equipment.

On the basis of its review of the applicant's technical report, current industry research, and operating experience, the staff concurs with the applicant and finds that reduction in strength of PVC components in an air or seawater environment is not an aging effect that requires aging management.

3.3A.2.3.3 Service Water - Aging Management Evaluation - Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the service water system component groups. In LRA Table 3.3.2-3, the applicant proposed to manage buildup of deposits for carbon steel pipe and strainers, and cast iron pipe component types exposed to seawater using AMP B2.1.21, "Service Water System (Open-Cycle Cooling)," which is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System." However, buildup of deposits due to biofouling is not identified in the GALL Report as an aging effect for the pipes and strainers component types.

The applicant stated, in the AMR results for open water, that the carbon steel and cast iron material-lined piping interfaces with seawater and is subject to macro-fouling, silting, and sedimentation. Therefore, buildup of deposits is a potential aging effect that requires aging management for these components.

The applicant stated in LRA Appendix C (page C-24) that buildup of deposits due to biofouling is an aging effect requiring management for heat exchanger tubes, tube sheets, and lined components. The applicant stated that lined piping was included because piping can contribute to heat exchanger fouling since small segments of the coating can become detached and foul associated heat exchangers. Buildup of deposits does not directly affect the pressure boundary of the lined piping. However, prolonged operation with deteriorated coatings would lead to loss of material. For this reason, both buildup of deposits and loss of material are managed by the service water system (open-cycle cooling) aging management activity. Specifically, internal visual inspections of the service water piping are periodically performed.

During the audit and review, the staff asked the applicant to provide justification as to why buildup of deposits is not applied to stainless steel service water filters/strainers since filtration is an intended function. The applicant responded that the stainless steel service water filters/strainers are not lined. Although filtration is an intended function, clogging of the filter is an expected service condition and does not result from age-related degradation. The stainless steel service water filters/strainers in question are equipped with differential pressure gauges and are periodically cleaned based on differential pressure.

The staff reviewed the service water system (open-cycle cooling) program and its evaluation is documented in Section 3.0.3.2.15 of this SER. On the basis of its review of the applicant's program and technical report, together with current industry research and operating experience, the staff finds that the service water program is acceptable for managing buildup of deposits for the lined components, since internal visual inspections of the service water components will be periodically performed to detect any sign of deposit build-up.

In the LRA, the applicant proposed to manage loss of material of copper alloy tubing and valve external surfaces caused by borated water leakage using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds use of the general condition monitoring program in lieu of the boric acid corrosion program acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system, since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In LRA Table 3.3.2-3, the applicant proposed to manage loss of material for nickel-based alloy expansion joints and tubing exposed to seawater using MPS AMP B2.1.21, "Service Water System (Open-Cycle Cooling)," which is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System." However, loss of material for nickel-based component types in treated water as a component, material, environment, and aging effect combination is not identified in the GALL Report.

The applicant stated in the AMR results for open water that the nickel-based alloys, related to pitting, in seawater are exposed to low-flow conditions with an aggressive environment. Therefore, pitting corrosion is a potential aging mechanism.

The staff reviewed the service water system (open-cycle cooling) program and its evaluation is documented in Section 3.0.3.2.15 of this SER. The staff finds that the service water system (open-cycle cooling) program is acceptable for managing loss of material (due to pitting corrosion) of nickel-based alloy components in a seawater environment for this system, since this program implements the intent of GL 89-13.

In the LRA, the applicant proposed to manage loss of material of stainless steel and copper alloy pipe, tubing, valves, filter/strainers, flow elements, flow indicators, flow orifices, pumps, and restricted orifices component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The environments are not in the GALL Report for this component type and material.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for the fiberglass service water pump motor protective tank exposed to air. The applicant stated in the AMR results report for open water that reduced strength due to ozone exposure of non-metallic components is possible in an air environment. The applicant explained that the fiberglass components exposed to air in this system are not located near high-voltage electrical equipment. Therefore, ozone exposure is not a potential aging mechanism, and review of operating experience has identified no concerns related to the occurrence of ozone exposure in the open water systems for this evaluation.

On the basis of its review of the applicant's technical report, current industry research, and operating experience, the staff concurred and finds that reduced strength due to ozone for fiberglass components in air environment is not an aging effect that requires aging management.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to air. The applicant stated in the AMR results for open water that change of material properties due to thermal exposure and irradiation, and cracking due to irradiation of rubber components in air are aging effects that do not require aging management for the components in this system.

On the basis of its review of the applicant's technical report, current industry research, and operating experience, the staff concurred and finds that no aging effect for rubber expansion joints in air is acceptable, since these components are not exposed to high levels of ultraviolet radiation, ozone, or temperatures greater than 95°F.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to seawater. The applicant stated in the AMR results for open water that change of material properties and cracking due to thermal exposure of rubber components in seawater are aging effects that do not require aging management for the components in this system.

On the basis of current industry research and operating experience, the threshold temperature for applying the aging effects of cracking and change of material properties to elastomers is 95 °F. For, the surface temperature of the rubber expansion joints in the open water systems will never exceed 95 °F, since the temperature of the internal water (raw water from the Long Island Sound) is significantly less than 95 °F. On the basis of its review, the staff finds that the applicant correctly identified no aging effect for this item, since these components are not exposed to temperatures greater than 95 °F.

3.3A.2.3.4 Sodium Hypochlorite - Aging Management Evaluation - Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the sodium hypochlorite system component groups.

In the LRA, the applicant proposed to manage loss of material of stainless steel valve component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The environments are not in the GALL Report for this component type and material. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for PVC pipes and valves exposed to air or in a seawater environment. Current industry research and operating experience reviews have identified instances of PVC degradation resulting from exposure to direct sunlight and exposure to ozone from high voltage. The MAER identifies the aging effect of reduced strength due to ozone exposure for PVC components exposed to seawater, and reduced strength due to ozone exposure or ultraviolet exposure for PVC components exposed to air. The applicant stated that it evaluated PVC components for the above aging effects and concluded that no aging management was required. This conclusion was based on the fact that the PVC components are not exposed to direct sunlight and are not exposed to high levels of ozone, since they are not in close proximity to high-voltage electrical equipment.

On the basis of its review of the applicant's technical report, current industry research, and operating experience, the staff finds that reduction in strength of PVC components in an air or seawater environment is not an aging effect that requires aging management.

3.3A.2.3.5 Reactor Building Closed Cooling Water - Aging Management Evaluation - Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarized the results of AMR evaluations for the reactor building closed cooling water (RBCCW) system component groups.

In the LRA, the applicant proposed to manage loss of material for RBCCW heat exchanger copper alloy tubes in treated water using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on the external surfaces of heat exchanger tubes to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of copper alloy valve external surfaces caused by borated water leakage using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the use of the general condition monitoring program in lieu of the boric acid corrosion program is acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system, since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of stainless steel and copper alloy valves, flow elements, flow indicators, flow orifices, flow switches, and tubing component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

3.3A.2.3.6 Chilled Water - Aging Management Evaluation - Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarized the results of AMR evaluations for the chilled water system component groups.

In the LRA, the applicant proposed to manage loss of material of carbon steel chiller water surge tank component groups exposed internally to moisture-laden air and/or an intermittently wetted environment using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of copper alloy tubing and valve external surfaces caused by borated water leakage using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the use of the general condition monitoring program in lieu of the boric acid corrosion program is acceptable for managing loss of material due to borated acid leakage on the external surfaces of copper alloy components in this system, since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of stainless steel and copper alloy tubing, valves, level indicators, flow elements, moisture indicators, and pumps component types exposed to a moisture-laden air and/or intermittently wetted environments using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on the external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, and copper alloy components exposed internally to gas for chilled water shell and tubes, chilled water evaporators tubes, compressor casings, filter/strainers, level indicators, moisture indicators, and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging effects that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

3.3A.2.3.7 Instrument Air - Aging Management Evaluation - Table 3.3.2-7

The staff reviewed Table 3.3.2-7 of the LRA and Table 3.3.2-7a in the LRA supplement letter dated January 11, 2005, which summarizes the results of AMR evaluations for the instrument air system component groups. The staff reviewed the technical report of AMR results for air and gas systems.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe, regulators, tubing, and valve component types exposed to a borated water leakage external environment using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. However, the GALL Report specifies GALL AMP XI.M10, "Boric Acid Corrosion," to manage this aging effect. The applicant stated, in Note 1, that the boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program provides inspections for the management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. Also, visual inspection of external surfaces is performed during various walkdowns by plant personnel to look for boron buildup and/or boric acid leaks. On the basis of its review, the staff finds that this program is acceptable for managing loss of material of copper alloy pipe, tubing, and valves component types exposed to a borated water leakage external environment.

In the LRA and the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for carbon steel, stainless steel, copper alloys, and PVC components exposed internally and externally to air, including accumulators (reserve air bottles), pipe, valves, hoses, regulators, tubing, tubing (stored tubing and fittings), compressor after coolers (shell), compressors and containment instrument air receiver tank component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel and copper alloys are not susceptible to significant general corrosion that would affect the intended function of components. PVC is impervious to air. Therefore, the staff finds that there are no applicable aging effects requiring management for metal or PVC in an air environment.

3.3A.2.3.8 Nitrogen - Aging Management Evaluation - Table 3.3.2-8 and Table 3.3.2-8a

The staff reviewed Table 3.3.2-8 of the LRA and Table 3.3.2-8a in the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the nitrogen system component groups. The staff reviewed the technical report of AMR results for air and gas systems.

In the LRA and the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for stainless steel components exposed externally to air, including pipe, valves, and flow indicator component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA and the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for stainless steel components exposed internally to gas for pipe, valves and flow indicator component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (nitrogen, which is an inert gas) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

3.3A.2.3.9 Station Air - Aging Management Evaluation - Table 3.3.2-9 and Table 3.3.2-9a

The staff reviewed Table 3.3.2-9 of the LRA and Table 3.3.2-9a in the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the station air system component groups. The staff reviewed the technical report of AMR results for air and gas systems.

In the LRA and the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for carbon steel, copper alloys, and cast iron components exposed externally to air, including pipe, valves, air compressor after coolers (shell), air compressor intercoolers (shell), and compressors component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Carbon steel and cast iron components that are exposed externally to a sheltered air environment and not exposed to moisture-laden air or intermittent wetting are expected to experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Copper alloys are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe and valve component types exposed to a borated water leakage external environment using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. In addition, the applicant stated that the boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The general condition monitoring program performs inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. The staff finds that this program is acceptable for managing loss of material since visual inspections of external surfaces are performed during various walkdowns by plant personnel to look for boron buildup and/or boric acid leaks.

3.3A.2.3.10 Chemical and Volume Control - Aging Management Evaluation - Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarized the results of AMR evaluations for the CVCS component groups.

In the LRA, the applicant identified no aging effects for carbon steel, cast iron, and stainless steel components exposed to air, including boric acid tanks, filter/strainer, flow elements, flow indicators, letdown heat exchangers (channel head), level indicators, pipe, pulsation dampers, pumps, regenerative heat exchangers (channel head), regenerative heat exchangers (shell), suction stabilizers, sump tanks, tubing, valves, volume control tank, filters/strainers (housing-charging pump lube oil), lube oil reservoirs (charging pump), and pumps (charging pump lube oil) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel, carbon steel, cast iron, and copper alloy filter/strainer (housing - charging pump lube oil), lube oil reservoirs (charging pump), pumps (charging pump lube oil), tubing, tubing (charging pump lube oil), and valve component types exposed internally and externally to an environment of oil using MPS AMP B2.1.25, "Work Control Process." The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified.

The staff finds the work control process program acceptable for managing the aging effect of loss of material. The staff's evaluation of the work control process program is documented in Section 3.0.3.3.4 of this SER.

In the LRA, the applicant identified no aging effects for stainless steel components exposed internally to an environment of gas for pipe, pulsation dampers, tubing, and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

The inservice inspection program is credited for managing cracking in low-alloy steel bolting exposed to air. During its review, the staff determined that additional information concerning the application of this AMP to effectively manage stress corrosion cracking in auxiliary system bolting was needed to complete its review. This request for information is described in RAI 3.3.11-A-1. RAI 3.3.11-A-1, the applicant's response to this RAI and the staff's evaluation of the responses are described below.

The credited inservice inspection program AMP to manage CVCS bolting included exceptions to GALL and RAI 3.3.11-A-1 requested the applicant to clarify if the credited program is different from the GALL bolting integrity for managing cracking in CVCS piping and bolting in the RCPB and to identify the specific differences and the basis for those differences. The RAI also requested the applicant to describe bolting practices to preclude stress corrosion cracking and additional information to assure that aging degradation is detected before the loss of the intended function of the closure bolting.

<u>RAI 3.3.11-A-1</u>
For CVCS bolting in an air environment, Note B in LRA Table 3.3.2-10 identifies that the item is consistent with NUREG-1801 for component material, environment and aging

effect, but the AMP takes some exceptions to NUREG-1801 AMP. LRA Table 3.3.2-10 references LRA item 3.1.1-26 in Table 3.1.1and credits the inservice inspection program for managing cracking in CVCS bolting. LRA item 3.1.1-26 states that this item is not consistent with NUREG-1801 and page B-6 of the LRA states that the aging management reviews did not identify the need for the GALL XI.M18 bolting integrity AMP. NUREG-1339 (referenced in GALL AMP XI.M18) includes a condition that bolting degradation is resolved on the basis of a plant-specific bolting integrity program. Clarify if the credited inservice inspection program is different from the GALL bolting integrity program for managing cracking in CVCS piping and valve bolting in the RCPB. If there are differences, identify those specific differences to the GALL bolting integrity program and the basis for those differences. Describe the bolting practices used to preclude stress corrosion cracking such as the control of high strength bolting materials, lubricants, bolt stress and hardness testing. Also, clarify how a visual inspection of CVCS closure bolting in RCPB piping and valves is effective in detecting fine cracks or cracking in bolting where the entire bolting surfaces are not readily visible.

By letter dated December 3, 2004, the applicant responded by providing the following information:

> As identified in Appendix B2.0, the Millstone LRA did not include a specific bolting integrity aging management program (AMP) description with comparison to NUREG 1801, XI.M18 "Bolting Integrity." However, due to NRC concerns related to how and where Millstone addressed degradation of bolting, Millstone has developed a specific bolting integrity AMP and is providing a supplement to the Millstone Units 2 and 3 LRAs.

In this letter, the applicant provided both an Appendix A and an Appendix B description of the bolting integrity AMP. The bolting integrity AMP is identified by the applicant as an existing program that is consistent with GALL XI.M18 with clarification and exceptions. The staff review of the new bolting integrity AMP is described in Section 3.0.3.2.18 and Open Items 3.0.3.2.18-1 and 3.0.3.2.18-2.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs pending resolution of the AMP review, the staff finds the applicant has identified appropriate AMPs for managing the aging effects caused by leaking borated water on external surfaces of the chemical and volume control system component types.

3.3A.2.3.11 Sampling - Aging Management Evaluation - Table 3.3.2-11 and LRA Table 3.3.2-11a

The staff reviewed Table 3.3.2-11 of the LRA and Table 3.3.2-11a in the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the sampling system component groups.

In the LRA and the January 11, 2005 supplement, the applicant identified no aging effects for low-alloy steel and stainless steel bolting, pipe tubes, valves and secondary sample station/sink component types exposed externally to air. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of air on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for copper alloys components exposed internally to gas for sample chiller (tubes) component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (nitrogen, which is an inert gas) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

3.3A.2.3.12 Primary Makeup Water - Aging Management Evaluation - Table 3.3.2-12 and Table 3.3.2-12a

The staff reviewed Table 3.3.2-12 of the LRA and Table 3.3.2-12a of the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the primary makeup water system component groups.

In the LRA and the applicant's January 11, 2005 supplement, the applicant identified no aging effects for low-alloy steel and stainless steel bolting, pipe, flow elements, primary water head tank, pumps, tubing, valves, deaerator transfer pump and make-up water vacuum deaerator component types exposed externally to air. Aging effects for these combinations of components, material, and environment are not identified in the GALL Report.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of air on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the applicant's letter, dated January 11, 2005, the applicant proposed to manage loss of material of stainless steel for primary water storage tank component types exposed to an atmosphere/weather environment using AMP B2.1.13, "General Condition Monitoring Program," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

3.3A.2.3.13 Access Control Area Air Conditioning - Aging Management Evaluation - Table 3.3.2-13 and Table 3.3.2-13a

The staff reviewed Table 3.3.2-13 of the LRA and Table 3.3.2-13a in the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the access control area air conditioning system component groups.

In the LRA and the applicant's January 11, 2005 supplement, the applicant identified no aging effects for carbon steel damper housings and access control area air conditioning unit (housing) components type exposed internally and externally to air environment that is not intermittently wetted.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the components' intended functions due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.14 Main Condensers Evacuation - Aging Management Evaluation - Table 3.3.2-14 and Table 3.3.2-14a

The staff reviewed Table 3.3.2-14 of the LRA and Table 3.3.2-14a in the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the main condensers evacuation system component groups.

In the LRA and the applicant's January 11, 2005 supplement, the applicant identified no aging effects for carbon steel components exposed externally to air, including damper housing, ductwork, fan/blower housing, pipe, valves, filter/strainers, flow orifices, flow switches, and steam jet air ejector vent condenser (shell) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon and low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel and CASS are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.15 Containment Air Recirculation and Cooling - Aging Management Evaluation - Table 3.3.2-15

The staff reviewed Table 3.3.2-15 of the LRA, which summarized the results of AMR evaluations for the containment air recirculation and cooling system component groups.

In the LRA, the applicant identified no aging effects for carbon steel and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including containment air recirculation cooling unit housings, damper housings, ductwork, fan/blower housing, pipe, flow elements, tubing, and valve component types.

The applicant stated in the LRA that surfaces of carbon steel and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.16 Containment and Enclosure Building Purge - Aging Management Evaluation - Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarized the results of AMR evaluations for the containment and enclosure building purge system component groups. In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally or externally to air that is not intermittently wetted, including damper housings, ductwork, pipe, and valve component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.17 Containment Penetration Cooling - Aging Management Evaluation - Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarized the results of AMR evaluations for the containment penetration cooling system component groups. In the LRA, the applicant has identified no aging effects for carbon steel HVAC components exposed internally and externally to air that are not intermittently wetted, including damper housings, ductwork, and fan/blower housing component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.18 Containment Post-Accident Hydrogen Control - Aging Management Evaluation - Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarized the results of AMR evaluations for the containment post-accident hydrogen control system component groups.

In the LRA, the applicant identified no aging effects for carbon steel and stainless steel HVAC components exposed internally and externally to air that is not intermittently wetted, including fan/blower housing, pipe, tubing, valves, detection chamber, flexible hose, flow elements, hydrogen recombiner housings, and flow orifices component types.

The applicant stated in the LRA that surfaces of carbon steel and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.19 Control Room Air Conditioning - Aging Management Evaluation - Table 3.3.2-19

The staff reviewed LRA Table 3.3.2-19, which summarized the results of AMR evaluations for the control room air conditioning system component groups.

In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally or externally to air that is not intermittently wetted, including compressor casings, control room air handling units (housing), control room filter banks, damper housings, ductwork, fan/blower housings (air-cooled condenser unit), fan/blower housings (control room air handling unit), pipe, valves, and smoke detectors component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy HVAC components exposed internally or externally to air that is not intermittently wetted, including compressor casings (air cooled compressor), filter/dryer, moisture indicator, muffler, pipe, tubing, and valve component types.

The applicant stated in the LRA that surfaces of copper alloy components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy components exposed internally to an environment of gas for compressor casings, compressor casings (air-cooled condenser), control room air handling units (coils), filter/dryer, moisture indicator, mufflers, pipe, tubing, and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

During the audit and review, the staff questioned why various portions of the control room air conditioning system were not included within the scope of license renewal and subject to an AMR. In its LRA supplement letter dated July 7, 2004, the applicant added several components to the control room air conditioning system components that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the control room air conditioning system AMR. The staff finds this material/environment/aging effect/AMP combination to be acceptable. The staff's evaluation of the scope of the control room air conditioning system AMR is documented in Section 2.3A.3.19 of this SER.

3.3A.2.3.20 Control Element Drive Mechanism Cooling - Aging Management Evaluation - Table 3.3.2-20

The staff reviewed LRA Table 3.3.2-20, which summarized the results of AMR evaluations for the CEDM cooling system component groups. In the LRA, the applicant proposed to manage loss of material of stainless steel CEDM cooling coils component groups exposed internally to moisture-laden air and/or an intermittently wetted environment using AMP B2.1.25, "Work Control Process," which is a plant-specific program.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

3.3A.2.3.21 Diesel Generator Ventilation - Aging Management Evaluation - Table 3.3.2-21

The staff reviewed LRA Table 3.3.2-21, which summarized the results of AMR evaluations for the diesel generator ventilation system component groups. In the LRA, the applicant has identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings, ductwork, and fan/blower housing component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.22 ESF Room Air Recirculation - Aging Management Evaluation - Table 3.3.2-22

The staff reviewed LRA Table 3.3.2-22, which summarized the results of AMR evaluations for the ESF room air recirculation system component groups.

In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings, ductwork, fan/blower housing, ESF room air recirculation unit housings, and pipe component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.
The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.23 Enclosure Building Filtration - Aging Management Evaluation - Table 3.3.2-23

The staff reviewed LRA Table 3.3.2-23, which summarized the results of AMR evaluations for the enclosure building filtration system component groups.

In the LRA, the applicant identified no aging effects for carbon and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including damper housing, ductwork, enclosure building filtration filter bank housing, fan/blower housing, pipe, valves, and flow elements component types.

The applicant stated in the LRA that surfaces of carbon and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy HVAC components exposed internally or externally to air that is not intermittently wetted, including tubing and valve component types.

The applicant stated in the LRA that surfaces of copper alloy components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.24 Fuel Handling Area Ventilation - Aging Management Evaluation - Table 3.3.2-24

The staff reviewed LRA Table 3.3.2-24, which summarized the results of AMR evaluations for the fuel handling area ventilation system component groups.

In the LRA, the applicant identified no aging effects for carbon and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including damper housing, ductwork, pipe, valves, and flow elements component types.

The applicant stated in the LRA that surfaces of carbon and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.25 Main Exhaust Ventilation - Aging Management Evaluation - Table 3.3.2-25

The staff reviewed LRA Table 3.3.2-25, which summarized the results of AMR evaluations for the main exhaust ventilation system component groups.

In the LRA, the applicant identified no aging effects for carbon and stainless steel HVAC components exposed to an internally or externally to air that is not intermittently wetted, including damper housing, ductwork, filter bank housing, pipe, tubing, and valve component types.

The applicant stated in the LRA that surfaces of carbon and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the

basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy HVAC components exposed internally or externally to air that is not intermittently wetted, including the tubing component type.

The applicant stated in the LRA that surfaces of copper alloy components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.
The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.26 Non-Radioactive Area Ventilation - Aging Management Evaluation - Table 3.3.2-26

The staff reviewed LRA Table 3.3.2-26, which summarized the results of AMR evaluations for the non-radioactive area ventilation system component groups.

In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings, ductwork, and fan/blower housing component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.
The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.27 Process and Area Radiation Monitoring - Aging Management Evaluation - Table 3.3.2-27

The staff reviewed LRA Table 3.3.2-27, which summarized the results of AMR evaluations for the process and area radiation monitoring system component groups.

In the LRA, the applicant identified no aging effects for carbon and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including bolting, pipe, tubing, valves, fan blower housing, filter housing, and radiation detectors component types.

The applicant stated in the LRA that surfaces of carbon and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

During the audit and review, the staff questioned why various portions of the process and area radiation monitoring system were not included within the scope of license renewal and subject to an AMR. In its LRA supplement dated July 7, 2004, the applicant added several components to the process and area radiation monitoring system list of components that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the process and area radiation monitoring system AMR. The staff finds this material/environment/aging effect/AMP combination to be acceptable. Therefore, the staff's evaluation of the scope of the process and area radiation monitoring system AMR is documented in Section 2.3A.3.27 of this SER.

3.3A.2.3.28 Radwaste Area Ventilation - Aging Management Evaluation - Table 3.3.2-28

The staff reviewed LRA Table 3.3.2-28, which summarized the results of AMR evaluations for the radwaste area ventilation system component groups. In the LRA, the applicant has identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings and ductwork component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air"

to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.
The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.29 Turbine Building Ventilation - Aging Management Evaluation - Table 3.3.2-29

The staff reviewed LRA Table 3.3.2-29, which summarized the results of AMR evaluations for the turbine building ventilation system component groups. In the LRA, the applicant has identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including the damper housings component type.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3A.2.3.30 Vital Switchgear Ventilation - Aging Management Evaluation - Table 3.3.2-30

The staff reviewed LRA Table 3.3.2-30, which summarized the results of AMR evaluations for the vital switchgear ventilation system component groups.

In the LRA, the applicant identified no aging effects for carbon steel and cast iron HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings, DC switchgear air conditioning unit housings, ductwork, fan/blower housings, motor control center (MCC) air conditioning unit housing, pipe, valves, vital switchgear cooling unit housings, and West 480V LCR cooling unit housings component types.

The applicant stated in the LRA that surfaces of carbon steel and cast iron components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy HVAC components exposed externally to air that is not intermittently wetted, including MCC air conditioning units (accumulator), MCC air conditioning units (distributor), MCC air conditioning units (evaporator coil), MCC air conditioning units (filter/dryer), MCC air conditioning units (receiver), MCC air conditioning units (sight glass housing), MCC air conditioning units (tubing), and MCC air conditioning units (valves) component types.

The applicant stated in the LRA that surfaces of copper alloy components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interpreted the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy components exposed internally to an environment of gas for MCC air conditioning units (accumulator), MCC air conditioning units (distributor), MCC air conditioning units (evaporator coil), MCC air conditioning units (condenser coil), MCC air conditioning units (filter/dryer), MCC air conditioning units (receiver), MCC air conditioning units (sight glass housing), MCC air conditioning units (tubing), and MCC air conditioning units (valves) component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

3.3A.2.3.31 Unit 2 Fire Protection - Aging Management Evaluation - Table 3.3.2-31

The staff reviewed LRA Table 3.3.2-31, which summarized the results of AMR evaluations for the Unit 2 fire protection system component groups.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, copper alloy, and PVC components exposed to air, including flame arrestors, flex connections, flow indicators, flow orifices, nozzles, pipe, pumps, retard chambers, sprinkler heads, strainers, tubing, valves, and water motor gongs component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel and copper alloy are not susceptible to significant general corrosion that would affect the intended function of components. PVC is impervious to an air environment. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel drip pans and tubing component types exposed externally to a moisture-laden air and/or intermittently wetted environment using AMP B2.1.13, "General Condition Monitoring Program," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe, tubing, and valve component types exposed to a borated water leakage external environment using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. However, the GALL Report specifies GALL AMP XI.M10, "Boric Acid Corrosion," to manage this aging effect. The applicant stated in Note 1 that the boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. Also, visual inspection of external surfaces is performed during various walkdowns by plant personnel to look for boron buildup and/or boric acid leaks. On the basis of its review, the staff finds that this program is acceptable for managing loss of material of copper alloy pipe, tubing, and valve component types exposed to a borated water leakage external environment.

In the LRA, the applicant identified no aging effects for carbon and stainless steel, PVC, and copper alloy components exposed internally to an environment of air or gas, including flex connections, flow orifices, nozzles, pipe, sprinkler heads, tubing, valves, and water motor gongs component types. Gas is not identified in the GALL Report as an environment for these components and materials. However, the staff identified a discrepancy between Unit 2 fire protection system sprinkler heads and Unit 3 fire protection sprinkler heads in that the sprinkler heads in Unit 3 were in a moist air environment and had an aging effect of loss of materials. In its LRA supplement dated July 7, 2004, the applicant stated that the Unit 2 fire protection system, as presented in LRA Table 3.3.2-31 (page 3-282), Note 2 (subject to moisture-laden air and/or intermittently wetted environment), should be included with the copper alloy "sprinkler head" component group exposed internally to an air environment for the Unit 2 fire protection system. The aging effect of "loss of material" should be added to this component group. The fire protection program will manage these aging effects. Based on the addition of this aging effect, the staff finds the applicant's response to be acceptable.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal components in a gas environment.

The applicant, in the LRA, proposed to manage loss of material of copper alloy pipe, tubing, and valve component types exposed externally to a moisture-laden air and/or intermittently wetted environment using AMP B2.1.10, "Fire Protection Program," which is consistent with GALL AMP XI.M26, "Fire Protection," and GALL AMP XI.M27, "Fire Water System." The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. On the basis of its review, the staff finds that the fire protection program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces to detect any sign of aging degradation during maintenance activities.

In the LRA, the applicant proposed to manage loss of material of stainless steel flex connections component type exposed internally to an environment of oil using AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants that are an indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

3.3A.2.3.32 Unit 3 Fire Protection - Aging Management Evaluation - Table 3.3.2-32

The staff reviewed LRA Table 3.3.2-32, which summarized the results of AMR evaluations for the Unit 3 fire protection system component groups.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, copper alloy, and PVC components exposed to air, including carbon dioxide (CO_2) tank cooling coils, coolant heat exchangers, flex hoses, flex connections, flow switches, instrument snubbers, nozzles, restricting orifices, sprinkler heads, tubing, valves, flow indicators, housing, diesel fuel storage tank, ductwork, exhaust silencer, expansion tank overflow container, reactor coolant pump oil collection tanks, flame arrestors, heater unit, hydropneumatic tank, lube oil cooler, odorizer, oil mist recovery unit, oil reservoir, pipe, pumps, vacuum limiter, and water manifold component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel and copper alloy are not susceptible to significant general corrosion that would affect the intended function of components. PVC is impervious to an air environment. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

However, LRA Table 3.3.2-32, Auxiliary Systems - Unit 3 Fire Protection (page 3-296), for external surfaces of copper alloy valves in an environment of air, did not include the aging effect of loss of material as in Unit 2 Table 3.3.2-31, Auxiliary Systems - Unit 2 Fire Protection (page 3-285). In LRA supplement dated July 7, 2004, the applicant stated that for the Unit 3 fire protection system, as presented in Unit 2 Table 3.3.2-32 (page 3-296), Note 2 (subject to moisture-laden air and/or intermittently wetted environment), should be included with the copper alloy "valves" component group exposed internally to an air environment for Unit 2 LRA, Table 3.3.2-32, Auxiliary Systems - Unit 3 Fire Protection (page 3-296). The aging effect of "loss of material" will be added to this component group. The applicant stated that fire protection program will manage this aging effect. Based on the addition of this aging effect, the staff finds the applicant's response to be acceptable.

In the LRA, the applicant proposed to manage loss of material of copper alloy filter/strainer component type exposed externally to a moisture-laden air and/or intermittently wetted environment using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for carbon and stainless steel, PVC, and copper alloy components exposed internally to an environment of air or gas for CO_2 storage tank, CO_2 tank cooling coils, damper housing, fan/blower housing, ductwork flex hoses and connections, nozzles, odorizers, restricting orifices, tubing, and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

In the LRA, the applicant proposed to manage loss of material of copper alloy sprinkler heads exposed externally to a moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.10, "Fire Protection Program," which is consistent with GALL AMP XI.M26, "Fire Protection," and GALL AMP XI.M27, "Fire Water System." The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The staff finds that the fire protection program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces to detect any sign of aging degradation during maintenance activities.

In the LRA, the applicant proposed to manage loss of material of stainless steel tubing component type exposed internally to an environment of oil using AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants that are an indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material of copper alloy and stainless steel tubing and restricting orifices component types exposed internally to oil (fuel oil) using AMP B2.1.12, "Fuel Oil Chemistry." The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program is consistent with GALL AMP XI.M30, "Fuel Oil Chemistry," with acceptable exceptions. On the basis of its review, the staff finds the program acceptable for managing the aging effects of loss of material. The effectiveness of the fuel oil chemistry program is verified by MPS AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

During the audit and review, the staff questioned why various portions of the fire protection system were not included within the scope of license renewal and subject to an AMR. In its LRA supplement dated July 7, 2004, the applicant added several components to the fire protection system that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the fire protection system AMR. The staff finds this material/environment/aging effect/AMP combination to be acceptable. The staff's evaluation of the scope of the fire protection system is documented in Section 2.3A.3.32 of this SER.

3.3A.2.3.33 Domestic Water - Aging Management Evaluation - Table 3.3.2-33 and Table 3.3.2-33a

The staff reviewed Table 3.3.2-33 of the LRA, and Table 3.3.2-33a of the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the domestic water system component groups.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe and valve component types exposed externally to a moisture-laden air and/or intermittently wetted environment using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for stainless steel and PVC components exposed to air, including pipe and valve component types. Air is not identified in the GALL Report as an environment for these components and materials. In addition, in the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for carbon steel components exposed to air, including domestic water hot water tank component types.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. PVC is impervious to an air environment. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for PVC pipe component type in a seawater environment. Operating experience reviews have identified instances of PVC degradation resulting from exposure to direct sunlight and exposure to ozone from high voltage. Since these PVC components are not exposed to direct sunlight and are not exposed to high levels of ozone, the staff concurred that there are no aging effects for PVC pipe components in a seawater environment.

3.3A.2.3.34 Diesel Generator - Aging Management Evaluation - Table 3.3.2-34

The staff reviewed LRA Table 3.3.2-34, which summarized the results of AMR evaluations for the diesel generator system component groups. The staff reviewed the technical report that provides the AMR results for the diesel generator and support systems.

In the LRA, the applicant proposed to manage loss of material of stainless steel, carbon steel, cast iron, and copper alloy lube oil heat exchangers (shell), lube oil heaters, oil pans, pipe, pumps, turbochargers, valves, filter/strainers, lube oil heat exchangers (tubes), lube oil heat exchangers (tube sheet), tubing, and valve component types exposed internally or externally to an environment of oil using AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants that are an indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material of copper-alloy air-cooling heat exchangers (tubes) and jacket-water heat exchangers (tubes) component types exposed to treated water using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, nickel-based alloy, copper alloy, and aluminum components exposed internally and externally to air, including filter/strainers, air cooling heat exchanger (shell), air intercoolers (shell), air start distributors, jacket water expansion tanks, jacket water heat exchangers (shell), lube oil heat exchangers (shell), lube oil heaters, oil pans, pipe, pumps, stand-by jacket coolant heaters, starting air tanks, turbochargers, valves, air cooling heat exchangers (channel), governor hydraulic oil boosters, jacket water heat exchangers (channel), level indicators, lube oil heat exchangers (channel), tubing, expansion joints, and flow orifices component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel, copper alloy, and aluminum are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

The Work Control Process is credited with managing buildup of deposit on copper alloy tubesheets exposed to an oil environment. During its review, the staff determined that additional information concerning aging management for buildup of deposit was needed to complete its review. This request for information is described in RAI 3.3.35-A-1. RAI 3.3.35-A-1, the applicant's response to this RAI and the staff's evaluation of the responses are described below.

LRA Table 3.3.2-34 identifies copper alloy tubesheets in the lube oil heat exchangers as susceptible to buildup of deposit in an oil environment. The LRA identifies heat transfer as an intended function for the tube sheet and credits the work control process AMP for managing this aging effect. This AMP identifies the use of lubricating oil analysis to detect contaminants and visual inspections to detect buildup of deposits. In heat exchangers, buildup of deposit (commonly known as fouling) can adversely affect the heat transfer function. The diesel generators are normally only operated for short operational periods and the lubricating oil may not have a chance to reach steady state or worse case conditions during testing. The applicant was requested to clarify if heat exchanger performance tests to recognized industry practices are used to detect fouling in the lube oil heat exchangers or are frequent visual inspections and cleaning required. In the absence of heat exchanger performance testing, the applicant was requested to submit the technical justification that unacceptable buildup of deposit on the tube sheet exposed to lubricating oil would be detected prior to loss of the required heat transfer function.

By letter dated November 9, 2004, the applicant responded by providing the following information:

> The performance of the lube oil heat exchangers is confirmed during emergency diesel generator (EDG) periodic surveillance testing. In accordance with the plant Technical Specifications, the EDGs are operated at a design load for a minimum of 60 minutes each 31 days. This test loading and duration ensures that the diesel engine and its auxiliary systems, including lubricating oil, reach steady state operating conditions for the majority of the testing period, thereby providing sufficient data to evaluate the heat transfer performance of the lube oil heat exchanger,
>
> Buildup of deposit due to fouling in an oil environment is not expected to be significant, but is conservatively assumed in the aging management review for these heat exchangers because of water contamination of the oil. Buildup of deposit is managed by the Work Control Process AMP, which includes the periodic testing of the EDGs. Lube oil temperature is recorded during EDG testing and abnormal readings would initiate an evaluation through the corrective action process to determine the cause of the elevated temperatures. The frequency of the EDG performance tests ensures that fouling would not prevent the intended function of the lube oil heat exchanger. In addition, a review of Millstone operating experience indicates that there has been no instances of fouling of the EDG lube oil heat exchangers affecting the heat transfer intended function,

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant provided sufficient information to conclude that buildup of deposit in the EDG lube oil heat exchangers will be effectively managed by the work control process AMP. This conclusion is based on the applicant's periodic surveillance testing of the EDGs which records steady state lube oil temperatures to detect fouling.

3.3A.2.3.35 Diesel Generator Fuel Oil - Aging Management Evaluation - Table 3.3.2-35

The staff reviewed LRA Table 3.3.2-35, which summarized the results of AMR evaluations for the diesel generator fuel oil system component groups. The staff reviewed the AMR results report for the diesel generator and support systems.

In the LRA, the applicant proposed to manage loss of material of copper alloy, carbon steel, and stainless steel pumps, tubing, valves, and filter/strainers component types exposed internally to fuel oil using AMP B2.1.12, "Fuel Oil Chemistry." The applicant stated in LRA Section 3.3.2.2.7 that AMP B2.1.25, "Work Control Process," will be used to provide confirmation of the effectiveness of the fuel oil chemistry program.

The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2) establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment within the scope of license renewal. On the basis of its review, the staff finds the fuel oil chemistry program acceptable for managing this aging effect.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for confirming the effectiveness of the fuel oil chemistry program.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, copper alloy, and aluminum components exposed internally and externally to air, including flame arrestors, clean oil storage tanks, diesel oil supply tanks, level indicators, pipe, pumps, valves, filter/strainers, and tubing component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel, copper alloy, and aluminum are not susceptible to significant general corrosion that would affect the intended function of components. Moreover, the diesel fuel oil tank is supported on saddle-type steel supports and is not in contact with concrete or soil. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

3.3A.2.3.36 Station Blackout Diesel Generator - Aging Management Evaluation - Table 3.3.2-36

The staff reviewed Table 3.3.2-36 of the LRA, which summarized the results of AMR evaluations for the station blackout (SBO) diesel generator system component groups. The staff reviewed the technical report that provides the AMR results for the diesel generator and support systems.

In the LRA, the applicant proposed to manage cracking of stainless steel expansion tanks, pipe, tubing, and valve component types exposed internally to treated water using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. As stated above, the staff finds the work control process program acceptable for managing the aging effect of cracking.

In the LRA, the applicant proposed to manage loss of material of stainless steel, carbon steel, and cast iron flow indicators, lube oil coolers (channel), oil sumps, pipe, silencers, pumps, turbo chargers, lube oil coolers (tubes), lube oil coolers (tube sheet), radiators, lubricators, restricting orifices, tubing, and valve component types exposed internally or externally to oil using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. Also as stated above, the staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material of stainless steel fuel heaters, tubing, and valves component types exposed internally to fuel oil using AMP B2.1.12, "Fuel Oil Chemistry." The applicant stated in LRA Section 3.3.2.2.7 that AMP B2.1.25, "Work Control Process," will be used to provide confirmation of the effectiveness of the fuel oil chemistry program. The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2) establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment within the scope of license renewal. On the basis of its review, the staff finds the fuel oil chemistry program acceptable for managing this aging effect.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for confirming the effectiveness of the fuel oil chemistry program.

In the LRA, the applicant proposed to manage loss of material of stainless steel expansion tanks and valve component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposes to manage loss of material of stainless steel valve component group exposed internally to moisture-laden air and/or an intermittently wetted environment using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, and aluminum components exposed internally and externally to air, including filter/strainers, radiators, aftercoolers, aspirators, flow indicators, fuel heaters, fuel oil day tanks, immersion heaters, injectors, lube oil coolers (channel), lube oil coolers (shell), oil sumps, pipe, silencers, pump, turbochargers, air receivers, expansion joints, lubricators, pulsation dampeners, restricting orifices, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel, and aluminum are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concurs that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to air. Based on industry research and operating experience, change of material properties due to thermal exposure and irradiation and cracking due to irradiation of rubber components in air is contingent on radiation levels, ambient temperatures, and exposure to ultraviolet radiation and ozone.

On the basis of its review, the staff concurs with the applicant's finding that no aging effect for rubber expansion joints in air is applicable, since these components are not exposed to high levels of ultraviolet radiation, ozone, or temperatures greater than 95°F.

In the LRA, the applicant identified no aging effects for aluminum filter/strainers component types exposed internally to lubricating oil. The technical report of AMR results for the diesel generator and support systems did not specifically evaluate aging effects for aluminum exposed internally to oil. During the audit and review, the staff requested that the applicant provide a basis for its conclusion that there are no aging effects requiring management for this combination of component, material, and environment. During the audit, the applicant stated that the MAER was used as the basis. The staff reviewed the applicant's MAER and finds that additional information regarding the basis was necessary. The applicant revised its MAER and the technical report of AMR results for the diesel generator and support systems to include the basis. The staff reviewed the basis and finds it acceptable based on the addition of information to the MAER and the technical report. In addition, the applicant stated that, in a lubricating oil environment, significant corrosion is only expected where the water can settle or pool. Due to the differential densities of lubricating oil and water, water will tend to separate and settle in low-flow or stagnant areas where the flow velocity is insufficient to flush the water through the system. Lube oil systems are assumed to be free of water contamination as their initial condition. Lube oil systems are typically closed systems that have little potential for ingress of contaminants unless a component failure occurs. License renewal does not assume component failures as a means to establish the conditions necessary for aging to occur. For example, tube failures in lube oil coolers are not assumed. Therefore, water contamination of lube oil is event-driven, and would be addressed by corrective maintenance. For license renewal purposes, lube oil is therefore assumed to be free of water contamination. On the basis of its review, the staff concurs that there are no applicable aging effects requiring management for aluminum in a fuel oil environment.

In the LRA, the applicant identified no aging effects for aluminum radiators component types exposed externally to atmosphere/weather. The technical report that provides the AMR results for the diesel generator and support systems did not specifically evaluate aging effects for aluminum in an external environment of atmosphere/weather. During the audit and review, the staff requested that the applicant provide a basis for its conclusion that there are no aging effects requiring management for this combination of component, material, and environment. During the audit, the applicant stated that the technical report was revised to add the following statement:

> Industry experience identified a potential conflict with the MAER with regard to aluminum in an air environment. St. Lucie identified corrosion problems with the aluminum and copper components associated with the cooling fins of a radiator in a cooling water system. The St. Lucie evaluation identified that it was an unusual occurrence since aluminum elsewhere in the plant did not demonstrate similar problems. Accordingly, and in conjunction with the MAER basis, operating experience was used to validate that no problems of this type had occurred.

The staff reviewed the revised technical report and operating experience. On the basis of its review, the staff finds that there are no applicable aging effects requiring management for aluminum in an atmosphere/weather environment.

3.3A.2.3.37 Security - Aging Management Evaluation - Table 3.3.2-37

The staff reviewed LRA Table 3.3.2-37, which summarized the results of AMR evaluations for the security system component groups. The staff reviewed the AMR results report for the diesel generator and support systems.

In the LRA, the applicant proposed to manage loss of material of carbon steel, cast iron, and copper alloy coolers (shell), fan/blower housings, heaters, oil pans, pipe, pump, valves, filter\strainers, coolers (tubes), and coolers (tube sheet) component types exposed internally or externally to lubricating oil using AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe, tubing, and valve component types exposed internally to fuel oil using AMP B2.1.12, "Fuel Oil Chemistry." The applicant stated in LRA Section 3.3.2.2.7 that AMP B2.1.25, "Work Control Process," will be used to provide confirmation of the effectiveness of the fuel oil chemistry program. The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2) establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment within the scope of license renewal. The staff finds the fuel oil chemistry program acceptable.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds the work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. It also provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff concluded that the work control process program is acceptable for confirming the effectiveness of the fuel oil chemistry program.

In the LRA, the applicant identified no aging effects for carbon steel, cast iron, and copper alloy components exposed internally and externally to air, including coolers (channel head), coolers (shell), diesel fuel oil storage tank, fan/blower housings, filter/strainers, heaters, oil pans, pipe, pumps, valves, filter/strainers, tubing, and radiators component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Copper alloys are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for the aluminum radiators component type exposed externally to air. The technical report of AMR results for the diesel generator and support systems did not specifically evaluate aging effects for aluminum in an external environment of air. During the audit and review, the staff requested that the applicant provide a basis for its conclusion that there are no aging effects requiring management for this combination of component, material, and environment. The applicant stated to the staff that the technical report was revised to add the following statement:

> Industry experience identified a potential conflict with the MAER with regard to aluminum in an air environment. St. Lucie Power Plant identified corrosion problems with the aluminum and copper components associated with the cooling fins of a radiator in a cooling water system. The St. Lucie evaluation identified that it was an unusual occurrence since aluminum elsewhere in the plant did not demonstrate similar problems. Accordingly, and in conjunction with the MAER basis, operating experience was used to validate that no problems of this type had occurred.

The staff reviewed the revised technical report and operating experience. On the basis of its review, the staff finds that there are no applicable aging effects requiring management for aluminum in an air environment.

3.3A.2.3.38 Clean Liquid Waste Processing - Aging Management Evaluation - Table 3.3.2-38 and Table 3.3.2-38a

The staff reviewed Table 3.3.2-38 of the LRA and Table 3.3.2-38a of the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the clean liquid waste processing system component groups.

In the LRA, the applicant credits AMP B2.1.6, "Chemistry Control Program for Secondary Systems," for managing the loss of material aging effect for the carbon steel degasifier preheater shell component type exposed internally to steam. The applicant stated that the environment is not in the GALL Report for this component type and material. The applicant further stated that the chemistry control for secondary systems program provides reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The program provides an environment that minimizes material degradation, maintains material integrity, and reduces the amount of corrosion product that could interfere with equipment operation and heat transfer. The applicant stated that the chemistry control for secondary systems program is based on EPRI guidelines provided in TR-102134, "PWR Secondary Water Chemistry Guidelines." These guidelines reflect industry operating experience to optimize plant chemistry control.

The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER. The staff finds that this program is consistent with GALL AMP XI.M2 with acceptable exceptions.

On the basis of its review of current industry research, operating experience, and the technical report for AMR results for steam and power conversion systems, the staff finds that the chemistry control for secondary systems program is acceptable for managing loss of material due to general corrosion and crevice corrosion of carbon steel components in steam, since this program provides an environment that minimizes material degradation, maintains material integrity, and reduces the amount of corrosion.

In the LRA, the applicant proposes to manage loss of material of stainless steel primary drain tank and quench cooler tubes and tube sheet component types exposed to treated water using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA and the applicant's supplement, dated January 11, 2005, the applicant proposed to manage loss of material of the stainless steel primary drain tank and equipment drain tank component type exposed internally to moisture-laden air and/or an intermittently wetted environment using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program is its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In the applicant's January 11, 2005 supplement, the applicant proposed to manage loss of material of the stainless steel for the degasifier vent condenser (shell) and the degasifiers exposed to treated water and steam environment using AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The staff finds that this program is consistent with GALL AMP XI.M2, "Water Chemistry," with an acceptable exception. Since this program is consistent with the GALL Report recommendation for other components with the same material, environment, and aging effect, the staff finds this to be acceptable.

In the LRA and the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for carbon steel and stainless steel components exposed to a sheltered air environment for degasifier effluent cooler shell and degasifier preheater shells, degasifier aftercooler helicoil tubes, flow elements, primary drain tank, and quench tank cooler shell, pipe, primary drain tank, pumps, strainers, tubing, valves, conductivity element, degasifier vent condenser (shell), degasifiers, equipment drain sump tank, flexible hoses and flow indicators component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of air on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

3.3A.2.3.39 Gaseous Waste Processing - Aging Management Evaluation - Table 3.3.2-39

The staff reviewed LRA Table 3.3.2-39, which summarized the results of AMR evaluations for the gaseous waste processing system component groups.

In the LRA, the applicant identified no aging effects for carbon steel components exposed to air, including after coolers (shell), pipe, valves, and waste gas compressor seal coolers component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposes to manage loss of material of stainless steel after coolers (tubes), after coolers (tube sheet), pipe, and valve component types exposed internally to moisture-laden air and/or an intermittently wetted environment using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

3.3A.2.3.40 Post-Accident Sampling - Aging Management Evaluation - Table 3.3.2-40

The staff reviewed LRA Table 3.3.2-40, which summarized the results of AMR evaluations for the post-accident sampling system component groups.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including bolting, flushing accumulators, nitrogen accumulators, filter/strainers, flow elements, pumps, reservoir, sample chambers, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Without the presence of an aggressive environment, no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel flushing accumulators, sample chambers, reservoir, pumps, tubing, and valve component types exposed internally to moisture-laden air and/or an intermittently wetted environment using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for stainless steel components exposed internally to gas for nitrogen accumulators, tubing, and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff concurs that there are no applicable aging effects requiring management for metal in a gas environment.

3.3A.2.3.41 Station Sumps and Drains - Aging Management Evaluation - Table 3.3.2-41 and Table 3.3.2-41a

The staff reviewed Table 3.3.2-41 of the LRA and Table 3.3.2-41a in the supplement, dated January 11, 2005, which summarized the results of AMR evaluations for the station sumps and drains system component groups.

In the LRA and the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for copper-alloy, carbon and stainless steel, cast iron, and PVC components exposed to air, including piping, pumps, tubing, valves, collection section tank, flow indicators, and filter component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. PVC is impervious to a dry air environment. Therefore, the staff concurs that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA and the January 11, 2005, supplement, the applicant proposed to manage loss of material of the copper alloy valve component types and of stainless steel collection section tank component types exposed internally to moisture-laden air and/or an intermittently wetted internal environment using AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In the LRA and its letter dated January 11, 2005, the applicant identified no aging effects for PVC material of pipe and filters component type in a raw water environment. Operating experience reviews have identified instances of PVC degradation resulting from exposure to direct sunlight and exposure to ozone from high voltage. Since these PVC components are not exposed to direct sunlight and are not exposed to high levels of ozone, the staff concurs that there are no aging effects for PVC material of pipe and filters component types in a raw water environment.

Operating experience reviews have identified instances of PVC degradation resulting from exposure to direct sunlight and exposure to ozone from high voltage. Since these PVC components are not exposed to direct sunlight and are not exposed to high levels of ozone, the staff concurs that there are no aging effects for PVC pipe components in seawater environment.

3.3A.2.3.42 Table 1: Auxiliary Systems - Aerated Liquid Radwaste - Aging Management Evaluation

In the LRA letter of November 9, 2004, the applicant identified no aging effects for stainless steel exposed to air, including conductivity element, flow elements, flow indicator, pipe, pumps, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of current industry research and operating experience, stainless steel exposed externally to air are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects for stainless steel components in an air environment.

3.3A.2.3.43 Table 2: Auxiliary Systems - Solid Waste Processing - Aging Management Evaluation

In the LRA supplement of November 9, 2004, the applicant identified no aging effects for stainless steel exposed to air, including flow indicator, pipe, pumps, spent resin fill head tank, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of current industry research and operating experience, stainless steel exposed externally to air are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects for stainless steel components in an air environment.

3.3A.2.3.44 Table 3: Auxiliary Systems - Turbine Building Closed Cooling Water - Aging Management Evaluation

In the LRA supplement of November 9, 2004, the applicant stated that loss of material of chemical addition tank, flexible hoses, flow elements, flow orifices and tubing of stainless steel exposed to moisture-laden air and/or intermittently wetted environment in the auxiliary system is managed using AMP B.2.1.13, "General Condition Monitoring." The staff reviewed the general condition monitoring and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns.

In the LRA supplement of November 9, 2004, the applicant identified no aging effects for copper alloys exposed to gas in for the chiller condensers (tubes) component types. Gas is not identified in the GALL Report as an environment for these components and materials. On the basis of current industry research and operating experience, copper alloys exposed externally to gas are not susceptible to significant general corrosion that would affect the intended function of components.

In the LRA supplement of November 9, 2004, the applicant stated that loss of material of TBCCW heat exchangers (tubes) of copper alloys stainless steel in treated water environment in the auxiliary system is managed using AMP B.2.1.25, "Work Control Process."

The staff reviewed the work control process and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program performs maintenance activities to provide visual inspection and tracks the performance of inspection and surveillance activities. On this basis, the staff finds that the management of cracking for these components is adequate.

3.3A.2.3.45 Table 4: Auxiliary Systems - Water Box Priming - Aging Management Evaluation

In the LRA supplement of November 9, 2004, the applicant identified no aging effects for copper alloys and stainless steel exposed to indoors air environment and are not intermittently wetted for the filler/strainers, flow orifices, flow switches, pipe, and valve component types.

On the basis of current industry research and operating experience, copper alloys and stainless steel exposed externally to indoors air environment and are not intermittently wetted are not susceptible to significant general corrosion that would affect the intended function of components.

All other AMRs in LRA Tables 3.3.2-1 through 3.3.2-41 and LRA supplements were evaluated. The staff finds them to be acceptable.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving combinations of material, environment, AERM, and AMP that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3A.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the auxiliary systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).

3.3B Unit 3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the Unit 3 auxiliary systems components and component groups associated with the following systems:

- circulating water system
- service water system
- sodium hypochlorite system
- reactor plant component cooling system
- turbine plant component cooling water system
- chilled water system
- charging pumps cooling system
- safety injection pumps cooling system
- neutron shield tank cooling system
- containment atmosphere monitoring system
- containment instrument air system
- instrument air system
- nitrogen system
- service air system
- chemical and volume control system
- reactor plant sampling system
- primary grade water system
- auxiliary building ventilation system
- circulating and service water pumphouse ventilation system
- containment air recirculation system
- containment purge air system
- containment leakage monitoring system
- containment vacuum system
- control building ventilation system
- control rod drive mechanism (CRDM) ventilation and cooling system
- emergency generator enclosure ventilation system
- engineered safety features (ESF) building ventilation system
- fuel building ventilation system
- hydrogen recombiner and hydrogen recombiner building HVAC system
- main steam valve building ventilation system
- service building ventilation and air-conditioning system
- station blackout (SBO) diesel generator building ventilation system
- supplementary leak collection-and-release system
- technical support HVAC and filtration systems
- turbine building area ventilation system
- waste disposal building ventilation system
- Unit 2 fire protection system
- Unit 3 fire protection system
- domestic water system
- emergency diesel generator system

- emergency diesel generator fuel oil system
- SBO diesel generator system
- security system
- boron recovery system
- radioactive liquid waste processing system
- radioactive gaseous waste system
- post-accident sampling system
- radioactive solid waste system)
- reactor plant aerated drains system
- reactor plant gaseous drains system
- sanitary water system

3.3B.1 Summary of Technical Information in the Application

In LRA Section 3.3, the applicant provided AMR results for auxiliary systems components and component groups. In LRA Table 3.3.1, "Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3B.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the auxilary system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluation are documented in the staff's MPS audit and report and summarized in Section 3.3B.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff verified that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.3.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluation are documented in the staff's MPS audit and report and summarized in Section 3.3B.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with or not addressed in the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the staff's MPS audit and report and summarized in Section 3.3B.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.3B.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the auxiliary system components.

Table 3.3B-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.3B-1 Staff Evaluation for Auxiliary System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in spent fuel pool cooling and cleanup (Item Number 3.3.1-01)	Loss of material due to general, pitting, and crevice corrosion	Water chemistry and one time inspection	Not applicable	Not applicable (See Section 3.3B.2.2.1)
Linings in spent fuel cooling and cleanup system; seals and collars in ventilation systems (Item Number 3.3.1-02)	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant-specific	Work control process (B2.1.25); General condition monitoring (B2.1.13)	Consistent with GALL (See Section 3.3B.2.2.2)
Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) (Item Number 3.3.1-03)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 52.21(c)	TLAA	This TLAA is evaluated in Section 4.3B, Metal Fatigue
Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR) (Item Number 3.3.1-04)	Crack initiation and growth due to SCC or cracking	Plant-specific		Consistent with GALL (See Section 3.3B.2.2.4)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components (Item Number 3.3.1-05)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant-specific	General condition monitoring (B2.1.13); Fi re protection program (B2.1.10); Work control process (B2.1.25); Tank inspection program (B2.1.24); Structures monitoring program (B2.1.23); Infrequently accessed areas inspection program (B2.1.15)	Consistent with GALL, which recommends further evaluation (See Section 3.3B.2.2.5)
Components in reactor coolant pump oil collection system of fire protection (Item Number 3.3.1-06)	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	Tank inspection program (B2.1.24); Work control process (B2.1.25)	Consistent with GALL (See Section 3.3B.2.2.6)
Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system (Item Number 3.3.1-07)	Loss material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Fuel oil chemistry program (B2.1.12); Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.3B.2.2.7)
Heat exchangers in chemical and volume control system (Item Number 3.3.1-09)	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and plant-specific verification program	Chemistry control for primary systems program (B2.1.5); Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.3B.2.2.9)
Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-10)	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant-specific	Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends further evaluation (See Section 3.3B.2.2.10)
New fuel rack assembly (Item Number 3.3.1-11)	Loss of material due to general, pitting and, crevice corrosion	Structures monitoring		Not consistent with GALL (See Section 3.5B.2.3.4) The new fuel rack assembly is fabricated from stainless steel. No aging effect management is required for the stainless steel fuel rack assembly.

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Neutron absorbing sheets in spent fuel racks (Item Number 3.3.1-12)	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring		Boraflex neutron absorbing sheets used in the spent fuel storage racks are not credited spent fuel pool criticality analysis. Therefore, the Boraflex sheets perform no intended function.
Spent fuel storage racks and valves in spent fuel pool cooling and cleanup (Item Number 3.3.1-13)	Crack initiation and growth due to stress corrosion cracking	Water chemistry		Not consistent with GALL The spent fuel pool water temperature is maintained below the threshold temperature of 140 degree F for SCC.
Closure bolting and external surfaces of carbon steel and low-alloy steel components (Item Number 3.3.1-14)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3; General condition monitoring (B2.1.13)	Consistent with GALL (See Section 3.3B.2.1.1)
Components in or serviced by closed-cycle cooling water system (Item Number 3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	Closed-cycle cooling water system (B2.1.7); Work control process (B2.1.25); Chemistry control for primary systems program (b2.1.5); Chemistry control for secondary systems program (B2.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.3B.2.1)
Cranes, including bridge and trolleys, and rail system in load handling system (Item Number 3.3.1-16)	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling systems	Inspection activities: load handling cranes and devices (B2.1.19)	Consistent with GALL, which recommends no further evaluation (See Section 3.3B.2.1)
Components in or serviced by open-cycle cooling water systems (Item Number 3.3.1-17)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	Service water system (open-cycle cooling) (B2.1.21); Work control process (B2.1.25); Closed-cycle cooling water system (B2.1.7)	Consistent with GALL, which recommends no further evaluation (See Section 3.3B.2.1.2)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Buried piping and fittings (Item Number 3.3.1-18)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tank surveillance or Buried piping and tanks inspection	Buried piping inspection (B2.1.4)	Consistent with GALL, which recommends further evaluation (See Section 3.3B.2.2.11)
Components in compressed air system (Item Number 3.3.1-19)	Loss of material due to general and pitting corrosion	Compressed air monitoring	Work control process (B2.1.25); Tank Inspection program (B2.1.24)	Not consistent with GALL (See Section 3.3B.2.3)
Components (doors and barrier penetration seals) in concrete structures in fire protection (Item Number 3.3.1-20)	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	Fire protection program (B2.1.10); Work control process (B2.1.25)	Consistent with GALL (See Section 3.3B.2.1.3)
Components in water-based fire protection (Item Number 3.3.1-21)	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	Fire protection program (B2.1.10); Work control process (B2.1.25) ; Tank inspection program (B2.1.24)	Not consistent with GALL (See Section 3.3B.2.3)
Components in diesel fire system (Item Number 3.3.1-22)	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	Fuel oil chemistry (B2.1.12)	Not consistent with GALL (See Section 3.3B.2.3)
Tanks in diesel fuel oil system (Item Number 3.3.1-23)	Loss of material due to general, pitting, and crevice corrosion	Above ground carbon steel tanks	Tank inspection program (B2.1.24)	Consistent with GALL, which recommends no further evaluation (See Section 3.3B.2.1)
Closure bolting (Item Number 3.3.1-24)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	Bolting integrity	Consistent with GALL (See Section 3.3B.2.1.6)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components (aluminum, bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink (Item Number 3.3.1-29)	Loss of material due to selective leaching	Selective leaching of materials	Work control process (B2.1.25); Buried piping inspection (B2.1.4)	Consistent with GALL (See Section 3.3B.2.1.4)
Fire barriers, walls, ceilings, and floors in fire protection (Item Number 3.3.1-30)	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel	Fire protection and structures monitoring		Not consistent with GALL (See Section 3.5B.2.3.37)

The staff's review of the MPS auxiliary systems and associated components followed one of several approaches. One approach, documented in Section 3.3B.2.1, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.3B.2.2, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.3B.2.3, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the auxiliary systems components is documented in Section 3.0.3 of this SER.

3.3B.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Section 3.3.2.1 of the Unit 3 LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the auxiliary systems components:

- infrequently accessed areas inspection program
- work control process
- service water system (open-cycle cooling)
- closed-cycle cooling water system
- boric acid corrosion
- general condition monitoring
- buried pipe inspection program
- tank inspection program
- chemistry control for primary systems program

- chemistry control for secondary systems program
- inservice inspection program: systems, components, and supports
- fire protection program
- fuel oil chemistry
- bolting integrity program

Staff Evaluation. In Tables 3.3.2-1 through 3.3.2-50 of the Unit 3 LRA, the applicant provided a summary of AMRs for the auxiliary systems components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.3B.2.1.1 Loss of Material Due to Boric Acid Corrosion

In the discussion section of LRA Table 3.3.1, Item 3.3.1-14, the applicant stated that loss of material due to boric acid corrosion is managed by MPS AMP B2.1.3, "Boric Acid Corrosion Program," and MPS AMP B2.1.13, "General Condition Monitoring Program." The boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components. The boric acid corrosion program and general condition monitoring program are evaluated in Sections 3.0.3.1 and 3.0.3.3.2 of this SER.

In the Unit 3 LRA, the applicant stated that the general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. During the audit, the staff asked the applicant for clarification of how loss of material for components not normally visible, or in infrequently accessed areas, is managed by this program. During the audit, further clarification was requested on how identification, documentation, evaluation, and trending of boric acid leakage is performed under this program. During the audit, the applicant stated that the general condition monitoring program is an extension of the boric acid corrosion program in that it identifies borated water leakage during inspections and then, through the corrective action program, the leak is assigned and evaluated by the boric acid corrosion program. When borated water leakage is identified by the general condition monitoring program, a condition report is written to identify the leak. During the daily review of the new condition reports, it is assigned to the boric acid corrosion program where it gets fully evaluated and repaired as required. This is the same process used to identify leaks in the boric acid corrosion program.

For those areas identified as infrequently accessed areas, for the purposes of detecting boric acid leakage, entry into the area is performed often enough (at least once per refueling interval) to credit the general condition monitoring program. The one exception is the Unit 3 demineralizer cubicles area. However, for this area, a video inspection is performed at least once every 10 years to verify the integrity of the equipment. There is reasonable assurance that this inspection interval will detect borated water leakage prior to the loss of intended function of the affected equipment. In addition, the inspection opportunities for these cubicles will probably be more frequent than once every 10 years due to the need to perform corrective maintenance, filter changeout, etc. The Unit 3 areas accessed at least once per refueling interval are typically observed by operations personnel during tagouts, health physics during general area surveys or a survey performed for upcoming work in the area, or during containment walkdowns as part of the boric acid corrosion program.

The staff's evaluation of the general condition monitoring program is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that this program is acceptable for managing loss of material since visual inspections of external surfaces are performed during various walkdowns by plant personnel to detect boron buildup and/or boric acid leaks.

3.3B.2.1.2 Loss of Material Due to General, Pitting, and Galvanic Corrosion, MIC, and Biofouling; Buildup of Deposits Due to Biofouling

In the discussion section of LRA Table 3.3.1, Item 3.3.1-17, the applicant stated that loss of material for components in an open-cycle cooling water environment is managed by MPS AMP B2.1.21, "Service Water System (Open-Cycle Cooling) Program." However, Item 3.3.1-17 does not address buildup of deposits in a seawater environment for the heat exchanger tubes and lined piping as an aging effect managed by the service water program. In LRA supplement dated July 7, 2004, the applicant stated that Unit 3 LRA Table 3.3.1, Item 3.3.1-17 (page 3-210), the first sentence in the discussion should include "and Buildup of Deposits" after "Loss of Material." The staff reviewed the applicant's response and finds that response is acceptable.

In an LRA supplement dated November 9, 2004, the applicant added the groundwater underdrains storage tank to the scope of license renewal and performed an aging management review. The applicant stated that loss of material of stainless steel is managed using MPS AMP B2.1.24, "Tank Inspection Program." The applicant also stated that visual inspections are performed that look for loss of material (e.g., pitting, MIC, etc). Because the subject tank is fully accessible from underneath (i.e., it is not resting on the ground or concrete), volumetric inspection is not necessary. The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. On the basis of its review, the staff finds that the tank inspection is acceptable for managing this aging effect.

3.3B.2.1.3 Loss of Material Due to Wear, Hardening and Shrinkage Due to Weathering

In the discussion section of LRA Table 3.3.1, Item 3.3.1-20, the applicant stated that loss of material due to wear is not an applicable aging effect for components (doors and barrier penetration seals) in the fire protection system. Fire doors could see wear on hinges, locks, etc., due to periodic opening and closing. This could cause loss of material and impact on the intended function of fire doors. During the audit and review, the staff asked the applicant to provide justification as to why this aging effect was not included. The applicant stated that fire doors are passive features to seal passageways through fire-rated barriers. Fire doors are equipped with hardware and attachment/closure devices that perform their intended function with moving parts and/or change of configuration, and are considered to be active components. As such, wear of the hardware, appurtenances, and attachment/closure mechanisms is not considered to be an aging effect, but rather a consequence of frequent or rough usage. The applicant restated that the conclusions in the Unit 3 LRA remain valid and unchanged. However, the applicant initiated revisions to the Unit 3 technical report for miscellaneous structural commodities to incorporate, in Section 2.0 of this SER, the above evaluation for wear of the hinges and locks for the fire doors. On the basis of its review, the staff finds the applicant's response to be acceptable.

3.3B.2.1.4 Loss of Material Due to Selective Leaching

In the discussion section of LRA Table 3.3.1, Item 3.3.1-29, the applicant stated that loss of material due to selective leaching is managed using MPS AMP B2.1.25, "Work Control Process," and MPS AMP B2.1.4, "Buried Pipe Inspection Program." The applicant stated that these two programs are not consistent with GALL AMP XI.M33, "Selective Leaching of Materials," in that the GALL Report recommends a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching to determine whether loss of materials due to selective leaching is occurring and whether the process will affect the ability of the components to perform their intended function for the period of extended operation. However, the work control process program and the buried pipe inspection program perform only routine visual inspections (which is more than a one-time inspection) when the opportunity arises, but do not perform hardness testing. The staff reviewed the work control process program and the buried pipe inspection program and its evaluation is documented in Sections 3.0.3.3.4 and 3.0.3.2.1 of this SER, respectively.

Since selective leaching generally does not cause changes in dimension and is difficult to detect by visual inspection alone, the staff asked the applicant to justify the use of visual inspection only, or provide other means of detection (Brinnell hardness, destructive testing) or other mechanical means (scraping, chipping, etc.).

In the Unit 3 technical report for the work control process, the applicant stated that selective leaching is an aging mechanism that causes an aging effect of change in material properties. However, in Unit 3 technical report for closed water system AMR, the applicant stated that selective leaching is an aging mechanism under the aging effect of loss of material. Unit 3 technical report for the closed water system AMR also references the Unit 3 technical report for the material aging effect report, which considers selective leaching under loss of material. The staff noted there is a discrepancy as to how selective leaching is considered between the AMP and the AMR technical reports.

During the audit and review, the applicant was requested to provide a rationale for considering selective leaching as causing change in material properties, which is generally an aging effect associated with non-metallic, elastomer type materials. The applicant concurred that the technical report for the work control process should have associated selective leaching with the aging effect of loss of material. The staff reviewed the change document to the technical report for the work control process, which identifies the change to include selective leaching under the "loss of material" aging effect. On the basis of its review, the staff finds this to be acceptable.

During the audit and review, the staff also noted that there was an error in the line item for cast iron and copper alloys in LRA Table 3.3.2-37 (pages 3-341 to 3-352) Unit 3 fire protection system. It appeared that the applicant may have intended to reference Table 3.3.1, Item 3.3.1-29 for selective leaching instead of referencing Table 3.3.1, Item 3.3.1-21. Unit 2 has referenced this correctly. Also, the GALL Report item should be VII.C.1.2-a, similar to that referenced in the Millstone LRA.

In an LRA supplement dated July 7, 2004, the applicant stated that the Unit 3 LRA Table 3.3.2-37 (pages 3-341 to 3-352) should state, "3.3.1-29" for the second Table 1 Item listed for components with cast iron/raw water and copper alloy/raw water material/environment combinations. The NUREG-1801 Volume 2 Item column for the affected component groups should be "VII.C1.2-a" except for the "Pipe" and "Tubing" component groups, which should be "VII.C1.1-a." The staff reviewed the applicant's response and finds that it is acceptable.

3.3B.2.1.5 Loss of Fracture Toughness Due to Thermal Aging Embrittlement

The applicant identified, in LRA Table 3.3.2-15 (page 3-268), for the CVCS, loss of fracture toughness as an aging effect for stainless steel regenerative heat exchanger (page 3-268) and valves (page 3-275). The staff noted that loss of fracture toughness is an aging effect normally associated with CASS material. During the audit and review, the applicant was requested to clarify the material. In LRA supplement dated July 7, 2004, the applicant stated that the material listed for the regenerative heat exchanger (channel head) and regenerative channel head (shell) in Unit 3 LRA Table 3.3.2-15 should be "stainless steel (CASS)" rather than just "stainless steel." The staff reviewed the applicant's response and finds it acceptable.

During the audit and review, the staff also questioned why various portions of the fire protection system were not included within the scope of license renewal and subject to an AMR. In its LRA supplement letter July 7, 2004, the applicant added several components to the fire protection system list of components that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the fire protection system AMR. The staff finds this material/environment/aging effect/AMP combination to be acceptable. The staff's evaluation of the scope of the fire protection system is documented in Section 3.0.3.2.7 of this SER.

3.3B.2.1.6 Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and Stress Corrosion Cracking

In LRA Table 3.3.1, Item 3.3.1-24, the applicant stated that bolting in the auxiliary systems is not subject to wetted conditions, therefore, loss of material due to general corrosion is not expected. Additionally, cracking for bolting in auxiliary systems is not identified as an AERM.

The staff noted that SRP-LR Table 3.3-1 recommended GALL AMP XI.M18, "Bolting Integrity," for managing closure bolting in high pressure or high temperature system for loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC.

The staff questioned the applicant whether all the resolution of generic safety issue for bolting, as stated in NUREG-1339, are addressed. By letter dated December 3, 2004, the applicant submitted its LRA supplement. In its response, the applicant stated that it has developed a specific bolting integrity aging management program that addressed degradation of bolting at MPS. The bolting integrity program is reviewed in Section 3.0.3.2.18 of this SER.

By letter dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaced the existing information in the "Discussion" column of Unit 3 LRA Table 3.3.1, Item 24 with "consistent with the NUREG-1801."

The staff reviewed the applicant's response and finds this acceptable since it is consistent with the GALL Report.

On the basis of its audit and review, the staff determined that for all other AMRs not requiring further evaluation, as identified in the Unit 3 LRA Table 3.3.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

Staff RAIs Pertaining to Recent Operating Experience and Emerging Issues. Because the GALL Report and SRP-LR were issued in July 2001, these documents do not reflect the most current recommendations for managing certain aging effects that have been the subject of recent operating experience or the topic of an emerging issue. As a result, the staff issued an RAI to determine how the applicant proposed to address these items for license renewal. The applicant's response to this RAI, and the staff's evaluations of the response, is documented as follows.

Boric Acid Corrosion (RAI 3.3-B-1). The LRA identified a borated water leakage environment for various mechanical components in auxiliary systems. Both the boric acid corrosion program and general condition monitoring program are credited with managing loss of material from external surfaces of these components. The LRA stated that the general condition monitoring program is performed in accessible plant areas. The applicant was requested to clarify how loss of material is managed for auxiliary system components not normally visible, such as under insulation or in normally inaccessible areas. In addition, the LRA states that the boric acid corrosion program is consistent with GALL AMP XI.M10. The scope of GALL AMP XI.M10 is limited to components in the vicinity of the reactor coolant pressure boundary. However, it appears that the MPS boric acid corrosion program is credited with managing loss of material caused by borated water leakage in systems that may not be in the vicinity of the reactor coolant pressure boundary, such as the radwaste area ventilation system. The applicant was requested to clarify this potential discrepancy. If the scope of the MPS boric acid corrosion program is different from the GALL XI.M10 program, the applicant was requested to revise the MPS program description accordingly in the AMP and FSAR supplement. Also the applicant was requested to identify the basis for applying the boric acid corrosion program to manage boric acid corrosion in copper alloy and cast iron materials that are not addressed in GALL AMP XI.M10 and may require a different inspection frequency.

By letter dated December 3 2004, the applicant responded as follows:

In a response dated December 3, 2004, the applicant clarified that general equipment (or materials) inspections are performed as often as daily. The applicant indicated that an independent assessment was performed by INPO in August 2003 and boric acid leaks are captured in the station corrective action program. INPO noted that the computer based training module has increased awareness of station employees with regard to boric acid corrosion and minor program enhancements are being addressed through the corrective action program.

The applicant stated that the following clarification will be added to Section A2.1.2, Boric Acid Corrosion Program, of the Unit 3 LRA:

> The boric acid corrosion program provides both detection and analysis of leakage of borated water inside containment. The general condition monitoring program is the primary method for detecting borated water leakage outside containment. The analysis of the leakage is performed through the boric acid corrosion program. Any necessary corrective actions are implemented through the corrective action program.

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant credits a combination of the general condition monitoring program and the boric acid corrosion program to detect and evaluate borated water leakage and boric acid corrosion to maintain the intended function of the auxiliary system components. For areas outside containment, general equipment (or materials) frequent inspections are performed as often as daily, which would identify any borated water leakage and any required subsequent evaluation. The applicant has agreed to include a clarification in the FSAR supplement to indicate that the general condition monitoring program is the primary method for detecting borated water leakage outside containment and the analysis of the leakage is performed through the boric acid corrosion program with corrective actions implemented through the corrective action program.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in LRA Table 3.3.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further project team review is required.

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3B.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.3.2.2, the applicant provides further evaluation of aging management as recommended by the GALL Report for auxiliary systems. The applicant provided information concerning how it will manage the following aging effects:

- loss of material due to general, pitting, and crevice corrosion
- hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear
- cumulative fatigue damage
- crack initiation and growth due to cracking or stress corrosion cracking
- loss of material due to general, microbiologically influenced, pitting, and crevice corrosion
- loss of material due to general, galvanic, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and biofouling
- quality assurance for aging management of non-safety-related components
- crack initiation and growth due to stress corrosion cracking and cyclic loading

- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.3B.2.2 of the Standard Review Plan for License Renewal. Details of the staff's audit and review are documented in the staff's audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.3B.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion

In LRA Section 3.3.2.2.1, the applicant addressed loss of material in components of the spent fuel pool system.

SRP-LR Section 3.3.2.2.1 states that loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tube sheets of the heat exchanger in the spent fuel pool cooling and cleanup system. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI TR-105714 guidelines for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material from general, pitting, or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of selected components at susceptible locations is an acceptable method for ensuring that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

Further, SRP-LR Section 3.3.2.2.1 states that loss of material due to pitting and crevice corrosion could occur in the filter housing, valve bodies, and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI TR-105714 guidelines for primary water chemistry and TR-102134 for secondary water chemistry to manage the effects of loss of material from pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The AMP recommended by the GALL Report is GALL AMP XI.M2, "Water Chemistry," for management of loss of material due to general, pitting, and crevice corrosion.

The applicant stated in the LRA that as set forth in the GALL Report, this item applies to spent fuel pool cooling and cleanup carbon steel components with elastomer linings. The spent fuel pool cooling system does not contain carbon steel components with elastomer linings. Therefore, the applicant concluded that this item is not applicable. The applicant has included the spent fuel pool cooling system in Unit 3 LRA Section 3.2, "Engineered Safety Features Systems." The staff reviewed Unit 3 LRA Table 3.2.2-5, AMR for spent fuel pool cooling system, and verified that the system did not contain carbon steel components with elastomer linings. On the basis of its review, the staff finds this line item is not applicable for components in the Unit 3 spent fuel pool cooling system.

However, these components are fabricated from stainless steel material. As stated in Section 3.2B.2.3.5 of this SER, the applicant proposed to manage loss of material of stainless steel expansion joints, flow elements, pipe, pumps, and spent fuel pool heat exchangers (channel head) component types exposed to chemically treated borated water using only MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," which is consistent with GALL AMP XI.M2, "Water Chemistry," with an exception. The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. The staff finds that because the effects of pitting and crevice corrosion on stainless steel components are not significant in chemically treated borated water, inspection of selected components to verify the absence of loss of material is not required. On the basis of its review, the staff finds that the chemistry control for primary systems program is acceptable for managing this aging effect.

3.3B.2.2.2 Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material Due to Wear

In LRA Section 3.3.2.2.2, the applicant addressed the potential for degradation of elastomers in collars and seals in spent fuel cooling systems and ventilation systems.

SRP-LR Section 3.3.2.2.2 states that hardening and cracking due to elastomer degradation could occur in elastomer linings of the filter, valve, and ion exchangers in spent fuel pool cooling and cleanup systems. Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the duct and in the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating ventilation systems and in the collars and seals of the duct in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the duct in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated in the LRA that the spent fuel pool cooling system does not contain carbon steel components with elastomer linings. Therefore, this item is not applicable. The applicant has included the spent fuel pool cooling system in LRA Section 3.2, "Engineered Safety Features Systems." The staff reviewed Table 3.2.2-5, AMR for spent fuel pool cooling system, and verified that the system did not contain carbon steel components with elastomer linings. On the basis of its review, the staff agrees that this line item is not applicable for components in the Unit 3 spent fuel pool cooling system.

The applicant also stated in the LRA that elastomers are used in ventilation system components and are evaluated for cracking and change of material properties due to thermal and radiation exposure. The applicant credited MPS AMP B2.1.25, "Work Control Process," and MPS AMP B2.1.13, "General Condition Monitoring Program," for managing age-related degradation of elastomers used in ventilation system components. Also, this program provides input to the corrective action program if aging effects are identified. The staff accepted the work control process program for managing the aging effects of cracking and change in material properties and its evaluation of this program is documented in Section 3.0.3.3.4 of this SER. The staff also accepted the general condition monitoring program for managing cracking and change of material properties since visual inspections will be performed on external surfaces to detect any sign of aging degradation. The staff's evaluation of the general condition monitoring program is documented in Section 3.0.3.3.2 of this SER.

In LRA Section 3.3.2.2.2, the applicant stated that loss of material due to wear is not an AERM for the elastomers in the ventilation systems. During the audit and review, the staff requested further clarification concerning the applicant's assertion. The rationale offered by the applicant was that the elastomers in the ventilation systems are not subject to motions which could result in wear. The staff finds that the applicant's justification is acceptable.

3.3B.2.2.3 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.3B.2.2.4 Crack Initiation and Growth Due to Cracking or Stress Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4. In LRA Section 3.3.2.2.4, the applicant addressed the potential for cracking in the high-pressure pumps of the chemical and volume control system.

SRP-LR Section 3.3.2.2.4 addresses crack initiation and growth due to cracking in the high-pressure pump in the CVCS. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated in the LRA that cracking is not identified as an AERM for the CVCS high-pressure pump casing. The high-pressure pump casing is constructed of stainless steel and operates at temperatures less than 140 °F. SCC is applicable to stainless steel components in aqueous environments that experience operating temperatures greater than 140 °F.

The applicant stated that based on industry experience, a temperature criterion of greater than 140 °F is used as the threshold for susceptibility of austenitic stainless steel to SCC. No instances were identified that would bring this temperature threshold into question. On the basis of its review, the staff finds the applicant's statement reasonable and acceptable because the applicant's bases for excluding the aging effects of cracking in the Unit 3 CVCS high-pressure pump casing are consistent with industry and site operating experience.

3.3B.2.2.5 Loss of Material Due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

In LRA Section 3.3.2.2.5, the applicant addressed the loss of material from corrosion that could occur on internal and external surfaces of components exposed to air and the associated range of atmospheric conditions.

SRP-LR Section 3.3.2.2.5 states that loss of material due to general, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, the auxiliary and radwaste area, the primary containment heating and ventilation systems, in the piping of the diesel generator building ventilation system, in the above-ground piping and fittings, valves, and pumps in the diesel fuel oil system and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the EDG system. Loss of material due to general, pitting, crevice, and MIC could occur in the duct fittings, access doors, and closure bolts, equipment frames and housing of the duct; loss of material due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler heating/cooling; and loss of material due to general corrosion could occur on the external surfaces of all carbon steel SCs, including bolting exposed to operating temperatures less than 212°F in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated that MPS AMP B2.1.10, "Fire Protection Program;" MPS AMP B2.1.24, "Tank Inspection Program;" and MPS AMP B2.1.25, "Work Control Process," manage loss of material due to general corrosion, MIC, pitting, and crevice corrosion for the internal surfaces of ducts, piping, filter housings, compressed air systems components, and fuel oil systems components. Loss of material for external surfaces of carbon steel components is managed by MPS AMP B2.1.13, "General Condition Monitoring Program;" MPS AMP B2.1.10, "Fire Protection Program;" MPS AMP B2.1.23, "Structures Monitoring Program;" and MPS AMP B2.1.24, "Tank Inspection Program." MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," manages this aging effect for components in infrequently accessed areas.

The staff identified a discrepancy between LRA Table 3.3.2-36: Auxiliary Systems - Unit 2 Fire Protection and LRA Table 3.3.2-37: Auxiliary Systems - Unit 3 Fire Protection. In LRA Table 3.3.2-36 (page 3-334), the applicant stated, for carbon steel pipe exposed to internally moist air, that the fire protection program is used to manage the aging effects of loss of material. In LRA Table 3.3.2-37 (page 3-346), the applicant credited the work control process program to manage loss of material and references LRA Table 3.3.1, Item 3.3.1-05. During the audit and review, the staff requested the applicant to clarify which is appropriate for managing the aging effect of loss of material. In an LRA supplement dated July 7, 2004, the applicant stated that for LRA Table 3.3.2-37 (page 3-346), the "Work Control Process" AMP for the carbon steel "Pipe" group exposed internally to an air environment should be the "Fire Protection Program" AMP. The "NUREG-1801" item should be "VII.H2.3-a" and the "Notes" should be "C, 2." The staff reviewed the applicant's response and finds it to be acceptable.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds the work control process program to be acceptable for managing the aging effects of loss of material due to general corrosion, MIC, pitting, and crevice corrosion for the internal surfaces of ducts, piping, filter housings, compressed air systems components, and fuel oil systems components.

The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The fire protection program is consistent with GALL AMPs XI.M.26, "Fire Protection," and XI.M.27, "Fire Water System." On the basis of its review, the staff finds that the fire protection program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces to detect any sign of aging degradation when the system is opened for maintenance and/or repair.

The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. The tank inspection program is consistent with GALL AMP XI.M.29, "Aboveground Carbon Steel Tanks." On the basis of its review, the staff finds that the tank Inspection program is acceptable for managing loss of material due to general corrosion since wall thickness measurements will be performed on the lower portion of the tank.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The general condition monitoring program performs visual inspections to detect evidence of degradation or adverse conditions in accessible plant areas. System engineers perform comprehensive visual inspections during walkdowns of plant systems and components during normal operation and during refueling outages; plant equipment operators perform equipment and structures inspections twice a day to maintain awareness of system and plant operation and material condition during normal operation and refueling outages. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of materials since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

The structures monitoring program manages the aging effects of cracking, loss of material, and change of material properties by monitoring structures and structural support systems that are within the scope of license renewal. The majority of these structures and structural support systems are monitored under 10 CFR 50.65 pursuant to guidance contained in RG 1.160, Revision 2, and NUMARC 93-01, Revision 2. These two documents provide guidance for development of licensee-specific programs to monitor the condition of structures and structural components within the scope of the Maintenance Rule, such that there is no loss of structure or structural component intended function. The remaining structures within the scope of license renewal (such as non-safety-related buildings and enclosures, duct banks, valve pits and trenches, high-energy line break barriers, and flood gates) are also monitored to ensure there is no loss of intended function. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. On the basis of its review, the staff finds that the structures monitoring program is acceptable for managing loss of materials since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

The staff reviewed the infrequently accessed areas inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The infrequently accessed areas inspection program is a new, plant-specific program that manages the aging effects of loss of material using visual inspections of the external surfaces of SCs. The program encompasses infrequently accessed areas of the plant which contain in-scope equipment. All areas not normally accessible for inspection and evaluation, and that contain SCs subject to aging management, have been identified for inclusion in the program. On the basis of its review, the staff finds that the infrequently accessed areas inspection program is acceptable for managing loss of material due to general corrosion on external surfaces of carbon steel components, since visual inspections will be performed on external surfaces to detect any sign of aging degradation in the service water system.

During the audit and review, the staff questioned why various portions of the diesel generator system were not included within the scope of license renewal and subject to an AMR. In its response dated July 7, 2004, the applicant added several components to the diesel generator system that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the diesel generator system AMR for components addressed by LRA Section 3.3.2.2.5. The staff finds this material/environment/aging effect/AMP combination to be acceptable. The staff's evaluation of the scope of the diesel generator system is documented in Section 2.3A.3.34 of this SER.

3.3B.2.2.6 Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion

In LRA Section 3.3.2.2.6, the applicant addressed further evaluation of programs to manage loss of material in the reactor coolant pump (RCP) oil collection system to verify the effectiveness of the fire protection program.

SRP-LR Section 3.3.2.2.6 states that loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the RCP oil collection system in fire protection. The fire protection program relies on a combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50, Appendix R and Branch Technical Position 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from washdowns may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that corrosion is not occurring.

The GALL Report recommends further evaluation of programs to manage loss of material due to general, galvanic, pitting, and crevice corrosion to verify the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the RCP oil collection system is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. This would be provided by a program consistent with GALL AMP XI.M32, "One-Time Inspection."

The applicant stated in the LRA that loss of material is managed for the components associated with the RCP oil collection system by MPS AMP B2.1.24, "Tank Inspection Program," which subjects the RCP oil collection tanks to periodic internal and external inspections. Additionally, during containment close-out activities, the RCP oil collection tanks are visually inspected and verified to be empty.

The staff reviewed the tank inspection program, which is consistent with GALL AMP XI.29, "Aboveground Carbon Steel Tanks," and its evaluation is documented in Section 3.0.3.2.17 of this SER. Since the tank inspection program includes volumetric examination for wall thickness measurement of the RCP oil collection tank, the staff finds the program acceptable for managing loss of material due to general, galvanic, pitting, and crevice corrosion.

The applicant referenced LRA Table 3.3.1, Item 3.3.1-06 (page 3-205), for components exposed internally to lube oil (Note 14) and loss of material aging effect combination in LRA Table 3.3.2-36, and credits the work control process program. In the discussion of Item 3.3.1-06, the applicant stated that the loss of material is managed by the tank inspection program. The staff noted that there is no mention of the work control process program in the discussion. In an LRA supplement dated July 7, 2004, the applicant stated that LRA Table 3.3.1, Item 3.3.1-06, should include the following words between the second and third sentences:

> For the non-tank components, loss of material is managed by the work control process.

Additionally, LRA Section 3.3.2.2.6 (page 3-198) should include the following words at the end of the first sentence:

> For the non-tank components, loss of material is managed by the work control process.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. It also provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that the work control process program is acceptable for managing the aging effect of loss of material.

3.3B.2.2.7 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

In LRA Section 3.3.2.2.7, the applicant addressed further evaluation of programs to manage loss of material in the diesel fuel oil system to verify the effectiveness of the diesel fuel monitoring program.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in the internal surface of tanks in the diesel fuel oil system and that loss of material due to general, pitting, and crevice corrosion and MIC could occur in the tanks of the diesel fuel oil system in the EDG system. The existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D4057, D1796, D2709, and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion/biofouling to verify the effectiveness of the program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The GALL Report recommends programs consistent with "Fuel Oil Chemistry" (XI.M30) and "One Time Inspection" (XI.M32) for management of this aging effect.

The applicant stated in the LRA that MPS AMP B2.1.12, "Fuel Oil Chemistry," manages loss of material for diesel fuel oil tanks and other components in the diesel generator fuel oil system, the security system, and the SBO diesel generator system. In lieu of a one-time inspection as described in SRP-LR Section 3.3.2.2.7, the applicant stated in LRA Section 3.3.2.2.7 that MPS AMP B2.1.25, "Work Control Process," will be used to provide confirmation of the effectiveness of the fuel oil chemistry program, and that tank inspections performed under the applicant's MPS AMP B2.1.24, "Tank Inspection Program," provide additional confirmation that the fuel oil chemistry program is effective for managing aging effects for applicable tanks.

The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction, and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2) establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment within the scope of license renewal. On the basis of its review, the staff finds the fuel oil chemistry program to be acceptable.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that the work control process program is acceptable for use to provide confirmation of the effectiveness of the fuel oil chemistry program.

The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. The tank inspection program is consistent with GALL AMP XI.M29, "Aboveground Carbon Steel Tanks." On the basis of its review, the staff finds that the tank inspection program is acceptable for providing additional confirmation that the fuel oil chemistry program is effective for managing aging effects for applicable tanks.

3.3B.2.2.8 Quality Assurance for Aging Management of Non-safety-related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's quality assurance program.

3.3B.2.2.9 Crack Initiation and Growth Due to Stress Corrosion Cracking and Cyclic Loading

In LRA Section 3.3.2.2.9, the applicant addressed further evaluation of programs to manage cracking in the chemical and volume control system to verify the effectiveness of the water chemistry control program.

SRP-LR Section 3.3.2.2.9 states that crack initiation and growth due to SCC and cyclic loading could occur in the channel head and access cover, tubesheet, tubes, shell and access cover, and closure bolting of the regenerative heat exchanger and in the channel head and access cover, tubesheet, and tubes of the letdown heat exchanger in the chemical and volume control system. The water chemistry program relies on monitoring and control of water chemistry based on the guidelines of EPRI TR-105714, "PWR Primary Water Chemistry Guidelines: Revision 4," to manage the effects of crack initiation and growth due to SCC and cyclic loading. Verification of the effectiveness of the chemistry control program should be performed to ensure that crack initiation and growth are not occurring. The GALL Report recommends further evaluation to manage crack initiation and growth from SCC and cyclic loading for these systems to verify the effectiveness of the water chemistry program. A one-time inspection of selected components and susceptible locations is an acceptable method to ensure that crack initiation and growth are not occurring and that the component's intended function will be maintained during the period of extended operation.

The AMPs recommended by the GALL Report are "Water Chemistry" (X1.M2) and a plant-specific verification program for management of this aging effect.

The GALL Report recommends that the water chemistry program be augmented by verifying the absence of cracking due to SCC and cyclic loading, or loss of material due to pitting and crevice corrosion. The GALL Report states that an acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.

The applicant stated in the LRA that cracking due to SCC for the regenerative and letdown heat exchangers is managed by MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." Verification of the effectiveness of the chemistry control program is provided by MPS AMP B2.1.25, "Work Control Process." The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The corrective action program would evaluate the cause and extent of condition and, if required, recommend enhancements to ensure continued effectiveness of the chemistry control for primary systems program.

The staff reviewed the chemistry control for the primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The chemistry control for primary systems program is consistent with the GALL Report, with an acceptable exception. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. On the basis of its review, the staff finds the chemistry control for primary systems program to be acceptable for managing this aging effect.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff notes that visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of crack initiation and growth. On the basis of it review, the staff finds that the work control process program is acceptable for managing crack initiation and growth since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

3.3B.2.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

In LRA Section 3.3.2.2.10, the applicant addressed reduction of neutron-absorbing capacity and loss of material due to general corrosion, which could occur in the neutron absorbing sheets of the spent fuel storage rack in the spent fuel storage system.

SRP-LR Section 3.3.2.2.10 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The applicant stated in the LRA that the neutron absorber elements credited in the criticality analysis for the spent fuel pool are constructed of Boral. Boral is a thermal neutron poison composed of boron carbide and 1100 alloy aluminum. Boron carbide is a compound having a high boron content in a physically stable and chemically inert form. The neutron-absorbing central layer of Boral is clad with aluminum. The boron carbide and aluminum materials in Boral are unaffected by long-term exposure to radiation.

The applicant stated in the LRA that the Boral has shown no signs of degradation in neutron-absorbing capability. The applicant concluded, based on the design of the neutron absorber elements and the results of surveillance testing, that reduction of neutron-absorbing capacity is not an aging effect that requires management for Boral in the spent fuel pool. On the basis of its review, the staff concurs with the applicant's conclusion that there are no applicable aging effects requiring management for the Boral in the spent fuel pool.

In the LRA, the applicant stated that the aluminum cladding of the neutron absorber elements is not subject to general corrosion in the spent fuel pool environment. However, the applicant stated that pitting corrosion could occur if spent fuel pool water chemistry exceeded specific contaminant levels. The applicant stated, for the neutron absorber elements, loss of material is managed by maintaining the quality of the spent fuel pool water chemistry. The applicant credited MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program," for this purpose. The staff reviewed the chemistry control for primary systems program, with exception, and its evaluation is documented in Section 3.0.3.2.2 of this SER. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. On the basis of its review, the staff finds that the chemistry control for primary systems program is acceptable for managing this aging effect.

3.3B.2.2.11 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

In LRA Section 3.3.2.2.11, the applicant addressed the potential for loss of material in buried piping of the SW and diesel fuel oil systems.

SRP-LR Section 3.3.2.2.11 states that loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (SW system) and in the diesel fuel oil system. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

The AMP recommended by the GALL Report is the GALL AMP XI.M34, "Buried Piping and Tanks Inspection," for management of this aging effect.

The applicant stated in the LRA that loss of material for buried piping and valves in the service water system, and in the Unit 2 fire protection system, Unit 3 fire protection system, and enclosure building filtration system, is managed by MPS AMP B2.1.4, "Buried Pipe Inspection Program."

In the LRA, the applicant stated that as part of the buried pipe inspection program a baseline inspection of representative in-scope buried piping is performed, which provides an effective method for detection of aging effects. In addition, inspections are performed when the buried components are excavated for maintenance or any other reason, which provides an effective method to evaluate the condition of the buried piping and protective coatings. Operating experience with age-related degradation of buried piping is limited, and no failures of in-scope buried piping have been identified. The applicant stated that there is no buried piping in the diesel fuel oil systems.

The staff reviewed the buried pipe inspection program and its evaluation is documented in Section 3.0.3.2.1 of this SER. The staff finds that the buried pipe inspection program, which is consistent with GALL AMP XI.M28, "Buried Piping and Tanks Surveillance," and GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with exceptions and enhancements, to be acceptable. The staff also finds the exceptions and enhancements to be acceptable. The staff reviewed the plant operating experience and found that the program is effective in identifying age-related degradation, implementing repairs, and maintaining the integrity of buried pipe. On the basis of its review, the staff finds that the buried pipe inspection program is acceptable for managing the aging effect of loss of material in buried piping and fittings.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3B.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.3.2-1 through 3.3.2-50, the staff reviewed additional details of the results of the AMRs for material, environment, AERM, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report. The staff also reviewed additional systems and components, provided in the applicant's letter, dated January 11, 2005.

In LRA Tables 3.3.2-1 through 3.3.2-50, the applicant indicated, via Note F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect require management will be managed.

Staff Evaluation. For component type material/environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff requested the applicant to provide additional information on the issues described in the following general RAI.

Selective Leaching in Copper Alloys (RAI 3.3-B-2)

LRA Tables 3.3.2-2, 3.3.2-12, 3.3.2-15 and 3.3.2-41 for the service water, instrument air, CVCS and SBO diesel generator systems respectively identify loss of material as an aging effect applicable to nickel-based and copper alloys exposed to an atmosphere/weather and treated water environments. The LRA did not identify the alloy zinc content for these materials. The LRA credits the general condition monitoring program for managing loss of material on the exterior of various nickel-based or copper alloy materials and the work control process for managing loss of material in the interior of copper alloy tubes and tubesheets. These AMPs primarily rely on visual inspections. Industry documents, such as EPRI report 1003056, "Non-Class-1 Mechanical Implementation Guideline and Mechanical Tools," Rev. 3, identify various corrosion mechanisms, including selective leaching, causing loss of material in copper alloys with greater than 15 percent zinc content in a treated water environment or an air environment subject to moisture. Loss of material from selective leaching is specifically addressed in GALL AMP XI.M33, but page B-7 of the LRA states that the aging management reviews did not identify the need for this aging management program. The applicant was requested to identify the alloy zinc content for these materials and clarify if selective leaching is an applicable aging mechanism. If selective leaching is an applicable aging mechanism, the applicant was requested to clarify if hardness measurement and one-time inspection required by GALL AMP XI.M33 will be used to manage the aging effect.

By letter dated November 9, 2004, the applicant responded as follows:

> Dominion conservatively assumed that all copper alloys were of a material composition that could be susceptible to selective leaching. Accordingly, the zinc content for copper alloys was not identified in the LRA since it was not used as an input to the evaluation of aging mechanisms. Selective leaching was not considered to be an applicable aging mechanism for nickel-based alloys.
>
> Selective leaching of copper alloy components in the instrument air and station blackout diesel generator systems was not considered to be significant in an atmosphere/weather environment since this environment only involves periodic wetting of surfaces due to precipitation. Generally, surfaces would dry out and remain dry the majority of the time. If water collection or pooling from precipitation was present for a component, the component material was evaluated with a raw water environment as defined in LRA Table 3.0-1. However, loss of material due to general corrosion was conservatively

identified as an aging effect for these components and the General Condition Monitoring AMP provides overall management of this aging effect.

Selective leaching of copper alloy components in the instrument air, station blackout and, CVCS systems that are subjected to a treated water environment has been re-evaluated and considered to be an applicable aging mechanism. Although the treated water is adjusted to specifically control corrosion by the reduction of oxygen and/or the addition of corrosion inhibitor compounds, there us potential for selective leaching of susceptible materials in this environment. Management of loss of material due to selective leaching of copper alloy components in a treated water environment is performed by the Work Control Process AMP. Specific inspections for selective leaching by the Work Control Process are addressed in Audit Item #85 in the Dominion letter to the NRC staff dated July 7, 2004, (Serial No. 04-320).

No copper alloy components in the service water system are associated with a treated water or atmosphere/weather environment.

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant provided sufficient information to evaluate selective leaching in copper alloy components in auxiliary system components. The applicant re-evaluated selective leaching of copper alloys in a treated water environment and concluded that this is an aging mechanism. The applicant has agreed in its letter dated July 7, 2004, to include appropriate inspection criteria for selective leaching to its work control process AMP. The applicant also provided a reasonable basis to conclude that selective leaching is not a significant aging mechanism causing loss of material in copper alloy materials in auxiliary systems exposed to periodic moisture. This conclusion is in part based on the applicant's clarified environmental conditions that copper alloy components in systems exposed to atmosphere/weather conditions are not exposed to wetted conditions for a significant period of time. The staff agrees that selective leaching of nickel alloys is not considered to be a concern in this environment. On the basis of the applicant's response, all issues related to RAI 3.3-B-2 are resolved.

The system-specific staff evaluation is discussed below.

3.3B.2.3.1 Circulating Water - Aging Management Evaluation - Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarized the results of AMR evaluations for the circulating water system component groups.

In the LRA, the applicant identified no aging effects for fiberglass pipe component types exposed to air. The applicant stated, in its technical report for open water, that reduced strength due to ozone exposure of non-metallic is possible in an air environment. The applicant explained that the fiberglass components exposed to air in this system are not located near high-voltage electrical equipment. Therefore, ozone exposure is not a potential aging mechanism. In addition, a review of operating experience has identified no concerns related to the occurrence of ozone exposure in the open water systems. The staff reviewed the technical report, current industry research and operating experience. On the basis of its review, the staff concludes that reduced strength due to ozone for fiberglass components in air environment is not an aging effect that requires aging management.

In the LRA, the applicant identified no aging effects for fiberglass pipe component types exposed to seawater. The applicant stated, its technical report for open water, that exposure to ultraviolet radiation and ozone can cause damage to the chemical structure of the epoxy matrix of fiberglass. The earliest signs of this effect can be changes in color and surface cracking or crazing. Fiberglass exposed to direct sun or high levels of ozone that might be found in conjunction with high-voltage electrical equipment would be most prone to this effect. The staff reviewed the technical report, current industry research and operating experience and finds that fiberglass components in seawater environment are not exposed to high level of ultraviolet radiation or ozone. On the basis of its review, the staff concludes that cracking in fiberglass components in sea water is not an aging effect that requires aging management.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to air. The applicant explained, in its technical report for open water, that change of material properties due to thermal exposure and irradiation and cracking due to irradiation of rubber components in air are aging effects that do not require aging management for the components in this system. The staff reviewed the technical report, current industry research and operating experience and finds that these components are not exposed to high levels of ultraviolet radiation, ozone, or temperatures greater than 95 °F. On the basis of its review, the staff concludes that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for rubber expansion joints exposed to air.

In the LRA, the applicant has identified no aging effects for rubber expansion joints exposed to sea water. The applicant explained, in its technical report for open water, that change of material properties and cracking due to thermal of rubber components exposed to sea water are aging effects that do not require aging management for the components in this system. The staff reviewed the technical report, current industry research and operating experience and finds that the threshold temperature for applying the aging effects of cracking and change of material properties to elastomers is 95 °F. In addition, the surface temperature of the rubber expansion joints in the open water systems will likely never exceed 95 °F, since the internal water (raw water from the Long Island Sound) is significantly less than 95 °F. On the basis of its review, the staff concludes that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects for rubber expansion joints exposed to sea water since these components are not exposed to temperatures greater than 95 °F.

3.3B.2.3.2 Service Water - Aging Management Evaluation - Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarized the results of AMR evaluations for the service water system component groups.

In LRA Table 3.3.2-2, the applicant proposed to manage build up of deposit of carbon steel pipe component type exposed to sea water using MPS AMP B2.1.21, "Service Water System," which is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System." However, buildup of deposits due to biofouling is not identified in the GALL Report as an aging effect for the pipes and strainers component types. The applicant, in its technical report for open water, stated that the carbon steel and cast iron material lined piping interfaces with sea water and is subject to macro-fouling, silting, and sedimentation. Therefore, buildup of deposits is a potential aging effect for these components that requires aging management.

The applicant, in LRA Appendix C (page C-24), described that buildup of deposits due to biofouling is an aging effect requiring aging management for heat exchanger tubes, tube sheets, and lined components. The applicant stated that lined piping was included because piping can contribute to heat exchanger fouling since small segments of the coating can become detached and foul associated heat exchangers. Buildup of deposits does not directly effect the pressure boundary of the lined piping. However, prolonged operation with deteriorated coatings would lead to loss of material. For this reason, both buildup of deposits and loss of material are managed by the service water system (open-cycle cooling) aging management activity. Specifically, internal visual inspections of the service water piping are periodically performed.

The staff reviewed the service water system program and its evaluation is documented in Section 3.0.3.2.15 of this SER. On the basis of its review of the applicant program and technical report, together with current industry research and operating experience, the staff finds that the service water program is acceptable for managing buildup of deposits for the lined components, since internal visual inspections of the service water components will be periodically performed to detect any sign of deposit build up.

In the LRA, the applicant proposed to manage loss of material of stainless steel and copper alloy pipe control building HVAC booster pump, MCC and rod control HVAC booster pump, valves, and tubing types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

The applicant, in the LRA, proposed to manage loss of material of copper alloy pipe and valve external surfaces caused by borated water leakage using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the use of the general condition monitoring program in lieu of the boric acid corrosion program is acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material for nickel-based alloys expansion joints, flow elements, pipe and restricting orifices exposed to sea water using MPS AMP B2.1.21, "Service Water System (Open-Cycle Cooling)," which is consistent with the GALL XI.M20 program. However, loss of material for nickel-based components types in treated water as a component, material, environment, and aging effect combination is not identified in the GALL Report. The applicant, in its technical report for open water, stated that the nickel-based alloys in sea water are exposed to low flow conditions with an aggressive environment. Therefore, pitting corrosion is a potential aging mechanism. The staff reviewed the service water system program and its evaluation is documented in Section 3.0.3.2.15 of this SER. The staff finds that this program implements the intent of GL 89-13. On the basis of its review of the applicant's program and technical report, together with current industry research and operating experience, the staff finds that the service water program is acceptable for managing loss of material of nickel-based alloys (due to pitting corrosion) components in a sea water environment for this system.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material for titanium valves exposed to sea water using MPS AMP B2.1.21, "Service Water System (Open-Cycle Cooling)," which is consistent with the GALL XI.M20 program. However, loss of material for titanium component types in treated water is not identified in the GALL Report. The applicant, in its technical report for open water, stated that loss of material due to erosion of titanium component is possible in a sea water environment. The titanium components in this application have flow rates greater than 50 feet per second (fps) or contain fluids with high particulates. Therefore, erosion is a potential aging mechanism. The staff reviewed the service water system program and its evaluation is documented in Section 3.0.3.2.15 of this SER. The staff finds that this program implements the intent of the NRC Guidelines set forth in GL 89-13. On the basis of its review of the applicant's program and technical report, together with current industry research and operating experience, the staff finds that the service water program is acceptable for managing loss of material due to erosion/corrosion for titanium valves in a sea water environment.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to air. The applicant explained, in its technical report for open water, that change of material properties due to thermal exposure and irradiation and cracking due to irradiation of rubber components in air are aging effects that do not require aging management for the components in this system.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to air. The applicant explained, in its technical report for open water, that change of material properties due to thermal exposure and irradiation and cracking due to irradiation of rubber components in air are aging effects that do not require aging management for the components in this system. The staff reviewed the technical report, current industry research and operating experience and finds that these components are not exposed to high levels of ultraviolet radiation, ozone, or temperatures greater than 95°F. On the basis of its review, the staff concludes that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for rubber expansion joints exposed to air.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to sea water. The applicant stated in its technical report for open water, stated that change of material properties and cracking due to thermal of rubber components in sea water are aging effects that do not require aging management for the components in this system.

The staff reviewed technical report, current industry research and operating experience and finds that the threshold temperature for applying the aging effects of cracking and change of material properties to elastomers is 95°F. In addition, the surface temperature of the rubber expansion joints in the open water systems will never exceed 95°F, since the internal water (raw water from the Long Island Sound) is significantly less than 95°F. On the basis of its review, the staff concludes that it did not identify any concerns with the applicant's conclusions that there are no applicable aging effects for rubber expansion joints exposed to sea water since these components are not exposed to temperatures greater than 95°F.

In the LRA, the applicant has identified no aging effects for stainless steel spool piece and titanium valves exposed internally/externally to air. Air is not identified in the GALL Report as an environment for this combination of component and material.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Wrought austenitic stainless steel and titanium are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concludes that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.3 Sodium Hypochlorite - Aging Management Evaluation - Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarized the results of AMR evaluations for the sodium hypochlorite system component groups.

The applicant, in the LRA, proposed to manage loss of material of copper alloy pipes exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

In the LRA, the applicant identified no aging effects for fiberglass piping component types exposed to air. The applicant, in its technical report for open water, stated that reduced strength due to ozone exposure of non-metallic is possible in an air environment. The applicant explained that the fiberglass components exposed to air in this system are not located near high-voltage electrical equipment. Therefore, ozone exposure is not a potential aging mechanism. In addition, a review of operating experience has identified no concerns related to the occurrence of ozone exposure in the open water systems. The staff reviewed the technical report, current industry research and operating experience. On the basis of its review, the staff concludes that reduced strength due to ozone for fiberglass components in air environment is not an aging effect that requires aging management.

Based on the review of the applicant's open water technical report and on the basis of current industry research and operating experience, the staff finds that reduced strength due to ozone for fiberglass components in air environment is not an aging effect that requires aging management.

The applicant identified no aging effects for fiberglass piping component types exposed to sea water. The applicant stated, in its open water system AMR technical report, that exposure to ultraviolet radiation and ozone can cause damage to the chemical structure of the epoxy matrix of fiberglass. The earliest signs of this effect can be changes in color and surface cracking or crazing. Fiberglass exposed to direct sun or high levels of ozone that might be found in conjunction with high-voltage electrical equipment would be most prone to this effect.

On the basis of the open water technical report, current industry research, and operating experience, the fiberglass components in sea water environment are not exposed to high levels of ultraviolet radiation or ozone. Therefore, the staff finds that cracking in fiberglass components in sea water is not an aging effect that requires aging management.

The applicant identified no aging effects for PVC pipe and valve component types exposed to air and sea water. Current industry research and operating experience reviews have identified instances of PVC degradation resulting from exposure to direct sunlight and exposure to ozone from high voltage. The MPS MAER technical report identifies the aging effect of reduced strength due to ozone exposure for PVC components exposed to sea water, and reduced strength due to ozone exposure or ultraviolet exposure for PVC components exposed to air. The AMR evaluated PVC components for the above aging effects and concluded that no aging management was required. This conclusion was based on the fact that the PVC components are not exposed to direct sunlight and are not exposed to high levels of ozone, since they are not in close proximity to high voltage electrical equipment.

On the basis of the open water technical report, current industry research, and operating experience, the staff finds that reduced strength PVC components in air or seawater environment is not an aging effect that requires aging management.

3.3B.2.3.4 Reactor Plant Component Cooling - Aging Management Evaluation - Table 3.3.2-4 and Table 3.3.2-4a

The staff reviewed LRA Table 3.3.2-4 and the applicant's letter, dated January 11, 2005, which summarize the results of AMR evaluations for the reactor plant component cooling (RPCC) system component groups.

In the LRA, the applicant proposed to manage loss of RPCC heat exchanger copper alloy tubes in treated water using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the loss of material. On the basis of its review, the staff concludes that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed external surfaces of heat exchanger tubes to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of external surfaces of the copper alloy RPCC heat exchanger channel and valves exposed to borated water leakage using the MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the use of the general condition monitoring program in lieu of boric acid corrosion is acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system.

In the LRA and supplement dated January 11, 2005, the applicant proposed to manage loss of material of stainless steel and copper alloy RPCC heat exchanger channel, valves, flow elements, hoses, tubing, and radiation detectors component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

3.3B.2.3.5 Turbine Plant Component Cooling Water - Aging Management Evaluation - Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarized the results of AMR evaluations for the turbine plant component cooling water system component groups.

In the Unit 2 LRA, the applicant proposed to manage loss of material of stainless steel pipe and valve component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program an its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

3.3B.2.3.6 Chilled Water - Aging Management Evaluation - Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarized the results of AMR evaluations for the chilled water system component groups.

In the LRA, the applicant proposed to manage loss of material of external surfaces of the copper alloy tubing and valves exposed to borated water leakage using the MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the use of the general condition monitoring program in lieu of the boric acid corrosion program is acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system.

In the LRA, the applicant also proposed to manage loss of material of stainless steel and copper alloy tubing, valves, flow elements, and hoses component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

3.3B.2.3.7 Charging Pumps Cooling - Aging Management Evaluation - Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarized the results of AMR evaluations for the charging pumps cooling system component groups.

In the LRA, the applicant proposed to manage loss of material of external surfaces of the copper alloy valves exposed to borated water leakage using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program in lieu of boric acid corrosion is acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system.

In the LRA, the applicant proposed to manage loss of material of stainless steel and copper alloy charging pump coolers channel and shell, valves, flow elements, pumps, and tubing component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

3.3B.2.3.8 Safety Injection Pumps Cooling - Aging Management Evaluation - Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarized the results of AMR evaluations for the safety injection pumps cooling system component groups.

In the LRA, the applicant proposed to manage loss of material of external surfaces of the copper alloy safety injection pump coolers shell and channel and valves exposed to borated water leakage using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program is acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system.

In the LRA, the applicant proposed to manage loss of material of stainless steel and copper alloy safety injection pump coolers shell and channel, valves flow elements, pumps, restricting orifices, and tubing component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

3.3B.2.3.9 Neutron Shield Tank Cooling - Aging Management Evaluation - Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarized the results of AMR evaluations for the neutron shield tank cooling system component groups.

In the LRA, the applicant proposed to manage loss of material of external surfaces of the copper alloy valves exposed to borated water leakage using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program in lieu of boric acid corrosion is acceptable for managing loss of material due to borated acid leakage on external surfaces of copper alloy components in this system.

In the LRA, the applicant proposed to manage loss of material of stainless steel and copper alloy valves and tubing component types exposed to a moisture-laden air and/or intermittently wetted environments using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

3.3B.2.3.10 Containment Atmosphere Monitoring - Aging Management Evaluation - Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarized the results of AMR evaluations for the containment atmosphere monitoring system component groups. The staff reviewed the technical report for AMR results for the air and gas systems.

In the LRA, the applicant identified no aging effects for low-alloy and stainless steel components exposed internally or externally to air, including bolting, pipe, and valves component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concludes that there are no applicable aging effects for metal in an air environment.

3.3B.2.3.11 Containment Instrument Air - Aging Management Evaluation - Table 3.3.2-11

The staff reviewed LRA Table 3.3.2-11, which summarized the results of AMR evaluations for the containment instrument air system component groups. The staff reviewed the technical report for AMR results for the air and gas systems.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe, tubing, and valve component types exposed externally to a borated water leakage environment using the MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. However, the GALL Report specifies GALL AMP XI.M10, "Boric Acid Corrosion" to manage this aging effect. The applicant stated, in Note 1, that the boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. Also, visual inspection of external surfaces is performed during various walkdowns performed by plant personnel to look for boron buildup and/or boric acid leaks. On the basis of its review, the staff concludes that this program is acceptable for managing loss of material of copper alloy pipe, tubing, and valves component types exposed to a borated water.

In the LRA, the applicant identified no aging effects for stainless steel, low-alloy steel, and copper alloys components exposed internally or externally to air, including bolting, pipe, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel and copper alloys are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concludes that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.12 Instrument Air - Aging Management Evaluation - Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarized the results of AMR evaluations for the instrument air system component groups. The staff reviewed the technical report for AMR results for the air and gas systems.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe and valve component types exposed externally to a borated water leakage environment using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. However, the GALL Report specifies GALL AMP XI.M10, "Boric Acid Corrosion" to manage this aging effect. The applicant stated, in Note 1, that the boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. Also, visual inspection of external surfaces is performed during various walkdowns by plant personnel to look for boron buildup and/or boric acid leaks. On the basis of its review, the staff finds that this program is acceptable for managing loss of material of copper alloy pipe and valves exposed externally to a borated water leakage environment.

In the LRA, the applicant identified no aging effects for carbon steel, cast iron, and copper alloys components exposed externally, including air dryers, filters, instrument air aftercooler (shell), instrument air compressor (intercooler shell), instrument air filter silencer, instrument air receiver, pipe, strainers, traps, valves, instrument air compressor, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Copper alloys are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant also proposed to manage loss of materials of copper alloy instrument air aftercooler (tubing) component type in an environment of treated water (closed cooling water) using MPS AMP B2.1.7, "Closed-Cycle Cooling Water System." The staff reviewed the closed-cycle cooling water system program and its evaluation is documented in Section 3.0.3.2.4 of this SER. The staff finds that the closed-cycle cooling water system program is consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with an acceptable exception. On the basis of its review, the staff finds that the closed-cycle cooling water system program is acceptable for managing loss of material of components in the treated water environment that are serviced by closed-cycle cooling system.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe exposed externally to a damp soil environment using MPS AMP B2.1.4, "Buried Piping Inspection Program." The staff reviewed the buried piping inspection program and its evaluation is documented in Section 3.0.3.2.1 of this SER. The staff finds that the buried piping inspection program is consistent with GALL AMP XI.M28, "Buried Piping and Tanks Surveillance" and GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with acceptable exceptions and enhancements. The program includes a baseline inspection of representative samples of piping with different protective measures and also inspections of buried components when piping is excavated during maintenance or for any other reason. On the basis of its review, the staff finds that the program is acceptable for managing loss of material.

In the LRA, the applicant proposed to manage loss of material of copper alloy instrument air compressor (intercooler tubing) component groups exposed externally to moisture-laden air and/or an intermittently wetted environment (but internal to the air compressor) using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal surfaces of plant components and plant commodities are performed during maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components (external surface of intercooler tubing) to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for the cast iron air compressor component type exposed internally to oil. However, the combination of cast iron in oil was not addressed in the applicant's technical report for AMR results for the air and gas systems, and that no basis was evident for the applicant's conclusion that there was no aging effect for this component type. During the audit and review, the staff requested that the applicant provide a basis for considering no aging effects. In an LRA supplement dated July 7, 2004, the applicant stated that the oil environment was inadvertently listed for the instrument air compressor. On the basis of its review, the staff finds the applicant's response acceptable.

3.3B.2.3.13 Nitrogen - Aging Management Evaluation - Table 3.3.2-13

The staff reviewed LRA Table 3.3.2-13, which summarized the results of AMR evaluations for the nitrogen system component groups. The staff reviewed the applicant's technical report, which provides the AMR results for the air and gas systems.

In the LRA, the applicant identified no aging effects for carbon steel components exposed externally to air, including pipe and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for carbon steel components exposed internally to gas for pipe and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (nitrogen, which is an inert gas) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel pipe component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff concludes that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

3.3B.2.3.14 Service Air - Aging Management Evaluation - Table 3.3.2-14 and Table 3.3.2-14a

The staff reviewed Table 3.3.2-14 of the LRA and Table 3.3.2-14a in the applicant's letter dated January 11, 2005, which summarizes the results of AMR evaluations for the service air system component groups. The staff reviewed the applicant's technical report, which provides the AMR results for the air and gas systems.

In the LRA, the applicant proposed to manage loss of material of stainless steel pipe, and valve component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff notes that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

In the LRA and the applicant's supplement dated January 11, 2005, the applicant proposed to manage loss of material of stainless steel pipe, valves, and flow transmitters component groups exposed internally to moisture-laden air and/or an intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In LRA and the applicant's letter dated January 11, 2005, the applicant identified no aging effects for carbon steel and stainless steel components exposed externally to air, including pipe, valves and flow transmitters component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.15 Chemical and Volume Control - Aging Management Evaluation - Table 3.3.2-15 and Table 3.3.2-15a

The staff reviewed Table 3.3.2-15 of the LRA and the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the CVCS component groups.

In the LRA and the applicant's supplement dated January 11, 2005, the applicant identified no aging effects for carbon steel, low-alloy steel, and stainless steel components exposed to air, including bolting, charging pump lube oil coolers (shell), chiller surge tank, letdown chiller heat exchanger (shell), level indicators, lube oil reservoirs, pipe, pumps, thermal regeneration chiller compressor oil cooler (channel head), thermal regeneration chiller compressor oil cooler (shell), thermal regeneration chiller condenser (channel head) thermal regeneration chiller condenser (shell), thermal regeneration chiller evaporator (shell), valves, boric acid blender and tanks, chemical mixing tank, demineralizer, excess letdown heat exchanger (channel head), filter/strainer, flexible hoses, flow element, letdown chiller heat exchanger (channel head), letdown heat exchanger (channel head), letdown reheat heat exchanger (channel head and shell), moderating heat exchanger (channel head and shell), moderating heat exchanger (shell), RCP seal standpipes, regenerative heat exchanger (channel head), regenerative heat exchanger (shell), restricting orifices, seal water heat exchanger (channel head), tubing, volume control tank, and boric acid batching tank component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of carbon steel, and copper alloy charging pump lube oil coolers (tubes), charging pump lube oil coolers (tubesheet), charging pump lube oil coolers (shell), CS manifolds (charging pump LO), flexible hoses, level indicators, lube oil reservoirs, pipe, pumps, thermal regeneration chiller compressor oil cooler (channel head), thermal regeneration chiller compressor oil cooler (tube sheet), thermal regeneration chiller compressor oil cooler (tubes), tubing, and valve component types exposed internally or externally to oil using MPS AMP B2.1.25, "Work Control Process." The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material. The staff's evaluation of the work control process program is documented in Section 3.0.3.3.4 of this SER.

In the LRA, the applicant identified no aging effects for stainless steel components exposed internally to gas or air for pipe, valves, and volume control tank component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) or air on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas or air environment.

In the LRA, the applicant identified no aging effects for carbon steel components exposed internally to air for thermal regeneration chiller condenser (shell), thermal regeneration chiller evaporator (shell), and valve component types. Air is not identified in the GALL Report as an environment for these components and materials. However, the applicant identifies Note 5 for these components (page 3-273 and page 3-276). Specifically, Note 5 addresses external environment of air and not internal environment. During the audit and review, the applicant was requested to clarify this issue. In an LRA supplement dated July 7, 2004, the applicant stated that the Note 5 should be replaced with Note 6 in LRA Table 3.3.2-15 (page 3-273) for CVCS component groups "Thermal Regeneration Chiller Condenser (shell)" and "Thermal Regeneration Chiller Evaporator (shell)" for an internal environment of air. On the basis of its review, the staff finds the applicant's response acceptable.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of air on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff concludes that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of copper alloy charging pump lube oil coolers (tubes), and charging pump lube oil coolers (tube sheet) component types exposed internally to treated water using MPS AMP B2.1.7, "Closed-Cycle Cooling Water System." The staff reviewed the closed-cycle cooling water system program and its evaluation is documented in Section 3.0.3.2.4 of this SER. The staff finds that the closed-cycle cooling water system program is consistent with GALL AMP XI.M.21, "Closed-Cycle Cooling Water System" with an acceptable exception. The exception is performance testing of the closed-cycle cooling water side of heat exchangers. On the basis of its review, the staff finds the closed-cycle cooling water program acceptable for managing the aging effect of loss of material for these component groups.

3.3B.2.3.16 Reactor Plant Sampling - Aging Management Evaluation - Table 3.3.2-16 and Table 3.3.2-16a

The staff reviewed Table 3.3.2-16 of the LRA and Table 3.3.2-16a in the applicant's letter, dated January 11, 2005, which summarizes the results of AMR evaluations for the reactor plant sampling system component groups.

In the LRA, the applicant identified no aging effects for low-alloy and stainless steel components exposed to air, including bolting, flexible hoses, piping, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concludes that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.17 Primary Grade Water - Aging Management Evaluation - Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarized the results of AMR evaluations for the primary grade water system component groups.

In the LRA, the applicant identified no aging effects for low-alloy and stainless steel components exposed to air, including bolting, piping, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.18 Auxiliary Building Ventilation - Aging Management Evaluation - Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarized the results of AMR evaluations for the auxiliary building ventilation system component groups.

In the LRA, the applicant proposed to manage loss of material of stainless steel flow elements, pipe, and tubing component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff finds the general condition monitoring acceptable for managing loss of material due to pitting and crevice corrosion.

In the LRA, the applicant identified no aging effects for carbon and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including auxiliary building filter bank housings, damper housings, ductwork, filter bank housing, MCC rod control and cable vault air conditioning air supply unit, pipe, silencers, valves, flow elements, and tubing component types.

The applicant stated in the LRA that surfaces of carbon and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy HVAC components exposed internally or externally to air that is not intermittently wetted, including auxiliary building heating and ventilation air supply heating coils component types.

The applicant stated in the LRA that surfaces of copper alloy components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.19 Circulating and Service Water Pumphouse Ventilation - Aging Management Evaluation - Table 3.3.2-19

The staff reviewed LRA Table 3.3.2-19, which summarized the results of AMR evaluations for the circulating and service water pumphouse ventilation system component groups.

In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings, ductwork, fan/blower housing, and silencer component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.20 Containment Air Recirculation - Aging Management Evaluation - Table 3.3.2-20

The staff reviewed LRA Table 3.3.2-20 which summarized the results of AMR evaluations for the containment air recirculation system component groups.

In the LRA, the applicant identified no aging effects for carbon steel and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including containment air recirculation cooling unit housings, damper housings, ductwork, fan/blower housing, and tubing component types.

The applicant stated in the LRA that surfaces of carbon steel and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the

basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.21 Containment Purge Air - Aging Management Evaluation - Table 3.3.2-21

The staff reviewed LRA Table 3.3.2-21, which summarized the results of AMR evaluations for the containment purge air system component groups.

In the LRA, the applicant identified no aging effects for carbon steel components exposed to air, including damper housing, ductwork, pipe, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for carbon steel components exposed internally to air, including damper housing, ductwork, pipe, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The internal environment is air. Significant amounts of corrosion of carbon steel require an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Therefore, the staff did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for copper alloy components exposed to air, including containment purge heating and ventilation air supply heating coils component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Without the presence of the aggressive environment, copper alloy components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.22 Containment Leakage Monitoring - Aging Management Evaluation - Table 3.3.2-22

The staff reviewed LRA Table 3.3.2-22, which summarized the results of AMR evaluations for the containment leakage monitoring system component groups. In the LRA, the applicant identified no aging effects for carbon and stainless steel components exposed to air, including pipe, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for carbon and stainless steel components exposed internally to air, including pipe, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The internal environment is dry air. Significant amounts of corrosion of carbon steel require an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.23 Containment Vacuum - Aging Management Evaluation - Table 3.3.2-23 and Table 3.3.2-23a

The staff reviewed Table 3.3.2-23 of the LRA and Table 3.3.2-23a in the applicant's supplement dated January 11, 2005, which summarized the results of AMR evaluations for the containment vacuum system component groups.

In the LRA, the applicant identified no aging effects for carbon steel components exposed to air, including bolting component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended

operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA and the applicant's supplement dated January 11, 2005, the applicant identified no aging effects for stainless steel components exposed to an indoors air environment and are not intermittently wetted, including pipe, valves, pumps, and vacuum ejector component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.24 Control Building Ventilation - Aging Management Evaluation - Table 3.3.2-24

The staff reviewed LRA Table 3.3.2-24, which summarized the results of AMR evaluations for the control building ventilation system component groups.

In the LRA, the applicant proposed to manage loss of material of stainless steel and carbon steel chiller reservoirs, filter/strainer housing, pipe, valves, pumps (control building HVAC chiller oil pump), chiller oil coolers (shell), chiller oil coolers (tubes),and chiller oil coolers (tubesheet) component types exposed internally or externally to oil using MPS AMP B2.1.25, "Work Control Process." The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified.

The staff finds the work control process program acceptable for managing the aging effect of loss of material. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER.

In the LRA, the applicant proposed to manage loss of material of stainless steel expansion joints, flow elements, moisture indicators, tubing, and valve component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

In the LRA, the applicant identified no aging effects for carbon steel and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including air storage tanks, control building air handling units (housing), control room emergency ventilation filter bank housings, damper housings, duct flow restrictors, ductwork, fan blower housing, filter/strainer housing, heater housing, humidifiers, pipe, tubing, and valves component types.

The applicant stated in the LRA that surfaces of carbon and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for cast iron and copper alloy components exposed internally or externally to gas for economizers, evaporator (shell), evaporator (tubesheet), evaporator (tubes), and compressor component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

3.3B.2.3.25 CRDM Ventilation and Cooling - Aging Management Evaluation - Table 3.3.2-25

The staff reviewed LRA Table 3.3.2-25, which summarized the results of AMR evaluations for the CRDM ventilation and cooling system component groups.

All line items in this system are consistent with the GALL Report.

3.3B.2.3.26 Emergency Generator Enclosure Ventilation - Aging Management Evaluation - Table 3.3.2-26

The staff reviewed LRA Table 3.3.2-26, which summarized the results of AMR evaluations for the emergency generator enclosure ventilation system component groups. In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings, ductwork, and fan blower housing component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.27 ESF Building Ventilation - Aging Management Evaluation - Table 3.3.2-27

The staff reviewed LRA Table 3.3.2-27, which summarized the results of AMR evaluations for the ESF building ventilation system component groups.

In the LRA Table 3.3.2-27 the applicant credits MPS AMP B.2.1.25, "Work Control Process," to manage loss of material of carbon steel condensers (shell) and copper alloy condenser (tubes) exposed internally and externally to gas, respectively (Note G). However, also in LRA Table 3.3.2-27, the staff identified several other carbon steel and copper alloy component types that have no aging effect in the same environment (Note G). During the audit and review, the staff asked the applicant to justify the difference in aging effects and AMPs between the two material, environment, aging effect, and AMP combinations.

In the applicant's response, dated January 11, 2005, the applicant stated that it was conservatively assumed that a small amount of moisture may be present in the refrigerant gas environment. This moisture could condense in the condenser shell-side due to exposure to cooling water (cold seawater) on the tube-side of the condenser. Therefore, the loss of material aging effect was applied to the condenser shell and tubes exposed to a gas environment. Other carbon steel and copper alloy components are not exposed to potential condensation and, therefore, would not experience the same aging effect.

In LRA Table 3.3.2-27, the applicant credits MPS AMP B.2.1.25, "Work Control Process," to manage loss of material of copper alloy condensers (tubes) exposed externally to gas (Note A). This AMR line item references the GALL Report Item VII.F.2.2-a, which is an environment of warm, moist air. The staff asked the applicant to clarify the environment, aging effect, and aging management program combination.

In its response, dated January 11, 2005, the applicant stated that the potential for moisture in the refrigerant gas was incorrectly compared to the warm, moist air environment described in GALL Report Item VII.F2.2-a. No matching item from the GALL Report should have been listed in LRA Table 3.3.2-27 for this item and Note G should have been listed instead of Note A. On the basis of its review, the staff finds the applicant's response acceptable.

3.3B.2.3.28 Fuel Building Ventilation - Aging Management Evaluation - Table 3.3.2-28

The staff reviewed LRA Table 3.3.2-28, which summarized the results of AMR evaluations for the fuel building ventilation system component groups.

In the LRA, the applicant identified no aging effects for carbon steel, copper alloys and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including damper housing, ductwork, fan blower housing, fuel building filter bank housing, heating coils (fuel building), pipe, silencers, tubing, and valve component types.

The applicant stated in the LRA that surfaces of carbon steel, copper alloys and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the Unit 3 operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment

3.3B.2.3.29 Hydrogen Recombiner and Hydrogen Recombiner Building HVAC - Aging Management Evaluation - Table 3.3.2-29

The staff reviewed LRA Table 3.3.2-29, which summarized the results of AMR evaluations for the hydrogen recombiner and hydrogen recombiner building HVAC system component groups.

In the LRA, the applicant identified no aging effects for carbon steel and stainless steel HVAC components exposed internally or externally to air that is not intermittently wetted, including airblast heat exchangers, damper housing, ductwork, fan/blower housing, pipe, flow elements, radiant heaters, reaction chamber, tubing, and valve component types.

The applicant stated in the LRA that surfaces of carbon and stainless steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the Unit 3 operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.30 Main Steam Valve Building Ventilation - Aging Management Evaluation - Table 3.3.2-30

The staff reviewed LRA Table 3.3.2-30, which summarized the results of AMR evaluations for the main steam valve building ventilation system component groups.

In the LRA, the applicant identified no aging effects for carbon steel and copper alloy HVAC components exposed internally or externally to air that is not intermittently wetted, including damper housing, ductwork, fan/blower housing, and heating coils (main steam valve building) component types.

The applicant stated in the LRA that surfaces of carbon steel and copper alloy components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the Unit 3 operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.31 Service Building Ventilation and Air-Conditioning - Aging Management Evaluation - Table 3.3.2-31

The staff reviewed LRA Table 3.3.2-31, which summarized the results of AMR evaluations for the service building ventilation and air-conditioning system component groups. In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally or externally to air that is not intermittently wetted, including damper housing, and ductwork component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the Unit 3 operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.32 SBO Diesel Generator Building Ventilation - Aging Management Evaluation - Table 3.3.2-32

The staff reviewed LRA Table 3.3.2-32, which summarized the results of AMR evaluations for the SBO diesel generator building ventilation system component groups. In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally or externally to air that is not intermittently wetted, including air conditioning units; self contained housing component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.33 Supplementary Leak Collection and Release - Aging Management Evaluation - Table 3.3.2-33

The staff reviewed LRA Table 3.3.2-33, which summarized the results of AMR evaluations for the supplementary leak collection-and-release system component groups.

In the LRA, the applicant identified no aging effects for carbon and stainless steel components exposed to air, including damper housings, ductwork, fan/blower housings, flow elements, pipe, pipe (stack), filter bank housings, tubing, valves, valves (stack) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended

operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concludes that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for carbon and stainless steel components exposed internally to air, including damper housings, ductwork, fan/blower housings, flow elements, pipe, pipe (stack), filter bank housings, tubing, valves, valves (stack) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The internal environment is dry air. Significant amounts of corrosion of carbon steel require an electrolytic environment, and a simultaneous presence of oxygen and moisture. Significant corrosion of carbon steel in air environment also requires the components to be subject to condensation. Without the presence of the aggressive environment, therefore, carbon steel components will experience insignificant amounts of corrosion, and no aging effects would be applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.34 Turbine Building Area Ventilation - Aging Management Evaluation - Table 3.3.2-34

The staff reviewed LRA Table 3.3.2-34, which summarized the results of AMR evaluations for the turbine building area ventilation system component groups. In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the Unit 3 operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the

basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.35 Waste Disposal Building Ventilation - Aging Management Evaluation - Table 3.3.2-35

The staff reviewed LRA Table 3.3.2-35, which summarized the results of AMR evaluations for the waste disposal building ventilation system component groups. In the LRA, the applicant identified no aging effects for carbon steel HVAC components exposed internally and externally to air that is not intermittently wetted, including damper housings, and ductwork component types.

The applicant stated in the LRA that surfaces of carbon steel components located within structures have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation. The applicant interprets the GALL Report environment termed "warm, moist air" to be air with an undefined relative humidity level, and not a wetted environment. Since the AMR approach considers loss of material only in a moisture-laden air and/or intermittently wetted environment, the GALL Report items were determined to be not applicable.

The staff reviewed the Unit 3 operating experience as a confirmation of the validity of the AMR approach for corrosion in an air environment. The operating experience reviews did not find significant corrosion of ventilation system components (other than cooling coils and associated components) due to the air environment. The staff finds that, based on the absence of significant corrosion, "moist air" alone does not result in corrosion for these components. On the basis of its review, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.36 Unit 2 Fire Protection - Aging Management Evaluation - Table 3.3.2-36

The staff reviewed LRA Table 3.3.2-36, which summarized the results of AMR evaluations for the Unit 2 fire protection system component groups.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, copper alloy, and PVC components exposed to air, including flame arrestors, flex connections, flow indicators, flow orifices, nozzles, pipe, pumps, retard chambers, sprinkler heads, strainers, tubing, valves, and water motor gongs component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel and copper alloy are not susceptible to significant general corrosion that would affect the intended function of components. PVC is impervious to an air environment. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel drip pans and tubing component types exposed externally to a moisture-laden air and/or intermittently wetted environment using AMP B2.1.13, "General Condition Monitoring Program," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe, tubing, and valve component types exposed to a borated water leakage external environment using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. However, the GALL Report specifies GALL AMP XI.M10, "Boric Acid Corrosion," to manage this aging effect. The applicant stated in Note 1 that the boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components.

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. Also, visual inspection of external surfaces is performed during various walkdowns by plant personnel to look for boron buildup and/or boric acid leaks. On the basis of its review, the staff finds that this program is acceptable for managing loss of material of copper alloy pipe, tubing, and valve component types exposed to a borated water leakage external environment.

In the LRA, the applicant identified no aging effects for carbon and stainless steel, PVC, and copper alloy components exposed internally to an environment of air or gas, including flex connections, flow orifices, nozzles, pipe, sprinkler heads, tubing, valves, and water motor gongs component types. Gas is not identified in the GALL Report as an environment for these components and materials. However, the staff identified a discrepancy between Unit 2 fire protection system sprinkler heads and Unit 3 fire protection sprinkler heads in that the sprinkler heads in Unit 3 were in a moist air environment and had an aging effect of loss of materials. In its LRA supplement dated July 7, 2004, the applicant stated that the Unit 2 fire protection system, as presented in LRA Table 3.3.2-36, Note 2 (subject to moisture-laden air and/or intermittently wetted environment), should be included with the copper alloy "sprinkler head" component group exposed internally to an air environment for the Unit 2 fire protection system. The aging effect of "loss of material" should be added to this component group. The fire protection program will manage these aging effects. Based on the addition of this aging effect, the staff finds the applicant's response to be acceptable.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal components in a gas environment.

The applicant, in the LRA, proposed to manage loss of material of copper alloy pipe, tubing, and valve component types exposed externally to a moisture-laden air and/or intermittently wetted environment using AMP B2.1.10, "Fire Protection Program," which is consistent with GALL AMP XI.M26, "Fire Protection," and GALL AMP XI.M27, "Fire Water System." The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. On the basis of its review, the staff finds that the fire protection program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces to detect any sign of aging degradation during maintenance activities.

In the LRA, the applicant proposed to manage loss of material of stainless steel flex connections component type exposed internally to an environment of oil using AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants that are an indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

3.3B.2.3.37 Unit 3 Fire Protection - Aging Management Evaluation - Table 3.3.2-37

The staff reviewed LRA Table 3.3.2-37, which summarized the results of AMR evaluations for the Unit 3 fire protection system component groups.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, copper alloy, and PVC components exposed to air, including carbon dioxide (CO_2) tank cooling coils, coolant heat exchangers, flex hoses, flex connections, flow switches, instrument snubbers, nozzles, restricting orifices, sprinkler heads, tubing, valves, flow indicators, housing, diesel fuel storage tank, ductwork, exhaust silencer, expansion tank overflow container, reactor coolant pump oil collection tanks, flame arrestors, heater unit, hydropneumatic tank, lube oil cooler, odorizer, oil mist recovery unit, oil reservoir, pipe, pumps, vacuum limiter, and water manifold component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel and copper alloy are not susceptible to significant general corrosion that would affect the intended function of components. PVC is impervious to an air environment. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

However, LRA Table 3.3.2-37, Auxiliary Systems - Unit 3 Fire Protection, for external surfaces of copper alloy valves in an environment of air, did not include the aging effect of loss of material as in Unit 2 Table 3.3.2-36, Auxiliary Systems - Unit 2 Fire Protection. In LRA supplement dated

July 7, 2004, the applicant stated that for the Unit 3 fire protection system, as presented in Unit 2 Table 3.3.2-36, Note 2 (subject to moisture-laden air and/or intermittently wetted environment), should be included with the copper alloy "valves" component group exposed internally to an air environment for Unit 2 LRA, Table 3.3.2-36, Auxiliary Systems - Unit 3 Fire Protection. The aging effect of "loss of material" will be added to this component group. The applicant stated that fire protection program will manage this aging effect. Based on the addition of this aging effect, the staff finds the applicant's response to be acceptable.

In the LRA, the applicant proposed to manage loss of material of copper alloy filter/strainer component type exposed externally to a moisture-laden air and/or intermittently wetted environment using AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for carbon and stainless steel, PVC, and copper alloy components exposed internally to an environment of air or gas for CO_2 storage tank, CO_2 tank cooling coils, damper housing, fan/blower housing, ductwork flex hoses and connections, nozzles, odorizers, restricting orifices, tubing, and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in a gas environment.

In the LRA, the applicant proposed to manage loss of material of copper alloy sprinkler heads exposed externally to a moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.10, "Fire Protection Program," which is consistent with GALL AMP XI.M26, "Fire Protection," and GALL AMP XI.M27, "Fire Water System." The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The staff finds that the fire protection program is acceptable for managing loss of material since visual inspections will be performed on internal surfaces to detect any sign of aging degradation during maintenance activities.

In the LRA, the applicant proposed to manage loss of material of stainless steel tubing component type exposed internally to an environment of oil using AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants that are an indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material of copper alloy and stainless steel tubing and restricting orifices component types exposed internally to oil (fuel oil) using AMP

B2.1.12, "Fuel Oil Chemistry." The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program is consistent with GALL AMP XI.M30, "Fuel Oil Chemistry," with acceptable exceptions. On the basis of its review, the staff finds the program acceptable for managing the aging effects of loss of material. The effectiveness of the fuel oil chemistry program is verified by MPS AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

During the audit and review, the staff questioned why various portions of the fire protection system were not included within the scope of license renewal and subject to an AMR. In its LRA supplement dated July 7, 2004, the applicant added several components to the fire protection system that are subject to an AMR. The addition of these components did not result in the addition of material/environment combinations or AMPs for the fire protection system AMR. The staff finds this material/environment/aging effect/AMP combination to be acceptable. The staff's evaluation of the scope of the fire protection system is documented in Section 2.3B.3.39 of this SER.

3.3B.2.3.38 Domestic Water - Aging Management Evaluation - Table 3.3.2-38

The staff reviewed LRA Table 3.3.2-38, which summarized the results of AMR evaluations for the domestic water system component groups.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe, shock absorbers, strainers, and valve component types exposed externally to a moisture-laden air and/or intermittently wetted environment using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for carbon steel heater component type exposed to air. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe and valves exposed externally to an environment of borated water leakage using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. However, the GALL Report specifies GALL AMP XI.M10, "Boric Acid Corrosion" to manage this aging effect. The applicant stated, in Note 1, that the boric acid corrosion program includes specific inspections of reactor coolant pressure boundary and supporting systems components. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program provides inspections for management of loss of material due to boric acid corrosion beyond the scope of the boric acid corrosion program. Also, a visual inspection of external surfaces is performed during various walkdowns performed by plant personnel to look for boron buildup and/or boric acid leaks. On the basis of its review, the staff finds that this program is acceptable for managing loss of material of copper alloy pipe and valves exposed to externally to an environment of borated water.

3.3B.2.3.39 Emergency Diesel Generators - Aging Management Evaluation - Table 3.3.2-39

The staff reviewed LRA Table 3.3.2-39, which summarized the results of AMR evaluations for the emergency diesel generators system component groups. The staff reviewed the technical report for the AMR results for the diesel generator and support systems.

In the LRA, the applicant proposed to manage loss of material of stainless steel, carbon steel, cast iron, and copper alloy engine sumps, filter/strainers, governor lube oil coolers (shell), jacket water heaters, lube oil heat exchangers (shell), oil reservoirs, oil separators, pipe, pre-lube oil heaters, pumps, valves, turbochargers, governor lube oil coolers (tubes), lube oil heat exchangers (tubes), lube oil heat exchangers (tubesheet), and tubing component types exposed internally or externally to oil using MPS AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material due to selective leaching of copper alloy diesel engine jacket water cooler heat exchangers (tubes), and engine air cooler water heat exchangers (tubes) component types exposed to treated water using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material due to selective leaching since other mechanical means will be used in addition to visual inspection to detect selective leaching.

In the LRA, the applicant proposed to manage loss of material of stainless steel pipe component types exposed externally to an atmosphere/weather environment using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its review is documented in Section 3.0.3.3.2 of this SER. The staff finds that visual inspections will be performed on external surfaces to detect any sign of aging degradation. The staff finds the general condition monitoring program acceptable for managing loss of material due to pitting and crevice corrosion.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, copper alloy and aluminum components exposed internally and externally to air, including air distributors, air receiver tanks, air tanks, crankcase vacuum manometers, diesel engine jacket water cooler heat exchangers (shell), engine air cooler water heat exchangers (shell), engine sumps, filter/strainers, fresh water expansion tanks, governor lube oil coolers (shell), jacket water heaters, lube oil heat exchangers (channel), lube oil heat exchangers (shell), oil reservoirs, oil separators, pipe, pre-lube oil heaters, pumps, servo fuel rack shutdown and starting boosters, silencers, valves, turbochargers, level indicators, tubing, diesel engine jacket water cooler heat exchangers (channel), and engine air cooler water heat exchangers (channel, expansion joints, and restricting orifices component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel, copper alloy, and aluminum are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.40 Emergency Diesel Generator Fuel Oil - Aging Management Evaluation - Table 3.3.2-40

The staff reviewed LRA Table 3.3.2-40, which summarized the results of AMR evaluations for the emergency diesel generator fuel oil system component groups. The staff reviewed the technical report for the AMR results for the diesel generator and support systems.

In the LRA, the applicant proposed to manage loss of material of copper alloy, and stainless steel pumps, tubing, valves, flow elements, restricting orifices, and filter/strainers component types exposed internally to fuel oil using MPS AMP B2.1.12, "Fuel Oil Chemistry." The applicant stated in LRA Section 3.3.2.2.7 that MPS AMP B2.1.25, "Work Control Process," will be used to provide confirmation of the effectiveness of the fuel oil chemistry program.

The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2) establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment in license renewal scope. On the basis of its review, the staff finds the fuel oil chemistry program acceptable for managing this aging effect.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for confirming the effectiveness of the fuel oil chemistry program.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, copper alloy and aluminum components exposed internally and externally to air, including flame arrestors, flow elements, accumulator tanks, fuel oil day tanks, fuel oil storage tank, injectors, pipe, pumps, valves, restricting orifices, filter/strainers, and tubing component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel, copper alloy, and aluminum are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.41 Station Blackout Diesel Generator - Aging Management Evaluation - Table 3.3.2-41

The staff reviewed LRA Table 3.3.2-41, which summarized the results of AMR evaluations for the SBO diesel generator system component groups. The staff reviewed the technical report for the AMR results for the diesel generator and support systems.

In the LRA, the applicant proposed to manage cracking of stainless steel expansion tanks, pipe, tubing, and valve component groups exposed internally to treated water using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program is its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of cracking.

In the LRA, the applicant proposed to manage loss of material of stainless steel, carbon steel, and cast iron flow indicators, lube oil coolers (channel), oil sumps, pipe, silencers, pumps, turbo chargers, lube oil coolers (tubes), lube oil coolers (tubesheet), lubricators, restricting orifices, tubing, and valve component types exposed internally or externally to oil using MPS AMP

B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material of stainless steel fuel heaters, tubing, and valve component types exposed internally to fuel oil using MPS AMP B2.1.12, "Fuel Oil Chemistry." The applicant stated, in LRA Section 3.3.2.2.7, that MPS AMP B2.1.25, "Work Control Process" will be used to provide confirmation of the effectiveness of the fuel oil chemistry program. The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2) establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment within the scope of license renewal. On the basis of its review, the staff finds the fuel oil chemistry program acceptable for managing this aging effect.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for confirming the effectiveness of the fuel oil chemistry program.

In the LRA, the applicant proposed to manage loss of material of stainless steel expansion tanks, and valve component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspections will be performed on external surfaces to detect any sign of aging degradation.

In the LRA, the applicant proposed to manage loss of material of stainless steel valve component groups exposed internally to moisture-laden air and/or an intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to pitting and crevice corrosion since visual inspection will be performed on internal surfaces of components to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for carbon steel, stainless steel, cast iron, and aluminum components exposed internally and externally to air, including filter/strainers, radiators, aftercoolers, aspirators, flow Indicators, fuel heaters, fuel oil day tanks, immersion heaters, injectors, lube oil coolers (channel), lube oil coolers (shell), oil sumps, pipe, silencers, pump, turbochargers, air receivers, expansion joints, lubricators, pulsation dampeners, restricting orifices, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel, and aluminum are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff concurs that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for rubber expansion joints exposed to air. Based on industry research and operating experience, change of material properties due to thermal exposure and irradiation and cracking due to irradiation of rubber components in air is contingent on radiation levels, ambient temperatures, and exposure to ultraviolet radiation and ozone.

On the basis of its review, the staff concurs with the applicant's finding that no aging effect for rubber expansion joints in air to be acceptable, since these components are not expected to be exposed to high levels of ultraviolet radiation, ozone, or temperatures greater than 95 °F.

In the LRA, the applicant identified no aging effect for aluminum filter/strainers component group exposed internally to lubricating oil. The technical report for AMR results for the diesel generator and support systems did not specifically evaluate aging effects for aluminum exposed internally to oil. During the audit and review, the staff requested that the applicant provide a basis for its conclusion that there are no aging effects requiring management for this combination of component, material, and environment. The applicant stated that the MAER was used as the basis. The staff reviewed the applicant's MAER and finds that additional information regarding the basis was necessary. The applicant revised its MAER and the technical report to include the basis. The staff reviewed the basis and finds it acceptable. In addition, the applicant stated that, in a lubricating oil environment, significant corrosion is only expected where the water can settle or pool. Due to the differential densities of lubricating oil and water, water will tend to separate and settle in low flow or stagnant areas where the flow velocity is insufficient to flush the water through the system. Lube oil systems are assumed to be free of water contamination as their initial condition. Lube oil systems are typically closed systems that have little potential for ingress of contaminants unless a component failure occurs. License renewal does not assume component failures as a means to establish the conditions necessary for aging to occur. For example, tube failures in lube oil coolers are not assumed. Therefore, water contamination of lube oil is event driven, and would be addressed by corrective maintenance. For license renewal purposes, lube oil is therefore assumed to be free of water contamination. On the basis of its review, the staff concurs that there are no applicable aging effects requiring management for aluminum in a fuel oil environment.

In the LRA, the applicant identified no aging effects for aluminum radiators component group in an external environment of atmosphere/weather. The technical report for AMR results for the diesel generator and support systems did not specifically evaluate aging effects for aluminum in an external environment of atmosphere/weather. During the audit and review, the staff requested that the applicant provide a basis for its conclusion that there are no aging effects requiring management for this combination of component, material, and environment. During the audit, the applicant stated that the technical report was revised to add the following statement:

> Industry experience identified a potential conflict with the MAER with regard to Aluminum in an air environment. St. Lucie identified corrosion problems with the aluminum and copper components associated with the cooling fins of a radiator in a cooling water system. The St. Lucie evaluation identified that it was an unusual occurrence since aluminum elsewhere in the plant did not demonstrate similar problems. Accordingly, and in conjunction with the MAER basis, operating experience was used to validate that no problems of this type had occurred.

The staff reviewed the revised technical report and operating experience. On the basis of its review, the staff finds that there are no applicable aging effects requiring management for aluminum in an atmosphere/weather environment.

3.3B.2.3.42 Security - Aging Management Evaluation - Table 3.3.2-42

The staff reviewed LRA Table 3.3.2-42, which summarized the results of AMR evaluations for the security system component groups. The staff reviewed the technical report for AMR results for the diesel generator and support systems.

In the LRA, the applicant proposed to manage loss of material of carbon steel, cast iron, and copper alloy coolers (shell), fan/blower housings, heaters, oil pans, pipe, pump, valves, filter\strainers, coolers (tubes), and coolers (tubesheet) component types exposed internally or externally to lubricating oil using MPS AMP B2.1.25, "Work Control Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of loss of material.

In the LRA, the applicant proposed to manage loss of material of copper alloy pipe, tubing, and valve component types exposed internally to fuel oil using MPS AMP B2.1.12, "Fuel Oil Chemistry." The applicant stated in LRA Section 3.3.2.2.7 that MPS AMP B2.1.25, "Work Control Process," will be used to provide confirmation of the effectiveness of the fuel oil chemistry program. The staff reviewed the fuel oil chemistry program and its evaluation is documented in Section 3.0.3.2.9 of this SER. The fuel oil chemistry program (1) monitors and controls fuel oil quality to ensure that it is compatible with the materials of construction and to manage the conditions that cause general corrosion, pitting, and MIC of fuel tank internal surfaces; (2)

establishes fuel oil quality limits; and (3) samples and tests fuel oil used for equipment within the scope of license renewal. The staff finds the fuel oil chemistry program acceptable.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds the work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. It also provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff concludes that the work control process program is acceptable for confirming the effectiveness of the fuel oil chemistry program.

In the LRA, the applicant identified no aging effects for carbon steel, cast iron, and copper alloy components exposed internally and externally to air, including coolers (channel head), coolers (shell), diesel fuel oil storage tank, fan/blower housings, filter/strainers, heaters, oil pans, pipe, pumps, valves, filter/strainers, tubing, and radiators component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and cast iron requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel and cast iron components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Copper alloys are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for aluminum radiators component type in an external environment of air. The technical report for AMR results for the diesel generator and support systems did not specifically evaluate aging effects for aluminum in an external environment of air. During the audit and review, the staff requested that the applicant provide a basis for its conclusion that there are no aging effects requiring management for this combination of component, material, and environment. The applicant stated to the staff that the technical report was revised to add the following statement:

> Industry experience identified a potential conflict with the MAER with regard to Aluminum in an air environment. St. Lucie identified corrosion problems with the aluminum and copper components associated with the cooling fins of a radiator in a cooling water system. The St. Lucie evaluation identified that it was an unusual occurrence since aluminum elsewhere in the plant did not demonstrate similar problems. Accordingly, and in conjunction with the MAER basis, operating experience was used to validate that no problems of this type had occurred.

The staff reviewed the revised technical report and operating experience. On the basis of its review, the staff finds that there are no applicable aging effects requiring management for aluminum in an air environment.

3.3B.2.3.43 Boron Recovery - Aging Management Evaluation - Table 3.3.2-43 and Table 3.3.2-43a

The staff reviewed Table 3.3.2-43 of the LRA and Table 3.3.2-43a in the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the boron recovery system component groups.

In the LRA and the applicant's letter, dated January 11, 2005, the applicant identified no aging effects for low-alloy steel and stainless steel components exposed to air, including boron recovery tanks, cesium removal ion exchangers, filters/strainers, pipe, tubing, valves, boron distillate cooler (shell), boron distillate tank, boron evaporator, boron evaporator bottoms coolant preheater, boron evaporator bottons cooler (shell), boron evaporator condenser (channel head), boron evaporator condenser (shell), boron evaporator reboiler (channel head), boron evaporator reboiler (shell), boron evaporator sample cooler (shell), density element, flow indicating switch, flow indicating transmitter, flow transmitters, pumps and traps component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In LRA Table 3.4.2-43, the applicant proposed to manage loss of material for the stainless steel boron recovery tanks exposed internally to air environment using MPS AMP B2.1.24, "Tank Inspection Program." The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. On the basis of its review, the staff finds management of loss of material for this component using the tank inspection program to be adequate.

In the applicant's letter, dated January 11, 2005, the applicant proposed to manage loss of material for the boron distillate cooler (shell) and the boron evaporator exposed externally to air environment using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The chemistry control for primary systems program is consistent with the GALL Report, with an acceptable exception. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. On the basis of its review, the staff finds the chemistry control for primary systems program to be acceptable for managing this aging effect.

In the applicant's letter dated January 11, 2005, the applicant proposed to manage cracking of carbon steel for density element, flow transmitters, pumps and restricting orifices component types exposed externally to treated water environment using MPS AMP B2.1.25, "Work Control

Process." The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program provides the opportunity for personnel to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. Oil samples are analyzed periodically for contaminants for indication of degradation. The work control process program provides input to the corrective action program if aging effects are identified. The staff finds the work control process program acceptable for managing the aging effect of cracking.

3.3B.2.3.44 Radioactive Liquid Waste Processing - Aging Management Evaluation - Table 3.3.2-44 and Table 3.3.2-44a

The staff reviewed Table 3.3.2-44 of the LRA and Table 3.3.2-44a in the applicant's letter, dated January 11, 2005, which summarized the results of AMR evaluations for the radioactive liquid waste processing system component groups.

In the LRA and applicant's supplement dated January 11, 2005, the applicant identified no aging effects for low-alloy and stainless steel components exposed to air, including flow elements, piping, valves, pumps, radiation detectors, and tubing component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.3B.2.3.45 Radioactive Gaseous Waste - Aging Management Evaluation - Table 3.3.2-45 and Table 3.3.2-45a

The staff reviewed Table 3.3.2-45 of the LRA and Table 3.3.2-45a in the applicant's supplement, dated January 11, 2005, which summarized the results of AMR evaluations for the radioactive gaseous waste system component groups.

In the LRA, the applicant identified no aging effects for carbon steel and stainless steel components exposed to air, including damper housings, ductwork, pipe, process vent cooler, valves, degasifier condenser (shell), degasifers feed preheater (shell), degasifers, and tubing component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture.

Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of carbon steel and stainless steel pipe and valve component groups exposed internally to moisture-laden air and/or an intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material due to general corrosion.

In the applicant's letter dated January 11, 2005, the applicant proposed to manage loss of material of stainless steel for the degasifers and tubing exposed internally to treated water and steam environment using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The chemistry control for primary systems program is consistent with the GALL Report, with an acceptable exception. The exception relates to use of a later, non-NRC-approved revision of the EPRI guidelines. On the basis of its review, the staff finds the chemistry control for primary systems program to be acceptable for managing this aging effect.

3.3B.2.3.46 Post-Accident Sampling - Aging Management Evaluation - Table 3.3.2-46

The staff reviewed LRA Table 3.3.2-46, which summarized the results of AMR evaluations for the post-accident sampling system component groups.

In the LRA, the applicant identified no aging effects for stainless steel components exposed internally and/or externally to gas or air for accumulators, de-ionized water flush tank, drain tanks, filter/strainers, flow elements, hoses, hydrogen sensors, pipe, pumps, sample coolers shell, sample cylinders/chambers tubing and valve component types. Gas is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff concludes that there are no applicable aging effects requiring management for metal in a gas environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel de-ionized water flush tank, drain tanks, hydrogen sensors, pipe, vacuum pump, sample cylinders/chambers, tubing, and valve component groups exposed internally to a moisture-laden air and/or an intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. The staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

During the audit and review, the staff determined that additional components/structures were added to the scope of license renewal and subject to an AMR. By letter dated July 7, 2004, the applicant submitted additional information, entitled, "Millstone Power Station Units 2 and 3 Additional Information in Support of Application for renewed Operation Licenses." The applicant added, in Attachment 1 to its letter, the component type "hydrogen tanks" and "restricting orifices" to the LRA post-accident sampling system screening results and AMR, LRA Table 2.3.3.46 and Table 3.3.2-46, respectively. The applicant stated that the addition of these components did not result in the addition of material/environment/aging effect/program combinations for the LRA post-accident sampling system. The staff reviewed the applicant's response. On the basis of its review, the staff finds the additional AMR results in LRA Table 3.3.2-46 for the hydrogen tanks and restricting orifices component types acceptable.

3.3B.2.3.47 Radioactive Solid Waste - Aging Management Evaluation - Table 3.3.2-47

The staff reviewed LRA Table 3.3.2-47, which summarized the results of AMR evaluations for the radioactive solid waste system component groups. In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including pipe, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

3.3B.2.3.48 Reactor Plant Aerated Drains - Aging Management Evaluation - Table 3.3.2-48 and Table 3.3.2-48a

The staff reviewed Table 3.3.2-48 of the LRA and Table 3.3.2-48a in the applicant's letter dated January 11, 2005, which summarized the results of AMR evaluations for the reactor plant aerated drains system component groups.

In the LRA, the applicant identified no aging effects for carbon and stainless steel, PVC, fiberglass, copper alloys, and ethylene propylene diene monomer components exposed to air, including expansion joints, filters/strainers, flow elements, flow indicators, groundwater sumps, pipe, pumps, restricting orifices, tubing, and valve component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The internal environment is air without the presence of moisture. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of carbon steel and copper alloys requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel copper alloy components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. PVC, fiberglass and EPDM are impervious to an air environment. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage loss of material of stainless steel pipe and valve component types exposed to atmosphere/weather using MPS AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. Visual inspections will be performed on external surfaces to detect any sign of aging degradation. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing loss of material due to pitting and crevice corrosion.

In the LRA, the applicant proposed to manage loss of material of stainless steel expansion joint, groundwater sump, and pipe component groups exposed internally to a moisture-laden air and/or an intermittently wetted environment using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

In the LRA, the applicant identified no aging effects for PVC and fiberglass pipe, and tubing components exposed internally and externally to raw water and seawater. Both PVC and fiberglass material are benign in this environment.

On the basis of its review of current industry research and operating experience, the staff finds that a raw/sea water environment does not have significant aging effect on materials like PVC and fiberglass. Therefore, the staff did not identify any concerns with the applicant's conclusions that there are no applicable aging effects requiring management for PVC and fiberglass in raw/sea water environment.

In the applicant's letter dated January 11, 2005, the applicant proposed to manage loss of material of the stainless steel for the groundwater underdrains storage tank exposed to atmosphere/weather environment using MPS AMP B2.1.24, "Tank Inspection Program." The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. On the basis of its review, the staff finds management of loss of material for this component using the tank inspection program to be adequate.

3.3B.2.3.49 Reactor Plant Gaseous Drains - Aging Management Evaluation - Table 3.3.2-49 and Table 3.3.2-49a

The staff reviewed Table 3.3.2-49 of the LRA and Table 3.3.2-49a in the applicant's supplement, dated January 11, 2005, which summarized the results of AMR evaluations for the reactor plant gaseous drains system component groups.

In the LRA and the January 11, 2005, supplement, the applicant identified no aging effects for stainless steel components exposed to air, including flow indicators, pipe, pump, tubing, valves, containment drains transfer tank, and primary drains transfer tank component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Wrought austenitic stainless steel is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

In the LRA, the applicant proposed to manage cracking of stainless steel flow indicators, pipe, pump, tubing, and valves exposed internally to treated water using MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. However, the applicant identified Note E for these components and references Table 3.3.1, Item 3.3.1-15. The staff noted that Item 3.3.1-15 applies to loss of material aging effect and not cracking. The staff requested clarification for this reference. In response Audit Item 146 dated July 7, 2004, the applicant stated, that LRA Table 3.3.2-49 should not include entries in the 'NUREG-1801 Volume 2 Item' and 'Table 1 Item' columns for all line entries associated with the 'Cracking' aging effect. The Note for each 'Cracking' line entry should be "H." On the basis of its review, the staff finds the applicant's response acceptable.

Also, in the its January 11, 2005, letter, the applicant proposed to manage cracking of stainless steel containment drains transfer tank and the primary drains transfer tank exposed to internally to the environment of treated water using MPS AMP B2.1.25, "Work Control Process."

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. Visual inspections of the internal surfaces of plant components and plant commodities are performed during the performance of maintenance, in accordance with the work control process program, to determine the presence of loss of material. On the basis of its review, the staff finds that the work control process program is acceptable for managing loss of material due to general corrosion since visual inspections will be performed on internal surfaces of components to detect any sign of aging degradation.

3.3B.2.3.50 Sanitary Water - Aging Management Evaluation - Table 3.3.2-50

The staff reviewed LRA Table 3.3.2-50, which summarized the results of AMR evaluations for the sanitary water system component groups. In the LRA, the applicant identified no aging effects for cast iron and carbon steel components exposed to air, including pipe, and valves component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoors, or in an air-conditioned enclosure or room). Significant corrosion of cast iron and carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, cast iron and carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no applicable aging effects requiring management for metal in an air environment.

All other AMRs assigned to the staff in LRA Tables 3.3.2-1 through 3.3.2-50 were evaluated. The staff finds them to be acceptable.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, AERM, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3B.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the auxiliary systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).

3.4 Aging Management of Steam and Power Conversion System

3.4A Unit 2 Aging Management of Steam and Power Conversion System

This section of the SER documents the staff's review of the applicant's AMR results for the Unit 2 steam and power conversion components and component groups associated with the following systems:

- main steam system
- extraction steam system
- feedwater system
- condensate system
- condensate storage and transfer system
- condensate demin mixed bed system
- auxiliary feedwater system
- feedwater heater vents and drains system

- moisture separation and reheat system
- plant heating and condensate recovery system
- secondary chemical feed system
- turbine gland sealing system
- electro hydraulic control system
- turbine lube oil system
- exciter air cooler system
- stator liquid cooler system
- auxiliary steam reboiler and deaerating feedwater system

3.4A.1 Summary of Technical Information in the Application

In LRA Section 3.4, the applicant provided AMR results for steam and power conversion system components and component groups. In LRA Table 3.4.1, "Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for steam and power conversion system," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the steam and power conversion system components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4A.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did determine that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluation are documented in the staff's MPS audit and review report and summarized in Section 3.4A.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff verified that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.4.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.4A.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.4A.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.4A.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the steam and power conversion system components.

Table 3.4A-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4 that are addressed in the GALL Report.

Table 3.4A-1 Staff Evaluation for Steam and Power Conversion System in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping and fittings in main feedwater line, steam line, and auxiliary feedwater (AFW) piping (PWR only) (Item Number 3.4.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3A, Metal Fatigue
Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system) (Item Number 3.4.1-02)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water chemistry and one-time inspection	Chemistry control for secondary systems program (B2.1.6); Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.4A.2.2.2)
AFW piping (Item Number 3.4.1-03)	Loss of material due to general, pitting, and crevice corrosion, MIC and biofouling	Plant-specific		Not applicable (See Section 3.4A.2.2.3)
Oil coolers in AFW system (lubricating oil side possibly contaminated with water) (Item Number 3.4.1-04)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant-specific		Not applicable (See Section 3.4A.2.2.5)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
External surface of carbon steel components (Item Number 3.4.1-05)	Loss of material due to general corrosion	Plant-specific	General condition monitoring (B2.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.4A.2.2.4)
Carbon steel piping and valve bodies (Item Number 3.4.1-06)	Wall-thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	Flow-accelerated corrosion (B2.1.11)	Consistent with GALL, which recommends no further evaluation (See Section 3.4A.2.1)
Carbon steel piping and valve bodies in main steam system (Item Number 3.4.1-07)	Loss of material due to pitting and crevice corrosion	Water chemistry	Chemistry control for secondary systems program (B2.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.4A.2.1)
Closure bolting in high-pressure or high-temperature systems (Item Number 3.4.1-08)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting integrity	Consistent with GALL (See Section 3.4A.2.1.2)
Heat exchangers and coolers/condensers by open-cycle cooling water (Item Number 3.4.1-09)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system		Not applicable. There are no in-scope components in the steam and power conversion systems that are serviced by Open-Cycle Cooling Water System.
Heat exchangers and coolers/condensers by closed-cycle cooling water (Item Number 3.4.1-10)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-cycle cooling water system	Closed-cycle cooling water system (B2.1.7)	Consistent with GALL, which recommends no further evaluation (See Section 3.4A.2.1.3)
External surface of aboveground condensate storage tank (Item Number 3.4.1-11)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Aboveground carbon steel tanks	Tank inspection program (B2.1.24)	Consistent with GALL, which recommends no further evaluation (See Section 3.4A.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
External surface of buried condensate storage tank and AFW piping (Item Number 3.4.1-12)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection		Not applicable (See Section 3.4A.2.2.5)
External surface of carbon steel components (Item Number 3.4.1-13)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3); General condition monitoring (B2.1.13)	Consistent with GALL (See Section 3.4A.2.1.1)

The staff's review of the MPS steam and power conversion system and associated components followed one of several approaches. One approach, documented in Section 3.4A.2.1, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.4A.2.2, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.4A.2.3, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the steam and power conversion system components is documented in Section 3.0.3 of this SER.

3.4A.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Section 3.4.2.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the main steam, main feedwater, and emergency feedwater system components:

- boric acid corrosion program
- chemistry control for secondary systems program
- closed-cycle cooling water system program
- flow-accelerated corrosion program
- general condition monitoring program
- work control process program
- tank inspection program
- bolting integrity program

Staff Evaluation. In Tables 3.4.2-1 through 3.4.2-12 of the LRA, the applicant provided a summary of AMRs for the main feedwater, main steam, auxiliary feedwater, and blowdown system components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.4A.2.1.1 Loss of Material Due to Boric Acid Corrosion

In the discussion section of Table 3.4.1, Item 13, of the LRA, the applicant stated that loss of material due to boric acid corrosion is managed by MPS AMP B2.1.3, "Boric Acid Corrosion" and AMP B2.1.13, "General Condition Monitoring." The boric acid corrosion program includes specific inspections of steam and power conversion and supporting systems components. The boric acid corrosion program and the general condition monitoring program are evaluated in Sections 3.0.3.1 and 3.0.3.2 of this SER respectively.

The LRA identifies a borated water leakage environment for various components in the steam and power conversion and ESF systems and both the boric acid corrosion program and general condition monitoring program are credited with managing loss of material from external surfaces. The boric acid corrosion program described in LRA Section B2.1.3 appears to be limited to components located inside containment, as addressed in NUREG-1801, Section XI.M10. In RAI 3.4-1, the applicant was requested to clarify why the boric acid corrosion program is credited for managing boric acid corrosion in systems that are located outside containment. Also, in regard to the effectiveness of the general condition monitoring program, the applicant was requested to clarify:

i) How the program manages loss of material for components not normally accessible.
ii) The basis of the inspection frequency (once per refueling outage) considering the potential rate for material loss.
iii) What acceptance criteria and corrective actions are applied to the visual indication of boric acid crystals without material degradation.
iv) How the program provides for promptly identifying the specific cause and location of the borated water leakage.

In its response dated November 9, 2004, the applicant provided the following information:

> The Boric Acid Corrosion Program provides requirements to adequately manage boric acid related degradation of the reactor coolant system, ASME Class 1, 2 and 3 components, and associated or neighboring systems, structures, and components that are in the scope of License Renewal. The requirements of the Millstone Boric Acid Corrosion Program surpass the requirements listed in NUREG-1801, Section XI.M10, in that it is additionally applied to an identified boric acid system leak anywhere in the plant. As part of the Aging Management Review process, the Boric Acid Corrosion Program, along with the General Condition Monitoring Program, is credited for managing aging for the external surface of equipment located in a building that contains a boric acid liquid system (such as the Steam and Power Conversion system, the ESF system, and the Radwaste Ventilation system).

The General Condition Monitoring Program and the Boric Acid Corrosion Program are both listed for various components in the steam and power conversion, ESF, and radwaste ventilation systems because collectively they manage the loss of material for the external surfaces of these components. The General Condition Monitoring Program provides supplemental inspections to the Boric Acid Corrosion Program for managing loss of material due to boric acid corrosion in systems that are located outside containment, such as steam and power conversion, ESF, and radwaste ventilation systems. Any instances of boric acid leakage identified during general condition monitoring activities are entered into the corrective action program and evaluated using the guidance of the Boric Acid Corrosion Program.

The effectiveness questions identified are addressed by the Boric Acid Corrosion Program, not the General Condition Monitoring Program, since the Boric Acid Corrosion Program provides the evaluation and corrective actions when any evidence of boric acid leakage is identified. A more detailed answer is as follows:

i) Non-insulated components are examined by inspecting the accessible external surfaces for direct and indirect evidence of leakage. For components whose external surfaces are inaccessible for direct visual examination, the surrounding areas (including equipment surfaces located underneath the components) are examined for signs of leakage and other areas are considered where leakage may be channeled.

The Boric Acid Corrosion Program recognizes that boric acid leaks can travel down sloped piped or under insulation. Evidence of leakage can also be determined for components with vertical surfaces of insulation by examining the lowest elevation where the leakage may be detectable. Horizontal surfaces of insulation can be examined at insulation joints. When there is doubt as to a leak's origin, the evidence (i.e., accumulation of boric acid crystals) needs to be preserved until an evaluation has been performed to estimate the source, pathway, target and amount that may be affected. This includes the removal of insulation to determine the leak location.

For those areas identified as infrequently accessed areas, for the purposes of detecting boric acid leakage, entry into the area is performed often enough (at least once per refueling interval) to credit the inspections in the General Condition Monitoring AMP and the Boric Acid Corrosion AMP. The one exception is the Unit 3 demineralizer cubicles area. However, for this area, a video inspection is performed at least once per ten years to verify the integrity of the equipment. Based on operating experience, there is reasonable assurance that this inspection interval will detect borated water leakage prior to the loss of intended function of the affected equipment.

ii) The Millstone Boric Acid Corrosion Program examines locations susceptible to boric acid leakage inside Containment during each refueling outage. It is not practical to perform these examinations while the reactor plant is operating.

Any boric acid leakage identified by plant personnel is either corrected prior to the end of the outage or is evaluated to ensure the intended function is maintained until a repair can be performed. Dominion is aware of the issues associated with boric acid corrosion, and the plant operating conditions that could be indicative of boric acid leakage. For potential boric acid corrosion leakage, which may develop between refueling cycles, changes in plant parameters would provide indication that a potential leak may exist. Both identified and unidentified leakage is strictly monitored and trended for changes in sump level, flow rates, and frequency of pump operation. Changes in ambient conditions inside containment also provide indication of potential boric acid leakage.

Abnormal ambient conditions inside containment are documented through the corrective action process, which may require a shutdown of the reactor plant in order to repair a leak inside containment. Plant operating experience indicates that boric acid inspections performed once per refueling cycle are adequate to maintain the intended function of the equipment in containment. Plant and industry operating experience indicates that a boric acid leak that starts during the operating cycle does not damage the equipment to the point where it cannot perform its intended function.

iii) In accordance with the Boric Acid Corrosion Program, any boric acid leakage identified by plant personnel (including boric acid crystals without material degradation) is documented through the corrective action process (10 CFR 50, Appendix B). Minor leakage may be just cleaned or, if leakage is more severe, a Boric Acid Corrosion Program assessment of the boric acid build-up is performed prior to clean-up. The leakage source, path, and target areas are located, and corrective actions are implemented as determined by the Boric Acid Corrosion Program. Corrective actions include timely repair of the leakage after detection to prevent or mitigate the extent of boric acid corrosion. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the intended function is maintained consistent with the current licensing basis.

iv) The Boric Acid Corrosion Program provides for prompt identification of the specific cause and location of borated water leakage.

See response in item iii above.

Accessible areas are traversed on a daily basis by plant personnel who have been informed of expectations related to boric acid identification and corrective action. Personnel are expected to attempt to identify the leakage source as well as the extent of condition on secondary plant equipment. The Corrective Action Process triggers an investigation by the Boric Acid Corrosion Program. Minor boric acid may be just cleaned, more substantial leakage requires equipment to be repaired to stop the leak or an engineering evaluation be performed to ensure the intended function of the equipment is maintained until such a time that the leak can be repaired.

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant credits a combination of the general condition monitoring program and the boric acid corrosion program to detect and evaluate borated water leakage and boric acid corrosion to maintain the intended function of the auxiliary system components. For areas outside containment, general equipment (or materials) frequent inspections are performed as often as daily, which would identify any borated water leakage and any required subsequent evaluation. In response to staff's request of RAI 3.3-B-1, the applicant committed to the following clarification to the Unit 2 Appendix A "FSAR Supplement," Section A2.1.3, Boric Acid Corrosion, Program Description and the Unit 3 Appendix A "FSAR Supplement," Section A2.1.2, Boric Acid Corrosion, Program Description. (Refer to Section 3.3A for additional details.)

3.4A.2.1.2 Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and/or Stress Corrosion Cracking

In the discussion section of Table 3.4.1, Item 8, of the LRA, the applicant stated that loss of material due to general corrosion, crack initiation and growth due to cyclic loading and/or stress corrosion cracking (SCC), for closure bolting in high-pressure or high-temperature systems components, in the steam and power conversion systems are not subject to wetted conditions, therefore, loss of material due to general corrosion is not expected. Additionally, cracking for bolting in steam and power conversion systems is not identified as an aging effect requiring management. However, SRP-LR Table 3.4-1 stipulates that the AMR evaluations consider crack initiations and growth due to cyclic loading for components closure bolting in high pressure or hi-temperature systems and that the applicant could manage the aging effects via GALL AMP XI.M18, "Bolting Integrity."

The applicant stated in the LRA, that SCC is an aging mechanism that requires the simultaneous action of a corrosive environment, a sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate the susceptibility to SCC. Further, the applicant states that steam and power conversion systems bolting is fabricated to ASTM A194, Grade B7 standard, is not high yield strength (>150 ksi), and is not subjected to adverse environment that could result in SCC. Therefore, cracking is not an aging effect requiring management.

The staff noted that SCC could occur in corrosive environment and that the environment does not have to be in a wetted condition. The staff questioned the applicant whether the good bolting practices, bolting preload considerations, and proper sealant and lubricant, as stated in NUREG-1339, are followed. By letter dated December 3, 2004, the applicant submitted its LRA supplement. In its response, the applicant stated that it has developed a specific bolting integrity aging management program that addresses degradation of bolting at MPS. The bolting integrity program is addressed in Section 3.0.3.2.18 of this SER.

By supplement dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaces the existing information in the "Discussion" column of LRA Table 3.4.1, Item 8 with "consistent with the NUREG-1801." The staff reviewed the applicant's response and the staff finds this acceptable because it is consistent with the GALL Report.

3.4A.2.1.3 Loss of Material Due to General (Carbon Steel Only) Pitting and Crevice Corrosion

In the discussion section of LRA Table 3.4.1, Item 10, the applicant stated that for components in a treated water environment other than closed-cycle cooling water, loss of material is managed by the chemistry control for secondary systems or the work control process.

The GALL Report identifies that further evaluation is required for components managed by water chemistry program in the steam and power conversion system. During the audit and review, the staff requested that the applicant provide clarification of how those components that are managed by the chemistry control program do not require further evaluation.

By supplement dated November 9, 2004, the applicant stated that GALL Report, Item VIII.E.4-a, which references GALL AMP XI.M2, "Water Chemistry," should have been chosen for these components, along with a Note D to indicate that the component is different than the component described in the NUREG-1801. The further evaluation recommended, associated with GALL Report Item VIII.E.4-a in LRA Table 3.4.1, Item 3.4.1-02, is addressed in LRA Section 3.4.2.2.2.

The applicant also stated in the LRA, that the effectiveness of AMP B2.1.6, "Chemistry Control for Secondary Systems Program" is confirmed by AMP B2.1.25, "Work Control Process." The work control process program provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if and when aging effects are identified. The corrective action program evaluates the cause and extent of the condition and, if required, recommends enhancements to ensure continued effectiveness of the chemistry control for secondary systems program. The staff finds the applicant's response acceptable and to be consistent with the GALL Report.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in the LRA Table 3.4.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4A.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In Section 3.4.2.2 of the LRA, the applicant provides further evaluation of aging management as recommended by the GALL Report for steam and power conversion system. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage

- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, and crevice corrosion, microbiologically influenced corrosion, and biofouling
- general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion
- quality assurance for aging management of non-safety-related components

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.4.2.2 of the Standard Review Plan for License Renewal. Details of the staff's audit review are documented in the staff's audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections of this SER.

3.4A.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.4A.2.2.2 Loss of Material Due to General (Carbon Steel Only), Pitting, and Crevice Corrosion

In LRA Section 3.4.2.2.2, the applicant addressed loss of material due to general (carbon steel only), pitting, and crevice corrosion that could occur in the carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes.

SRP-LR Section 3.4.2.2.2 states that management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The water chemistry program relies on monitoring and control of water chemistry based on the guidelines in EPRI guideline TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The AMPs recommended by the GALL Report are GALL AMP XI.M2, "Water Chemistry," and GALL AMP XI.M32, "One Time Inspection," for management of this aging effect.

The applicant stated in the LRA that the loss of material due to general corrosion, pitting, and crevice corrosion in the steam and power conversion system components is managed by control of water chemistry through MPS AMP B2.1.6, "Chemistry Control for Secondary Systems." The applicant also stated that in lieu of a one-time inspection, MPS AMP B2.1.25, "Work Control Process," is used to provide confirmation of the effectiveness of the chemistry control for secondary systems program. The work control process provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis and provides input to the corrective action program if aging effects are identified. The corrective action program would evaluate the cause and extent of the condition and, if required, recommend enhancements to ensure continued effectiveness of the chemistry control for secondary systems program.

The staff reviewed the chemistry control for secondary systems and its evaluation is documented in Section 3.0.3.2.3 of this SER. In addition, in response to the staff's query regarding the one-time inspection, the applicant stated that the work control process program provides more opportunities for inspection of signs of aging than would a one-time inspection program. In addition, it provides confirmation of chemistry control effectiveness on a continuing basis, rather than a single point in time afforded by a one-time inspection program. The applicant confirmed that indications of age-related degradation would be evaluated and the extent of the condition be determined through the corrective action system. Enhancements to water chemistry control programs and follow-up inspections would be initiated, as necessary, to provide effective management of aging effects.

The staff reviewed the information provided in the LRA and concurs that the applicant's approach is consistent with GALL AMP XI.M32, "One-time Inspection," which states: "An alternate acceptable program may include routine maintenance or a review of repair records to confirm that these components have been inspected for aging degradation and significant aging degradation has not occurred and thereby verify the effectiveness of the existing AMPs." Also, the staff reviewed operating experience associated with the work control process program as it applied to the steam and power conversion system, specifically, the applicant's technical report on work control inspection opportunities which provided the results of a plant-wide review of maintenance history for a 10-year period. The staff finds that more than 50 work control related inspection opportunities were listed against the steam and power conversion system, which the staff found to be more than adequate to provide confirmation of the effectiveness of the chemistry control for secondary systems program.

3.4A.2.2.3 Loss of Material Due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

In LRA Section 3.4.2.2.3, the applicant addressed local loss of material due to general, pitting, and crevice corrosion, MIC and biofouling that could occur in carbon steel piping and fittings for untreated water from the backup water supply in the auxiliary feedwater system.

SRP-LR Section 3.4.2.2.3 states that loss of material due to general corrosion, pitting and crevice corrosion, MIC, and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the PWR auxiliary feedwater system. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1, of the standard review plan).

The applicant stated in LRA Section 3.4.2.2.3 that the backup water supply for the auxiliary feedwater system is the Unit 2 fire protection system. The backup water source is maintained isolated from the auxiliary feedwater system by two normally closed valves. A tell-tale drain valve between the two closed valves is left open to ensure that leakage past the closed valves can be detected, thus ensuring that untreated water from the fire protection system does not enter the auxiliary feedwater pumps suction piping. The applicant also stated that the backup water supply piping and components were evaluated to be satisfactory for the effects of aging with the Unit 2 fire protection system.

During the audit and review, the staff reviewed Unit 2 piping and instrumentation diagram and found that there was effective isolation to ensure that untreated water from the fire protection system does not enter the auxiliary feedwater pumps suction piping.

Since the untreated water environment is isolated from the auxiliary feedwater pumps suction piping, this aging effect is not applicable to auxiliary feedwater pumps suction piping. On this basis, the staff concludes that not including this aging effect is acceptable.

3.4A.2.2.4 Loss of Material Due to General Corrosion

In LRA Section 3.4.2.2.4, the applicant addressed loss of material due to general corrosion that could occur on the external surfaces of all carbon steel SCs, including closure boltings, exposed to operating temperature less than 212°F.

SRP-LR Section 3.4.2.2.4 states that loss of material due to general corrosion could occur on the external surfaces of all carbon steel SCs, including closure boltings, exposed to operating temperature less than 212°F. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

The applicant stated in the LRA that general corrosion is applicable to carbon steel, low-alloy steel, and cast iron components in an air environment only when it is exposed to intermittent wetting. The applicant also stated that loss of material due to general corrosion of external surfaces is managed by MPS AMP B2.1.13, "General Condition Monitoring."

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. On the basis of its review, the staff concludes that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns.

3.4A.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

In LRA Section 3.4.2.2.5, the applicant addressed the loss of material due to general, pitting, crevice and microbiologically influenced corrosion that could occur in the stainless steel and carbon steel shells, tubes, and tubesheets within the bearing oil coolers (for steam turbine pumps) in the auxiliary feedwater system and in the underground piping and fittings and emergency condensate storage tank in the auxiliary feedwater system and the underground condensate storage tank in the condensate system.

The applicant stated in LRA Sections 3.4.2.2.5.1 and 3.4.2.2.5.2 that the auxiliary feedwater pumps are not equipped with oil coolers and that there are no underground, carbon steel components associated with the auxiliary feedwater system, and therefore, this item is not applicable.

SRP-LR Section 3.4.2.2.5 addresses loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and MIC which could occur in stainless steel and carbon steel shells, tubes, and tubesheets within the bearing oil coolers (for steam turbine pumps) in the auxiliary feedwater system. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

SRP-LR 3.4.2.2.5 also addresses loss of material due to general corrosion, pitting and crevice corrosion, and MIC, which could occur in underground piping and fittings and emergency condensate storage tank in the auxiliary feedwater system and the underground condensate storage tank in the condensate system.

On the basis that the auxiliary feedwater pumps are not equipped with oil coolers and that there are no buried components in the steam and power conversion systems, the staff concurs with the applicant and finds that this aging effect is not applicable.

3.4A.2.2.6 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's quality assurance program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4A.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.4.2-1 through 3.4.2-12 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report or are not addressed in the GALL Report. The staff also reviewed additional systems and components, provided by LRA supplement letters dated November 9, 2004; December 3, 2004;

and the applicant's letter dated January 11, 2005. In Tables 3.4.2-1 through 3.4.2-12, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Staff Evaluation. For component type, material and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation.

The staff evaluation is discussed below.

3.4A.2.3.1 Main Steam - Aging Management Evaluation - Table 3.4.2-1 and 3.4.2-1a

The staff reviewed Table 3.4.2-1 of the LRA and Table 3 3.4.2-1a of the supplement dated January 11, 2005, which summarized the results of AMR evaluations for the main steam system component groups.

In LRA Table 3.4.2-1, the applicant identified no aging effects for the following carbon steel, and low alloy steel main steam component types exposed externally to air: condensing pots, moisture separators/reheaters (shell), pipe, steam traps, strainers, turbine casings, valves (atmospheric dumps and main steam safety/relief), and steam generator blowdown tank.

During the audit and review, the staff requested that the applicant provide clarification as to why there are no aging effects for these components. The applicant stated that the steam and power conversion systems components are normally operated at high temperatures (> 212 °F) and the external surface of the component was determined to be dry. The applicant also stated that these components are located inside buildings and because of the high operating temperature, would not be subject to condensation. These components were determined not to be susceptible to loss of material due to corrosion based on the dry environment, as described in LRA Appendix C, Section C3.7.15.

The staff expressed concern regarding possible long-term shutdown such as the plant shutdown in the 1990s. The applicant stated that the only potential source of wetting of the external surfaces for these components, in a sheltered environment, is condensation. However, intermittent wetting conditions would not be expected during out-of-service periods for these components because for condensation to occur, the surface temperature of the components would have to decrease below the dew point of the ambient environment. These normally high temperature components are located in buildings with warm to hot temperatures and they are insulated. Therefore, conditions for condensation are not expected even when the components are out-of-service for long periods of time.

Since the external surface temperature for these main steam system components is high enough to preclude condensation and these components are not exposed to the intermittent wetting, the staff finds there are no applicable aging effects for the above-mentioned components.

In LRA Table 3.4.2-1, the applicant also identified no aging effects for the following stainless steel main steam component types exposed externally to air: expansion joints, flexible hoses, flow elements, flow orifices, tubing, and valves.

On the basis of current industry research and operating experience, stainless steel exposed externally to air are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects for stainless steel components in an air environment.

In LRA Table 3.4.2-1, the applicant proposed to manage loss of material and cracking for the following stainless steel main steam component types - expansion joints, flexible hoses, flow elements, flow orifices, valves and tubing - exposed internally to treated water and steam using AMP B2.1.6, "Chemistry Control for Secondary Systems."

The applicant also proposed to manage cracking for the following stainless steel main steam component types - quench tank heat exchangers (tubes and tubesheet) - exposed internally and externally to treated water using AMP B2.1.6, "Chemistry Control for Secondary Systems" and AMP B2.1.7, "Closed-cycle Cooling Water System." The staff reviewed the chemistry control for secondary systems program and closed-cycle cooling water system program and its evaluation of these programs is documented in Sections 3.0.3.2.3 and 3.0.3.2.4 of this SER, respectively. The effectiveness of the chemistry control program is further provided by MPS AMP B2.1.25, "Work Control Process," and is documented in Section 3.0.3.3.4 of this SER.

On the basis of its review, and because the effects of pitting and crevice corrosion on stainless steel is not expected to be significant in treated water or steam, the staff finds that management of loss of material for stainless steel components using the chemistry control for secondary systems and closed-cycle cooling water system AMP is adequate.

The applicant stated in the LRA that stress corrosion cracking is an aging mechanism that requires the simultaneous action of a corrosion environment, a sustained stress, and a susceptible material. The applicant also stated that elimination of any one of these elements will eliminate the susceptibility to stress corrosion cracking. The applicant credits MPS AMP B2.1.6, "Chemistry Control for Secondary Systems," to manage this aging mechanism since it removed one of the three required actions.

Since the chemistry control program for secondary systems maintains a controlled environment with low contaminant concentration and the applicant's operating experience has shown this program to be effective for the management of cracking due to stress corrosion cracking, the staff finds that management of stress corrosion cracking for stainless steel components using chemistry control for secondary systems is adequate.

In LRA Table 3.4.2-1, the applicant proposed to manage loss of material for carbon steel main steam component type - silencers - exposed internally to air, with MPS AMP B2.1.25, "Work Control Process."

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds the work control process program acceptable for managing the aging effect of loss of material for the carbon steel silencer.

3.4A.2.3.2 Extraction Steam - Aging Management Evaluation - Table 3.4.2-2

The staff reviewed Table 3.4.2-2 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the extraction steam system component groups.

In Unit 2 LRA Table 3.4.2-2, the applicant proposed to manage loss of material and cracking for the following stainless steel extraction steam system component types - expansion joints, and tubing - exposed internally to steam, using AMP B2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for extraction steam components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of loss of material and cracking for stainless steel components using the chemistry control for secondary systems program to be adequate. The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER.

The applicant identified no aging effects for the following carbon low-alloy steel extraction steam system component types - pipe, steam traps, strainers, and valves - exposed externally to air. On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these carbon low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

3.4A.2.3.3 Feedwater - Aging Management Evaluation - Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarized the results of AMR evaluations for the feedwater system component groups.

In Unit 2 LRA Table 3.4.2-3, the applicant proposed to manage loss of material and cracking for the following stainless steel feedwater system component types - flow elements, flow orifices, and tubing - exposed internally to steam using AMP B2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for feedwater components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of loss of material and cracking for stainless steel components using the chemistry control for secondary systems program to be adequate. The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER.

In Unit 2 LRA Table 3.4.2-3, the applicant proposed to manage loss of material for the carbon steel feedwater system pumps exposed internally to treated water using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems" and MPS AMP B2.1.25, "Work Control Process."

The GALL Report recommends GALL AMP XI.M2, "Water Chemistry," to be augmented by verifying the effectiveness of water chemistry control by a supplementary program. GALL AMP XI.M32, "One-Time Inspection" is an acceptable verification program.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The effectiveness of the chemistry control program is provided further by MPS AMP B2.1.25, "Work Control Process," and is documented in Section 3.0.3.3.4 of this SER. The staff determined that the applicant's work control process program is an acceptable alternate inspection program for this component to manage the aging effects.

The applicant identified no aging effects for the following carbon steel feedwater system component types exposed externally to air: heaters (feedwater heater channel head), and heaters (feedwater heater shell).

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these carbon steel components exposed externally to air. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

3.4A.2.3.4 Condensate - Aging Management Evaluation - Table 3.4.2-4

The staff reviewed LRA Table 3.4.2-4, which summarized the results of AMR evaluations for the condensate system component groups.

In LRA Table 3.4.2-4, the AMR for rubber expansion joints is reviewed by the staff and its evaluation is documented in Section 3 of this SER.

In LRA Table 3.4.2-4, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy steel/cast iron condensate system component types exposed externally to air: flow elements, flow orifices, tubing, condensers (main condenser shell), drain coolers (channel head), drain coolers (shell), heat exchanger steam jet air ejectors (shell), heaters (feedwater heater channel head), heaters (feedwater heater shell), pipe, steam packing exhauster (channel head), steam packing exhauster (shell), valves, and pumps.

On the basis that these have the same previously discussed MEAP combination as the main steam components, the staff finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel/cast iron components exposed externally to air. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-4, the applicant proposed to manage loss of material and cracking for stainless steel condensate system component types - flow elements, flow orifices, and tubing - exposed internally to treated water using AMP B2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for condensate components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of loss of material and cracking for stainless steel components using the chemistry control for secondary systems program to be adequate. The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER.

The LRA Table 3.4.2-4 credits the AMP B2.1.25, "Work Control Process," to manage the change in material properties and cracking of rubber in various expansion joints in a treated water environment. The applicant has identified no aging effect for these expansion joints in an external air environment. The work control process AMP described in LRA Section B2.1.25 does not identify specific criteria unique to managing rubber expansion joints, and it is not clear how external visual inspections will manage internal degradation. In RAI 3.4-3 the staff requested the applicant to clarify how visual inspection of the external surfaces of the expansion joints is adequate to detect internal cracking prior to loss of the component pressure boundary function. In addition to visual inspections, the applicant was requested to clarify if other testing methods will be used, such as hardness testing to determine change of material properties. The applicant was also requested to Identify any operating experience pertaining to rubber expansion joint inspections to demonstrate the effectiveness of the work control process program to manage cracking and change in material properties in rubber expansion joints exposed to treated water and external air.

In its response dated November 9, 2004, the applicant stated:

> There are no external aging effects applicable to these expansion joints. In addition, there are no external visual inspections credited for management of internal aging effects of the expansion joints. The Work Control Process aging management of internal aging referenced in LRA Table 3.4.2-4 for these expansion joints uses internal inspections to detect signs of aging as described in LRA Appendix B Section B2.1.25. Maintenance activities performed in accordance with the Work Control Process provide opportunities to visually inspect the internal surfaces of these components.
>
> Internal cracking and change of material properties for these elastomer components are visually observable by such conditions as evidence of cracking and crazing, discoloration, distortion, evidence of swelling, tackiness, evaluation of resiliency and indentation recovery, etc.
>
> Millstone Unit 2 commitment item 25 (and commitment item 26 for Millstone Unit 3) identified in LRA Appendix A, Table A6.0-1, provides for changes to maintenance and work control procedures to ensure inspections are appropriately and consistently performed.
>
> A review of operating experience associated with these expansion joints indicates that degradation is observable through the Work Control Process activities. Conditions such as cracking and swelling have been noted resulting in replacement of the affected expansion joints.
>
> Therefore, the Work Control Process manages the internal aging effects of the expansion joints to provide reasonable assurance that the intended function will be maintained.

The staff finds the applicant's response reasonable and acceptable, because the applicant has committed to make changes to maintenance and work control procedures to ensure inspections are appropriately and consistently performed to detect degradation prior to loss of component function.

3.4A.2.3.5 Condensate Storage and Transfer - Aging Management Evaluation - Table 3.4.2-5

The staff reviewed LRA Table 3.4.2-5, which summarized the results of AMR evaluations for the condensate storage and transfer system component groups.

In LRA Table 3.4.2-5, the AMR for the carbon steel and low alloy steel condensate storage tank and the stainless steel rupture disks exposed internally to gas is reviewed the staff and its evaluation is documented in Section 3 of this SER.

In LRA Table 3.4.2-5, the AMR for the stainless steel rupture disks exposed externally to atmosphere/weather is reviewed by the staff and its evaluation is documented in Section 3 of this SER.

In LRA Table 3.4.2-5, the applicant identified no aging effects for stainless tubing exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for this stainless component exposed externally to air. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-5, the applicant proposed to manage loss of material for carbon steel and low-alloy steel pipe exposed externally to an atmosphere/weather environment with MPS AMP B2.1.13, "General Condition Monitoring."

The staff reviewed the general condition monitoring program and its evaluation is documented in 3.0.3.3.2. The staff finds that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns.

3.4A.2.3.6 Condensate Demin Mixed Bed - Aging Management Evaluation - Table 3.4.2-6

The staff reviewed LRA Table 3.4.2-6, which summarized the results of AMR evaluations for the condensate demin mixed bed system component groups.

In LRA Table 3.4.2-6, the applicant identified no aging effects for stainless steel tubing exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the project teams finds that there are no aging effects for this stainless component exposed externally to air. Its evaluation is documented in Section 3.4A.2.3.1 of this SER.

3.4A.2.3.7 Auxiliary Feedwater - Aging Management Evaluation - Table 3.4.2-7

The staff reviewed LRA Table 3.4.2-7, which summarized the results of AMR evaluations for the auxiliary feedwater system component groups.

In the LRA Table 3.4.2-7, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy steel auxiliary feedwater system component types exposed externally to air: flow elements, flow orifices, tubing, and turbine casing.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel component exposed externally to air. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-7, the applicant proposed to manage loss material for the carbon steel and low-alloy steel turbine casing exposed internally to treated water and steam environment using AMP B2.1.6, "Chemistry Control for Secondary Systems" and AMP B2.1.25, "Work Control Process."

The staff reviewed the chemistry control for secondary systems program and the work control process and its evaluation is documented in Sections 3.0.3.2.3 and 3.0.3.3.4 of this SER, respectively. The chemistry control program purposes to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material. The work control process ensures effectiveness of the water chemistry control for secondary systems. On this basis, the staff finds that management of loss of material for this component is adequate.

3.4A.2.3.8 Feedwater Heater Vents and Drains - Aging Management Evaluation - Table 3.4.2-8

The staff reviewed LRA Table 3.4.2-8, which summarized the results of AMR evaluations for the feedwater heater vents and drains system component groups.

In LRA Table 3.4.2-8, the applicant proposed to manage cracking for stainless steel feedwater heater vents and drains system component types - expansion joints, flow elements, flow orifices, restricting orifices, tubing, and valves - exposed internally to a treated water and steam environment using AMP B2.1.6, "Chemistry Control for Secondary Systems Program."

The MEAP for feedwater heater vents and drains components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of loss of material and cracking for stainless steel components using chemistry control for secondary systems program is adequate. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-8, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy steel feedwater heater vents and drains system component types - condensing pots, expansion joints, flow elements, flow orifices, heater drains tank, level indicators, pipe, pumps, restricting orifices, tubing, and valves - exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the project teams finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

In LRA Table 3.4.2-8, the applicant proposed to manage loss of material for the copper alloy gland seal coolers (coils) exposed internally and externally to a treated water environment using AMP B2.1.6, "Chemistry Control for Secondary Systems," and AMP B2.1.25, "Work Control Process."

The staff reviewed the chemistry control for secondary systems program and the work control process and its evaluation is documented in Sections 3.0.3.2.3 and 3.0.3.3.4 of this SER, respectively. The chemistry control program purposes to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material. The work control process ensures effectiveness of the water chemistry control for secondary systems and provides opportunity to inspect the outside surface of the cooler coils. On this basis, the staff finds that management of loss of material for this component is adequate.

3.4A.2.3.9 Moisture Separation and Reheat - Aging Management Evaluation - Table 3.4.2-9

The staff reviewed LRA Table 3.4.2-9, which summarized the results of AMR evaluations for the moisture separation and reheat system component groups.

In LRA Table 3.4.2-9, the applicant proposed to manage loss of material/cracking for stainless steel moisture separation and reheat system component types - condensing pots, drains pots, flow elements, and tubing - exposed internally to treated water and steam environment using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems."

The MEAP for moisture separation and reheat components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of loss of material and cracking for stainless steel components using the chemistry control for secondary systems program to be adequate. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-9, the applicant identified no aging effects for stainless steel/carbon steel/low-alloy steel moisture separation and reheat system component types exposed externally to air: condensing pots, drains pots, drain tanks, flow elements, tubing, and valves.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

3.4A.2.3.10 Plant Heating and Condensate Recovery - Aging Management Evaluation - Table 3.4.2-10

The staff reviewed LRA Table 3.4.2-10, which summarized the results of AMR evaluations for the plant heating and condensate recovery system component groups.

In LRA Table 3.4.2-10, the applicant proposed to manage loss of material for copper alloys plant heating and condensate recovery system component types - heating and ventilation Units(coils), and heating coils - exposed internally to a steam environment using AMP B2.1.6, "Chemistry Control for Secondary Systems."

The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER. The chemistry control program purposes to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material. The work control process ensures effectiveness of the water chemistry control for secondary systems. On this basis, the staff finds that management of loss of material for this component is adequate.

In LRA Table 3.4.2-10, the applicant proposed to manage loss of material for the copper alloys plant heating and condensate recovery system sample coolers (tubes) exposed internally and externally to a treated water environment using AMP B2.1.25, "Work Control Process" and AMP B2.1.7, "Closed-cycle Cooling Water System."

The staff reviewed the work control process program and the closed-cycle cooling water system program. Its evaluation of these programs is documented in Sections 3.0.3.3.4 and 3.0.3.2.4 of this SER, respectively. The closed-cooling water system program monitors chemical parameters and provides inspection to further verify the chemistry control. The work control process program performs maintenance activities to provide visual inspection and tracks the performance of inspection and surveillance activities. On this basis, the staff finds that the management of loss material for these components is adequate.

In LRA Table 3.4.2-10, the applicant proposed to manage loss of material for carbon steel and low-alloy steel plant heating and condensate recovery system type components - pipe, reservoir, and steam traps - exposed externally to the atmosphere/weather environment using MPS AMP B2.1.13, "General Condition Monitoring."

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns.

In the LRA Table 3.4.2-10, the applicant proposed to manage cracking for the stainless steel tubing exposed internally to a treated water and steam environment using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for plant heating and condensate recovery components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that the management of cracking for stainless steel components using chemistry control for secondary systems program to be adequate. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-10, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy plant heating and condensate recovery system component types - pipe, sample traps, strainers, tubing and valves - exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the project teams finds that there are no aging effects for these steel/carbon steel/low-alloy components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

3.4A.2.3.11 Secondary Chemical Feed - Aging Management Evaluation - Table 3.4.2-11

The staff reviewed LRA Table 3.4.2-1, which summarized the results of AMR evaluations for the secondary chemical feed system component groups.

In LRA Table 3.4.2-11, the applicant proposed to manage cracking for stainless steel secondary chemical feed system type components - tubing and valves - exposed internally to a treated water environment using AMP 2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for secondary chemical feed components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of cracking for stainless steel components using the chemistry control for secondary systems program to be adequate. The project team's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-11, the applicant identified no aging effects for stainless steel secondary chemical feed system type components - tubing and valves - exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel components exposed externally to air. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

3.4A.2.3.12 Turbine Gland Sealing - Aging Management Evaluation - Table 3.4.2-12

The staff reviewed LRA Table 3.4.2-12, which summarized the results of AMR evaluations for the turbine gland sealing system component groups.

In LRA Table 3.4.2-12, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy steel turbine gland sealing system type components - flow orifices, pipe, tubing, valves, and water pot - exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the project teams finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4A.2.3.1 of this SER.

In LRA Table 3.4.2-12, the applicant proposed to manage cracking and loss of material for stainless steel turbine gland sealing system type components - flow orifices, tubing, and valves - exposed internally to a steam environment using AMP B2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for turbine gland sealing components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of cracking and loss of material for stainless steel components using the chemistry control for secondary systems program to be adequate. The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER.

3.4A.2.3.13 Table 5: Steam and Power Conversion System - Auxiliary Steam Reboiler and Deaerating Feedwater - Aging Management Evaluation

In the LRA supplement letter of November 9, 2004, the applicant identified no aging effects for carbon steel and low-alloy steel exposed to an air environment for the auxiliary steam feedwater surge tank, pipe, and valve component types.

On the basis of current industry research and operating experience, carbon steel and low-alloy steel exposed air are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects for carbon steel and low-alloy steel components in an air environment.

3.4A.2.3.14 Table 6: Steam and Power Conversion System - Exciter Air Cooler - Aging Management Evaluation

In the LRA supplement letter of November 9, 2004, the applicant stated that loss of material of main transfomer and generator isophase bus duct cooling exchangers (coils) of copper alloys exposed to air and treated water environment in the exciter air cooler system is managed using AMP B.2.1.25, "Work Control Process."

The staff reviewed the work control process and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process program performs maintenance activities to provide visual inspection and tracks the performance of inspection and surveillance activities. On this basis, the project team finds that the management of loss material for these components is adequate.

3.4A.2.3.15 Table 7: Steam and Power Conversion System - Stator Liquid Cooler - Aging Management Evaluation

In the LRA supplement letter of November 9, 2004, the applicant stated that loss of material of tubing and valve of stainless steel exposed to moisture-laden air or intermittent wetted environment in the stator liquid cooler is managed using AMP B.2.1.13, "General Condition Monitoring."

The staff reviewed the general condition monitoring and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff finds that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns.

3.4A.2.3.16 Table 8: Steam and Power Conversion System - Turbine Lube Oil- Aging Management Evaluation

In the LRA supplement dated November 9, 2004, the applicant identified no aging effects for stainless steel exposed to air, including pipe, tubing, and valve component types.

On the basis of current industry research and operating experience, stainless steel exposed externally to air are not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects for stainless steel components in an air environment.

In the LRA supplement dated November 9, 2004, the applicant stated that cracking of pipe, tubing and valves of stainless steel exposed to oil environment in the turbine lube oil is managed using AMP B.2.1.25, "Work Control Process."

The staff reviewed the work control process and its evaluation is documented in Section 3.0.3.3.4 of this report. The work control process program performs maintenance activities to provide visual inspection and tracks the performance of inspection and surveillance activities. On this basis, the staff finds that the management of cracking for these components is adequate.

All other AMRs assigned in Tables 3.4.2-1 through 3.4.2-12 of the LRA the LRA supplements were evaluated. The staff finds them to be acceptable.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4A.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the steam and power conversion components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the steam and power conversion, as required by 10 CFR 54.21(d).

3.4B Unit 3 Aging Management of Steam and Power Conversion System

This section of the SER documents the staff's review of the applicant's AMR results for the Unit 3 steam and power conversion components and component groups associated with the following systems:

- main steam system
- feedwater system
- condensate make-up and draw-off system
- steam generator blowdown system
- auxiliary feedwater system
- auxiliary steam system
- auxiliary boiler condensate and feedwater system
- hot water heating system
- hot water pre-heating system
- steam generator chemical addition system
- turbine plant miscellaneous drains system

3.4B.1 Summary of Technical Information in the Application

In LRA Section 3.4, the applicant provided AMR results for steam and power conversion system components and component groups. In LRA Table 3.4.1, "Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion System," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the steam and power conversion system components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4B.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Detail of the staff's audit evaluation are documented in the staff's MPS audit and review report and summarized in Section 3.4B.2.1 of this SER.

The staff also performed an audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff verified that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.4.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.4B.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with or not addressed in the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.4B.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the steam and power conversion system components.

Table 3.4B-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4 that are addressed in the GALL Report.

Table 3.4B-1 Staff Evaluation for Steam and Power Conversion System in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping and fittings in main feedwater line, steam line, and auxiliary feedwater (AFW) piping (PWR only) (Item Number 3.4.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3B, Metal Fatigue
Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system) (Item Number 3.4.1-02)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water chemistry and one-time inspection	Chemistry control for secondary systems program (B2.1.6); Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.4B.2.2.2)
AFW piping (Item Number 3.4.1-03)	Loss of material due to general, pitting, and crevice corrosion, MIC and biofouling	Plant-specific		Not applicable (See Section 3.4B.2.2.3)
Oil coolers in AFW system (lubricating oil side possibly contaminated with water) (Item Number 3.4.1-04)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant-specific	Work control process (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.4B.2.2.5)
External surface of carbon steel components (Item Number 3.4.1-05)	Loss of material due to general corrosion	Plant-specific	General condition monitoring (B2.1.13)	Consistent with GALL, which recommends further evaluation (See Section 3.4B.2.2.4)
Carbon steel piping and valve bodies (Item Number 3.4.1-06)	Wall-thinning due to Flow-accelerated corrosion	Flow-accelerated corrosion	Flow-accelerated corrosion (B2.1.11)	Consistent with GALL, which recommends no further evaluation (See Section 3.4B.2.1)
Carbon steel piping and valve bodies in main steam system (Item Number 3.4.1-07)	Loss of material due to pitting and crevice corrosion	Water chemistry	Chemistry control for secondary systems program (B2.1.6)	Consistent with GALL, which recommends no further evaluation (See Section 3.4B.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Closure bolting in high-pressure or high-temperature systems (Item Number 3.4.1-08)	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting integrity	Consistent with GALL (See Section 3.4B.2.1.2)
Heat exchangers and coolers/condensers by open-cycle cooling water (Item Number 3.4.1-9)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	Work control process (B2.1.25)	Not applicable (See Section 3.4B.2.1.3)
Heat exchangers and coolers/condensers by closed-cycle cooling water (Item Number 3.4.1-10)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-cycle cooling water system	Closed-cycle cooling water system (B2.1.7)	Consistent with GALL, which recommends no further evaluation (See Section 3.4B.2.1.4)
External surface of aboveground condensate storage tank (Item Number 3.4.1-11)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Aboveground carbon steel tanks	Tank Inspection Program (B2.1.24)	Consistent with GALL, which recommends no further evaluation (See Section 3.4B.2.1)
External surface of buried condensate storage tank and AFW piping (Item Number 3.4.1-12)	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection		Not applicable (See Section 3.4B.2.2.5)
External surface of carbon steel components (Item Number 3.4.1-13)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3); General condition monitoring (B2.1.13)	Consistent with GALL (See Sections 3.4B.2.1.1)

The staff's review of the MPS steam and power conversion system and associated components followed one of several approaches. One approach, documented in Section 3.4B.2.1, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.4B.2.2, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.4B.2.3, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the steam and power conversion system components is documented in Section 3.0.3 of this SER.

3.4B.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Section 3.4.2.1 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the steam and power conversion system components:

- boric acid corrosion program
- buried pipe inspection program
- chemistry control for secondary systems program
- closed-cycle cooling water system program
- flow-accelerated corrosion program
- general condition monitoring program
- tank inspection program
- work control process program
- bolting integrity program

Staff Evaluation. In Tables 3.4.2-1 through 3.4.2-11 of the LRA, the applicant provided a summary of AMRs for the main feedwater, main steam, auxiliary feedwater, and blowdown system components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.4B.2.1.1 Loss of Material Due to Boric Acid Corrosion

In the discussion section of Table 3.4.1, item 13, of the LRA, the applicant stated that loss of material due to boric acid corrosion is managed by MPS AMP B2.1.3, "Boric Acid Corrosion," and MPS AMP B2.1.13, "General Condition Monitoring." The boric acid corrosion program includes specific inspections of steam and power conversion and supporting systems components. The boric acid corrosion program and the general condition monitoring program are evaluated in Sections 3.0.3.1 and 3.0.3.2 of this SER respectively.

The LRA identifies a borated water leakage environment for various components in the steam and power conversion and ESF systems and both the boric acid corrosion program and general condition monitoring program are credited with managing loss of material from external surfaces. The boric acid corrosion program described in LRA Section B2.1.3 appears to be limited to components located inside containment, as addressed in NUREG-1801, Section XI.M10. In RAI 3.4-1, the applicant was requested to clarify why the boric acid corrosion program is credited for managing boric acid corrosion in systems that are located outside containment. Also, in regard to the effectiveness of the general condition monitoring program, the applicant was requested to clarify:

- i) How the program manages loss of material for components not normally accessible.
- ii) The basis of the inspection frequency (once per refueling outage) considering the potential rate for material loss.
- iii) What acceptance criteria and corrective actions are applied to the visual indication of boric acid crystals without material degradation.
- iv) How the program provides for promptly identifying the specific cause and location of the borated water leakage.

In its response dated November 9, 2004, the applicant provided the following information:

> The Boric Acid Corrosion Program provides requirements to adequately manage boric acid related degradation of the reactor coolant system, ASME Class 1, 2 and 3 components, and associated or neighboring systems, structures, and components that are in the scope of License Renewal. The requirements of the Millstone Boric Acid Corrosion Program surpass the requirements listed in NUREG-1801, Section XI.M10, in that it is additionally applied to an identified boric acid system leak anywhere in the plant. As part of the Aging Management Review process, the Boric Acid Corrosion Program, along with the General Condition Monitoring Program, is credited for managing aging for the external surface of equipment located in a building that contains a boric acid liquid system (such as the Steam and Power Conversion system, the ESF system, and the Radwaste Ventilation system).
>
> The General Condition Monitoring Program and the Boric Acid Corrosion Program are both listed for various components in the steam and power conversion, ESF, and radwaste ventilation systems because collectively they manage the loss of material for the external surfaces of these components. The General Condition Monitoring Program provides supplemental inspections to the Boric Acid Corrosion Program for managing loss of material due to boric acid corrosion in systems that are located outside containment, such as steam and power conversion, ESF, and radwaste ventilation systems. Any instances of boric acid leakage identified during general condition monitoring activities are entered into the corrective action program and evaluated using the guidance of the Boric Acid Corrosion Program.
>
> The effectiveness questions identified are addressed by the Boric Acid Corrosion Program, not the General Condition Monitoring Program, since the Boric Acid Corrosion Program provides the evaluation and corrective actions when any evidence of boric acid leakage is identified. A more detailed answer is as follows:
>
> - i) Non-insulated components are examined by inspecting the accessible external surfaces for direct and indirect evidence of leakage. For components whose external surfaces are inaccessible for direct visual examination, the surrounding areas (including equipment surfaces located underneath the components) are examined for signs of leakage and other areas are considered where leakage may be channeled.

The Boric Acid Corrosion Program recognizes that boric acid leaks can travel down sloped piped or under insulation. Evidence of leakage can also be determined for components with vertical surfaces of insulation by examining the lowest elevation where the leakage may be detectable. Horizontal surfaces of insulation can be examined at insulation joints. When there is doubt as to a leak's origin, the evidence (i.e., accumulation of boric acid crystals) needs to be preserved until an evaluation has been performed to estimate the source, pathway, target and amount that may be affected. This includes the removal of insulation to determine the leak location.

For those areas identified as infrequently accessed areas, for the purposes of detecting boric acid leakage, entry into the area is performed often enough (at least once per refueling interval) to credit the inspections in the General Condition Monitoring AMP and the Boric Acid Corrosion AMP. The one exception is the Unit 3 demineralizer cubicles area. However, for this area, a video inspection is performed at least once per ten years to verify the integrity of the equipment. Based on operating experience, there is reasonable assurance that this inspection interval will detect borated water leakage prior to the loss of intended function of the affected equipment.

ii) The Millstone Boric Acid Corrosion Program examines locations susceptible to boric acid leakage inside Containment during each refueling outage. It is not practical to perform these examinations while the reactor plant is operating.

Any boric acid leakage identified by plant personnel is either corrected prior to the end of the outage or is evaluated to ensure the intended function is maintained until a repair can be performed. Dominion is aware of the issues associated with boric acid corrosion, and the plant operating conditions that could be indicative of boric acid leakage. For potential boric acid corrosion leakage, which may develop between refueling cycles, changes in plant parameters would provide indication that a potential leak may exist. Both identified and unidentified leakage is strictly monitored and trended for changes in sump level, flow rates, and frequency of pump operation. Changes in ambient conditions inside containment also provide indication of potential boric acid leakage.

Abnormal ambient conditions inside containment are documented through the corrective action process, which may require a shutdown of the reactor plant in order to repair a leak inside containment. Plant operating experience indicates that boric acid inspections performed once per refueling cycle are adequate to maintain the intended function of the equipment in containment. Plant and industry operating experience indicates that a boric acid leak that starts during the operating cycle does not damage the equipment to the point where it cannot perform its intended function.

iii) In accordance with the Boric Acid Corrosion Program, any boric acid leakage identified by plant personnel (including boric acid crystals without material degradation) is documented through the corrective action process (10 CFR 50, Appendix B). Minor leakage may be just cleaned or, if leakage is more severe, a Boric Acid Corrosion Program assessment of the boric acid build-up is performed prior to clean-up. The leakage source, path, and target areas are located, and corrective actions are implemented as determined by the Boric Acid Corrosion Program. Corrective actions include timely repair of the leakage after detection to prevent or mitigate the extent of boric acid corrosion. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the intended function is maintained consistent with the current licensing basis.

iv) The Boric Acid Corrosion Program provides for prompt identification of the specific cause and location of borated water leakage.

See response in item iii above.

Accessible areas are traversed on a daily basis by plant personnel who have been informed of expectations related to boric acid identification and corrective action. Personnel are expected to attempt to identify the leakage source as well as the extent of condition on secondary plant equipment. The Corrective Action Process triggers an investigation by the Boric Acid Corrosion Program. Minor boric acid may be just cleaned, more substantial leakage requires equipment to be repaired to stop the leak or an engineering evaluation be performed to ensure the intended function of the equipment is maintained until such a time that the leak can be repaired.

The staff reviewed the applicant's response and determined that the response was reasonable and acceptable because the applicant credits a combination of the general condition monitoring program and the boric acid corrosion program to detect and evaluate borated water leakage and boric acid corrosion to maintain the intended function of the auxiliary system components. For areas outside containment, general equipment (or materials) frequent inspections are performed as often as daily, which would identify any borated water leakage and any required subsequent evaluation. In response to staff's request of RAI 3.3-B-1, the applicant committed to the following clarification to the Unit 2 Appendix A "FSAR Supplement," Section A2.1.3, Boric Acid Corrosion, Program Description, and the Unit 3 Appendix A "FSAR Supplement," Section A2.1.2, Boric Acid Corrosion, Program Description. (Refer to Section 3.3A for additional details.)

3.4B.2.1.2 Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and/or Stress Corrosion Cracking

In Table 3.4.1, Item 8, for loss of material due to general corrosion, crack initiation and growth due to cyclic loading and/or stress corrosion cracking (SCC) for closure bolting in high-pressure or high-temperature systems components, the applicant stated that bolting in the steam and power conversion systems were not subject to wetted conditions. Therefore, loss of material due to general corrosion is not expected. Additionally, cracking for bolting in steam and power conversion systems was not identified as an aging effect requiring management. However, SRP-LR Table 3.4-1 stipulates that the AMR evaluations consider crack initiations and growth due to cyclic loading for component's closure bolting in high-pressure or high-temperature systems and that the applicant should manage the aging effects using GALL AMP XI.M18, "Bolting Integrity."

The applicant stated in the LRA that SCC is an aging mechanism that requires the simultaneous action of a corrosive environment, a sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate the susceptibility to SCC. Further, the applicant stated that steam and power conversion systems bolting is fabricated to ASTM A194, Grade B7 standard, is not high yield strength (>150 ksi), and is not subject to an adverse environment that could result in SCC. Therefore, cracking is not an aging effect requiring management.

The staff noted that SCC could occur in corrosive environment and that the environment does not have to be in a wetted condition. The staff questioned the applicant whether good bolting practices, bolting preload considerations, and proper sealant and lubricant, as stated in NUREG-1339, are followed.

By letter dated December 3, 2004, the applicant submitted a supplement. The applicant stated that it had developed a specific bolting integrity aging management program that addresses degradation of bolting at MPS. The bolting integrity program is addressed in Section 3.0.3.2.18 of this SER.

By letter dated January 11, 2005, the applicant submitted its bolting aging management roll-up item. In its response, the applicant replaced the existing information in the "Discussion" column of LRA Table 3.4.1, Item 8 with "consistent with the NUREG-1801." The staff reviewed the applicant's response and finds this acceptable since it is consistent with the GALL Report.

The staff reviewed the applicant's response and finds this acceptable since it is consistent with the GALL Report.

3.4B.2.1.3 Loss of Material Due to General Corrosion (Carbon Steel Only), Pitting, and Crevice Corrosion, MIC, and Biofouling; Buildup of Deposit Due to Biofouling

In the discussion section of Table 3.4.1, Item 9, of the LRA, the applicant proposed to manage loss of material due to general (carbon steel), pitting, and crevice corrosion, MIC, and biofouling and buildup of deposit due to biofouling hot water heating and pre-heating component serviced by open-cycle cooling water components using MPS AMP B2.1.25, "Work Control Process." The GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage the aging effects. The applicant proposed to manage the aging effects by MPS AMP B2.1.25, "Work Control Process," for those components identified in LRA Tables 3.4.2-8 and 3.4.2-9.

The staff reviewed the service water system (open-cycle cooling) and work control process program and its evaluation of these programs is documented in Sections 3.0.3.2.15 and 3.0.3.3.4 of this SER, respectively. On the basis of its review, the staff concludes that applicant's work control process program is an acceptable alternate inspection program for this component to manage the aging effects.

3.4B.2.1.4 Loss of Material Due to General (Carbon Steel Only), Pitting, and Crevice Corrosion

In the discussion section of Table 3.4.1, item 10, of the LRA, the applicant stated that for components in a treated water environment other than closed-cycle cooling water, loss of material is managed by the chemistry control for secondary systems or the work control process.

The GALL Report identifies that further evaluation is required for components managed by water chemistry program in the steam and power conversion system. During the audit and review, the staff requested that the applicant provide clarification why those components that are managed by the chemistry control program do not require further evaluation.

By letter dated November 9, 2004, the applicant submitted its response. In its response, the applicant stated that GALL Report, Item VIII.E.4-a, which references GALL AMP XI.M2, "Water Chemistry," should have been chosen for these components, along with a Note D to indicate that the component is different than the component described in the NUREG-1801. The further evaluation recommended, associated with GALL Report, Item VIII.E.4-a in LRA Table 3.4.1, Item 3.4.1-02, is addressed in LRA Section 3.4.2.2.2.

The applicant also stated, in the LRA, that the effectiveness of MPS AMP B2.1.6, "Chemistry Control for Secondary Systems Program," is confirmed by MPS AMP B2.1.25, "Work Control Process." The work control process program provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process program provides input to the corrective action program if and when aging effects are identified. The corrective action program evaluates the cause and extent of the condition and, if required, recommends enhancements to ensure continued effectiveness of the chemistry control for secondary systems program. The staff finds that the applicant's response is acceptable and consistent with the GALL Report.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in the LRA Table 3.4.1 (Table 1), the applicant's references to the GALL Report are acceptable and no further staff review is required.

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4B.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In Section 3.4.2.2 of the LRA, the applicant provides further evaluation of aging management as recommended by the GALL Report for steam and power conversion systems. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, and crevice corrosion, microbiologically influenced corrosion, and biofouling
- general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion
- quality assurance for aging management of non-safety-related components

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.4.2.2 of the Standard Review Plan for License Renewal. Details of the staff's audit and review are documented in the staff's MPS audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.4B.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.4B.2.2.2 Loss of Material Due to General (Carbon Steel Only), Pitting, and Crevice Corrosion

SRP-LR Section 3.4.2.2.2 states that the management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The water chemistry program relies on monitoring and control of water chemistry based on the EPRI guidelines of TR-102134, "PWR Secondary Water Chemistry Guideline-Revision 3," for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The AMPs recommended by the GALL Report are GALL AMP XI.M2, "Water Chemistry," and GALL AMP XI.M32, "One Time Inspection," for management of this aging effect.

The applicant stated in the LRA that the loss of material due to general corrosion, pitting, and crevice corrosion in the steam and power conversion system components is managed by control of water chemistry through MPS AMP B2.1.6, "Chemistry Control for Secondary Systems." The applicant also stated that in lieu of a one-time inspection, MPS AMP B2.1.25, "Work Control Process" is used to provide confirmation of the effectiveness of the chemistry control for secondary systems program. The work control process provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis and provides input to the corrective action program if aging effects are identified. The corrective action program would evaluate the cause and extent of the condition and, if required, recommend enhancements to ensure continued effectiveness of the chemistry control for secondary systems program.

The staff reviewed the chemistry control for secondary systems and its evaluation is documented in Section 3.0.3.2.3 of this SER. In addition, during the audit, in response to the staff's query regarding the one-time inspection, the applicant stated that the work control process program provides more opportunities for inspection of signs of aging than would a one-time inspection program. In addition, it provides confirmation of chemistry control effectiveness on a continuing basis, rather than at a single point in time afforded by a one-time inspection program. The applicant confirmed that indications of age-related degradation would be evaluated and the extent of the condition be determined through the corrective action system. Enhancements to water chemistry control programs and follow-up inspections would be initiated, as necessary, to provide effective management of aging effects.

The staff reviewed the information provided in the LRA and concurs that the applicant's approach is consistent with GALL AMP XI.M32, "One-time Inspection," which states: "An alternate acceptable program may include routine maintenance or a review of repair records to confirm that these components have been inspected for aging degradation and significant aging degradation has not occurred and thereby verify the effectiveness of the existing AMPs." Also, the staff reviewed operating experience associated with the work control process program as it applied to the steam and power conversion system. The staff reviewed the applicant's technical report for work control inspection opportunities, which provided the results of a plant-wide review of maintenance history for a 10-year period. The staff finds that more than 50 work control related inspection opportunities were listed against the steam and power conversion system. The staff finds this to be adequate for providing confirmation of the effectiveness of the chemistry control for secondary systems program.

3.4B.2.2.3 Loss of Material Due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

SRP-LR Section 3.4.2.2.3 states that loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the auxiliary feedwater system. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1, of the SRP-LR).

The applicant stated, in LRA Section 3.4.2.2.3, that the backup water supply for the auxiliary feedwater system is the service water system. The backup water source is maintained isolated from the auxiliary feedwater system by removed spool pieces, which are normally maintained in storage, thus ensuring that untreated water from the service water system does not enter the auxiliary feedwater pumps suction piping. The applicant also states that the backup water supply piping and components were evaluated to be satisfactory for the effects of aging with the service water system.

During the audit and review, the staff reviewed Unit 3 piping and instrumentation diagrams related to the service water system. On the basis of its review, the staff finds that there was effective isolation to ensure that untreated water from the service water system does not enter the auxiliary feedwater pumps suction piping.

Since the untreated water environment is isolated from the auxiliary feedwater pumps suction piping, this aging effect is not applicable to auxiliary feedwater pumps suction piping. On this basis, the staff concludes that not including this aging effect is acceptable.

3.4B.2.2.4 Loss of Material Due to General Corrosion

SRP-LR Section 3.4.2.2.4 states that loss of material due to general corrosion could occur on the external surfaces of all carbon steel SCs, including closure boltings, exposed to operating temperatures less than 212 °F. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

The applicant stated in the LRA that general corrosion is applicable to carbon steel, low-alloy steel, and cast iron components in an air environment only when it is exposed to intermittent wetting. The applicant also stated that loss of material due to general corrosion of external surfaces is managed by MPS AMP B2.1.13, "General Condition Monitoring."

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.4 of this SER. On the basis of its review, the staff concludes that this program is acceptable for managing loss of material since visual inspection of external surfaces is performed during various walkdowns.

3.4B.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

SRP-LR Section 3.4.2.2.5 addresses loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and MIC which could occur in stainless steel and carbon steel shells, tubes, and tubesheets within the bearing oil coolers (for steam turbine pumps) in the auxiliary feedwater system. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

SRP-LR Section 3.4.2.2.5 also addresses loss of material due to general corrosion, pitting and crevice corrosion, and MIC, which could occur in underground piping and fittings and emergency condensate storage tank in the auxiliary feedwater system and the underground condensate storage tank in the condensate system. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general corrosion, pitting and crevice corrosion, and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

The applicant stated, in LRA Section 3.4.2.2.5.1, that loss of material of the auxiliary feedwater pump lube oil coolers is managed by the work control process. The applicant further stated, in LRA Section 3.4.2.2.5.2, that there are no underground, carbon steel components associated with the auxiliary feedwater system, and therefore, this item is not applicable.

In LRA Table 3.4.2-5, the applicant proposed to manage loss of material due to pitting, crevice corrosion, and microbiologically influenced corrosion for the stainless steel oil coolers in auxiliary feedwater (AFW) system exposed to oil using MPS AMP B2.1.25, "Work Control Process."

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process provides the opportunity to visually inspect the components during preventive and corrective maintenance activities on an ongoing basis. The work control process provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that using the work control process program to manage the aging effect of loss of material for the oil cooler in AFW system is adequate.

On the basis that there are no buried components in steam and power conversion systems at MPS, the staff finds that this aging effect is not applicable.

3.4B.2.2.6 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's quality assurance program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4B.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.4.2-1 through 3.4.2-11 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report or are not addressed in the GALL Report. The staff also reviewed additional systems and components, provided in applicant's letter dated January 11, 2005.

In Tables 3.4.2-1 through 3.4.2-11, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect will be managed.

Staff Evaluation. For component type, material and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff evaluation is discussed below.

3.4B.2.3.1 Main Steam - Aging Management Evaluation - Table 3.4.2-1

The staff reviewed Table 3.4.2-1 of the LRA, which summarized the results of AMR evaluations for the main steam system component groups.

In LRA Table 3.4.2-1, the applicant identified no aging effects for the following carbon steel, and low alloy steel main steam component types - pipe, steam traps, valves, and valves (atmospheric dumps and main steam safety/relief) - exposed externally to air.

During the audit and review, the staff requested that the applicant provide clarification as to why there are no aging effects for these components. The applicant stated that the steam and power conversion systems components are normally operated at high temperatures (> 212 °F) and the external surface of the component was determined to be dry. The applicant also stated that these components are located inside buildings and because of the high operating temperature, would not be subject to condensation. These components were determined not to be susceptible to loss of material due to corrosion based on the dry environment, as described in LRA Appendix C, Section C3.7.15.

The staff expressed concern regarding possible long-term shutdown such as the plant shutdown in the 1990s. The applicant stated that the only potential source of wetting of the external surfaces for these components, in a sheltered environment, is condensation. However, intermittent wetting conditions would not be expected during out-of-service periods for these components because for condensation to occur, the surface temperature of the components would have to decrease below the dew point of the ambient environment. These normally high temperature components are located in buildings with warm to hot temperatures and they are insulated. Therefore, conditions for condensation are not expected even when the components are out of service for long periods of time.

Since the external surface temperature for these main steam system components is high enough to preclude condensation and these components are not exposed to the intermittent wetting, the staff finds there are no applicable aging effects for the above-mentioned components.

In LRA Table 3.4.2-1, the applicant identified no aging effects for the following stainless steel and nickel-based alloy main steam component types exposed externally to air: expansion joints, flexible hoses, flow elements, tubing, and valves.

On the basis of current industry research and operating experience, stainless steel/nickel-based alloy exposed externally to air is not susceptible to significant general corrosion that would affect the intended function of components. Therefore, the staff finds that there are no applicable aging effects for stainless steel components exposed externally to air.

In LRA Table 3.4.2-1, the applicant proposed to manage loss of material and cracking for the following stainless steel and nickel-based alloy main steam component types - expansion joints, flexible hoses, flow elements, and tubing - exposed internally to steam using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems."

The staff reviewed the chemistry control for secondary systems program and its evaluation of this program is documented in Section 3.0.3.2.2 of this SER. The effectiveness of the chemistry control program is further provided by MPS AMP B2.1.25, "Work Control Process" and is documented in Section 3.4.2.2.2 of this SER.

On the basis of its review and its determination that the effects of pitting and crevice corrosion on stainless steel and nickel-based alloys are not significant in treated water or steam, the staff finds that management of loss of material for stainless steel/nickel-based alloy components using the chemistry control for secondary systems program is adequate.

The applicant stated in the LRA that stress corrosion cracking is an aging mechanism that requires the simultaneous action of a corrosion environment, a sustained stress, and a susceptible material. The applicant also stated that elimination of any one of these elements will eliminate the susceptibility to stress corrosion cracking. The applicant credits MPS AMP B2.1.6, "Chemistry Control for Secondary Systems," to manage this aging mechanism since it removed one of the three required actions (corrosion environment).

The chemistry control program for secondary systems maintains a controlled environment with low contaminant concentration and the applicant's operating experience has shown this program to be effective for the management of cracking due to stress corrosion cracking, the staff therefore finds that the applicant has demonstrated that the effects of aging for stress corrosion cracking for stainless steel and nickel-based components using chemistry control for secondary systems will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4B.2.3.2 Feedwater - Aging Management Evaluation - Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarized the results of AMR evaluations for the feedwater system component groups.

In LRA Table 3.4.2-2, the applicant proposed to manage cracking for the following stainless steel feedwater steam system component types - flow elements, tubing, and valves - exposed internally to steam using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for feedwater steam components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of cracking for stainless steel components using the chemistry control for secondary systems program is adequate. The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER.

The applicant identified no aging effects for the following stainless steel, carbon steel, and low-alloy steel feedwater steam system component types - flow elements, pipe, tubing, and valves - exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel, carbon steel and low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

3.4B.2.3.3 Condensate Make-Up and Draw-Off - Aging Management Evaluation - Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarized the results of AMR evaluations for the condensate make-up and draw-off system component groups.

In LRA Table 3.4.2-3, the applicant identified no aging effects for the following stainless steel condensate make-up and draw-off system component types exposed externally to air: pipe, tubing, and valves.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

In LRA Table 3.4.2-3, the applicant identified no aging effects for the stainless steel condensate make-up and draw-off system rupture disk, and aluminum condensate storage tank exposed internally to gas environment.

On the basis of current industry research and operating experience, an internal environment of gas (which is similar to air) on metal will not result in aging that will be of concern during the period of extended operation. Therefore, the staff concludes that there are no applicable aging effects for metal in a gas environment.

In LRA Table 3.4.2-3, the applicant proposed to manage loss of material for the stainless steel pipe exposed externally to damp soil environment using MPS AMP B2.1.4, "Buried Pipe Inspection Program."

The staff reviewed the buried pipe inspection program and its evaluation is documented in Section 3.0.3.2.1 of this SER. On the basis of its review, the staff finds that using the buried pipe inspection program to manage the aging effect of loss of material for the buried pipe component is adequate.

The LRA Table 3.4.2-3 credits the AMP B2.124 "Tank Inspection Program" for managing the loss of material of the aluminum condensate storage tank in a damp soil environment. In RAI 3.4-2, the staff requested the applicant to provide the following additional information regarding the aging management of this tank: (a) the alloy content of the aluminum and the welded joints or connections; (b) the type of coatings and/or linings, if any; (c) the support configuration of the tank in the moist soil environment; (d) the NDE methods which are employed to determine degradation of the tank walls and bottom; (e) the frequency of the wall thickness measurements, their locations and acceptance criteria; and (f) the operating history of the tank relating to degradation and remedial actions taken in the past.

In its response dated November 9, 2004, the applicant stated:

(a) The aging management review for the condensate storage tank did not credit any specific alloy content in the determination of applicable aging mechanisms/effects for the aluminum tank or welds.

(b) The condensate storage tank is not coated or lined. Additionally, as stated in LRA Appendix C, Section C2.4, coatings and linings were not credited in the determination of applicable aging effects for in-scope components, including tanks.

(c) The support configuration for the condensate storage tank consists of a reinforced concrete foundation with an oiled sand cushion as described in LRA Section 2.4.2.32. The oiled sand tank bottom supporting material was conservatively assumed to be equivalent to moist soil for the purposes of the aging management review.

(d) The aging management review for the condensate storage tank concluded that the tank bottom could be subject to loss of material. As discussed in LRA Appendix B, Section B2.1.24 "Tank Inspection Program," thickness measurement of the tank bottom will be performed using volumetric non-destructive examination methods.

(e) Per LRA Appendix A, Table A6.0-1, commitment 24, a baseline inspection of the condensate storage tank bottom will be performed prior to the period of extended operation. After that, as a minimum (depending upon baseline inspection results), inspections will occur every ten years. As noted in (d) above, the tank bottom thickness will be measured using volumetric non-destructive examination methods prior to the period of extended operation. Subsequent inspections will be performed on a frequency consistent with scheduled tank internals inspection activities.

(f) The operating history associated with the condensate storage tank is described in LRA Appendix B, Section B2.1.24. During a past inspection of the tank, water was found to be slowly leaking from the tank. Previous inspections of the tank had detected only occasional wetness. Internal operating experience had identified that the bottom of a similarly designed tank (the condensate surge tank) had already been replaced. The condensate surge tank did not have a barrier installed between the aluminum tank bottom and the sand that forms part of the base mat. An alkaline solution resulting from groundwater intrusion to the concrete foundation ring caused pitting of the aluminum and eventual through-wall leakage. An engineering evaluation concluded that the condensate storage tank and condensate surge tank were both built at the same time using a similar design. As a result of the investigation and previous operating experience, a design change was implemented to replace the condensate storage tank bottom.

The new tank bottom was essentially a one for one replacement. In addition, the existing oil and sand mixture under the tank bottom was replaced with washed, clean, neutral, dry, low chloride and compacted sand, and asphalt impregnated fiber board was installed as a barrier between the aluminum tank and concrete foundation ring.

The staff finds the applicant's response reasonable and acceptable because the applicant is employing appropriate NDE methods for determining tank bottom degradation as well as remedial action to prevent degradation in the future.

3.4B.2.3.4 Steam Generator Blowdown - Aging Management Evaluation - Table 3.4.2-4 and Table 3.4.2-4a

The staff reviewed LRA Table 3.4.2-4 and Table 3.4.2-4a of the applicant's letter dated January 11, 2005, which summarized the results of AMR evaluations in the SRP-LR for the steam generator blowdown system component groups.

In LRA Table 3.4.2-4, the applicant identified no aging effects for the following stainless steel, carbon steel and low-alloy steel steam generator blowdown system component types exposed externally to air: flow elements, pipe, and tubing.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel, carbon steel and low-alloy steel components in external air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

In LRA Table 3.4.2-4, the applicant proposed to manage cracking for the following stainless steel steam generator blowdown system component types - flow elements, and tubing - exposed internally to treated water using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems."

The material, environment, aging effects, and aging management program (MEAP) for steam generator blowdown components is the same as that for the main steam components. Since both have the same MEAP combination, the staff finds that management of loss of material and cracking for stainless steel components using chemistry control for secondary systems program to be adequate. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

In LRA Table 3.4.2-4 and Table 3.4.2-4a of the applicant's letter dated January 11, 2005, the applicant identified no aging effects for the following stainless steel, carbon steel and low-alloy steel steam generator blowdown system component types - flow elements, pipe, tubing, and steam generator blowdown tank - exposed externally to air. On the basis that these components have the same MEAP combination as previously discussed, the staff finds that there are no aging effects for these stainless steel, carbon steel and low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

3.4B.2.3.5 Auxiliary Feedwater - Aging Management Evaluation - Table 3.4.2-5 and Table 3.4.2-5a

The staff reviewed LRA Table 3.4.2-5 and Table 3.4.2-5a of the applicant's letter dated January 11, 2005, which summarizes the results of AMR evaluations for the auxiliary feedwater system component groups.

In LRA Table 3.4.2-5, the applicant identified no aging effects for the following stainless steel auxiliary feedwater system component types exposed externally to air: AFW pump oil coolers (channel heads), AFW pump oil coolers (shell), cavitating venturies, flow elements, level indicators, pipe, restricting orifices, tubing, valves and carbon steel turbine casings.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

In LRA Table 3.4.2-5, the applicant has identified no aging effects for copper alloy spool pieces exposed internally and externally to air.

The applicant stated, in LRA Section 3.4.2.2.3, the removable spool pieces are normally maintained in storage. On the basis of current industry research and operating experience, an internal storage environment of air on copper alloys will not result in aging that will be of concern during the period of extended operation. Therefore, the staff concludes that there are no applicable aging effects for copper alloy spool pieces in an air environment.

In LRA Table 3.4.2-5, the applicant proposed to manage loss of material for the stainless steel demineralized water storage tank exposed internally to a treated water and air environment and carbon steel turbine casings exposed internally to treated water using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems" and MPS AMP B2.1.25, "Work Control Process."

The GALL Report recommends GALL AMP XI.M2, "Water Chemistry," to be augmented by verifying the effectiveness of water chemistry control by a supplementary program. GALL AMP XI.M32, "One-Time Inspection," is an acceptable verification program.

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The effectiveness of the chemistry control program is provided further by MPS AMP B2.1.25, "Work Control Process," and is documented in Section 3.0.3.2.3 of this SER. The work control process provides the opportunity to visually inspect the surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process also provides input to the corrective action program if aging effects are identified. On the basis on its review, the staff finds management of loss of material for these components using the chemistry control for secondary systems and work control process program to be adequate.

In LRA Table 3.4.2-5, the applicant proposed to manage loss of material for the stainless steel pipe exposed externally to damp soil environment using MPS AMP B2.1.4, "Buried Pipe Inspection Program."

The staff reviewed the buried pipe inspection program and its evaluation is documented in Section 3.0.3.2.1 of this SER. On the basis of its review, the staff finds the buried pipe inspection program acceptable for managing the aging effect of loss of material for the buried pipe component.

In LRA Table 3.4.2-5, the applicant proposed to manage loss of material for the stainless steel demineralized water storage tank exposed externally to atmosphere/weather environment using MPS AMP B2.1.24, "Tank Inspection Program."

The staff reviewed the tank inspection program and its evaluation is documented in Section 3.0.3.2.17 of this SER. On the basis of its review, the staff finds management of loss of material for this component using the tank inspection program to be adequate.

In LRA Table 3.4.2-5, the applicant proposed to manage cracking for the following stainless steel auxiliary feedwater system component types, AFW pump oil coolers (tube sheets) and AFW pump oil coolers (tube), exposed externally to oil environment and AFW pump oil coolers (shell) exposed internally to oil environment using MPS AMP B2.1.25, "Work Control Process."

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process provides the opportunity to visually inspect the surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds the work control process program acceptable for managing the aging effect of cracking for stainless steel AFW pump oil cooler tubesheets, tubes and shell.

3.4B.2.3.6 Auxiliary Steam - Aging Management Evaluation - Table 3.4.2-6

The staff reviewed LRA Table 3.4.2-6, which summarized the results of AMR evaluations for the auxiliary steam system component groups.

In LRA Table 3.4.2-6, the applicant identified no aging effects for the stainless steel/carbon steel/low-alloy steel pipe, tubing, and valves exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless components exposed externally to air. The staff's evaluation is documented in Section 3.4.2.3.1 of this SER.

In LRA Table 3.4.2-6, the applicant proposed to manage cracking for stainless steel tubing exposed internally to a treated water and steam environment using MPS AMP B2.1.6, "Chemistry Control for Secondary Systems Program."

MEAP for auxiliary steam is the same as that for the main steam components as discussed in Section 3.4B.2.3.1. Since both have the same MEAP combination, the staff finds that management of loss of material and cracking for stainless steel components using the chemistry control for secondary systems program to be adequate. The staff reviewed the chemistry control for secondary systems program and its evaluation is documented in Section 3.0.3.2.3 of this SER.

3.4B.2.3.7 Auxiliary Boiler Condensate and Feedwater - Aging Management Evaluation - Table 3.4.2-7 and Table 3.4.2-7a

The staff reviewed LRA Table 3.4.2-7 and Table 3.4.2-7a of the applicant's supplement dated January 11, 2005, which summarizes the results of AMR evaluations for the auxiliary boiler condensate and feedwater system component groups.

In Table 3.4.2-7 of the LRA and Table 3.4.2-7a of the applicant's letter dated January 11, 2005, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy steel auxiliary boiler condensate and feedwater system component types exposed externally to air: auxiliary condensate flash tank, restricting orifices, sample coolers, steam traps, tubing, flow elements, and radiation detectors.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4B.2.3.1 of this SER.

3.4B.2.3.8 Hot Water Heating - Aging Management Evaluation - Table 3.4.2-8

The staff reviewed LRA Table 3.4.2-8, which summarizes the results of AMR evaluations for the hot water heating system component groups.

In LRA Table 3.4.2-8, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy steel hot water heating system component types exposed externally to air: flex connections, flow elements, pipe, and tubing.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4B.2.3.1 of this SER.

In LRA Table 3.4.2-8, the applicant has identified no aging effects for the copper alloy unit heaters exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these copper alloy components in external air. Its evaluation is documented in Section 3.4.2.3.5 of this SER.

3.4B.2.3.9 Hot Water Pre-Heating - Aging Management Evaluation - Table 3.4.2-9

Summary of Technical Information in the Application. The staff reviewed LRA Table 3.4.2-9, which summarized the results of AMR evaluations for the hot water pre-heating system component groups.

In LRA Table 3.4.2-9, the applicant identified no aging effects for the following stainless steel/carbon steel/low-alloy steel hot water pre-heating system component types exposed externally to air: flow elements, pipe, tubing, and valves.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4B.2.3.1 of this SER.

3.4B.2.3.10 Steam Generator Chemical Addition - Aging Management Evaluation - Table 3.4.2-10

The staff reviewed LRA Table 3.4.2-10, which summarized the results of AMR evaluations for the steam generator chemical addition system component groups.

In the LRA Table 3.4.2-10, the applicant identified no aging effects for stainless steel pipe and valves exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel/carbon steel/low-alloy steel components exposed externally to air. The staff's evaluation is documented in Section 3.4B.2.3.1 of this SER.

In LRA Table 3.4.2-10, the applicant proposed to manage loss of material for the stainless steel pipe exposed externally to an atmosphere/weather environment using MPS AMP B2.1.13, "General Condition Monitoring Program."

The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that this program is acceptable for managing loss of material since visual inspections of external surfaces are performed during various walkdowns.

In LRA Table 3.4.2-10, the applicant proposed to manage cracking for the stainless steel piping and valves exposed internally to a treated water environment using MPS AMP B2.1.25, "Work Control Process."

The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The work control process provides the opportunity to visually inspect the internal surfaces of components during preventive and corrective maintenance activities on an ongoing basis. The work control process provides input to the corrective action program if aging effects are identified. On the basis of its review, the staff finds that using the work control process program to manage the aging effect of loss of material for these components is adequate.

3.4B.2.3.11 Turbine Plant Miscellaneous Drains - Aging Management Evaluation - Table 3.4.2-11

The staff reviewed LRA Table 3.4.2-11, which summarized the results of AMR evaluations for the turbine plant miscellaneous drains system component groups.

In LRA Table 3.4.2-11, the applicant identified no aging effects for carbon steel and low-alloy steel pipe, steam traps, and valves exposed externally to air.

On the basis that these components have the same previously discussed MEAP combination, the staff finds that there are no aging effects for these stainless steel components exposed externally to air. The staff's evaluation is documented in Section 3.4B.2.3.1 of this SER.

The staff reviewed all other AMRs assigned in Tables 3.4.2-1 through 3.4.2-11 of the LRA and LRA supplements. The staff finds them to be acceptable.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4B.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the steam and power conversion system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the steam and power conversion system, as required by 10 CFR 54.21(d).

3.5 Aging Management of Containment, Structures and Component Supports

3.5A Unit 2 Aging Management of Containment, Structures and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the containment, structures and component supports components and component groups associated with the following structures:

- containment
- structures and structural components:
    - Unit 2 containment enclosure building
    - Unit 2 auxiliary building
    - Unit 2 warehouse building
    - Unit 2 turbine building
    - Unit 1 turbine building
    - Unit 1 control room and radwaste treatment building
    - Unit 2 fire pump house
    - Unit 3 fire pump house
    - SBO diesel generator enclosure and fuel oil tank vault
    - Unit 2 condensate polishing facility and warehouse no. 5
    - security diesel generator enclosure
    - stack monitoring equipment building
    - millstone stack
    - switchyard control house

- retaining wall
  - 345kV switchyard
  - Unit 2 intake structure
  - sea walls
  - Unit 2 discharge tunnel and discharge structure
  - Unit 2 bypass line
  - tank foundations
  - yard structures
- NSSS equipment supports
- general structural supports
- miscellaneous structural commodities
- load handling cranes and devices

3.5A.1 Summary of Technical Information in the Application

In LRA Section 3.5, the applicant provided AMR results for containment, structures and component supports components and component groups. In LRA Table 3.5.1, "Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Structures and Component Supports," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the containment, structures and component supports components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5A.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the containment, structures and components supports system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluation are documented in the staff's MPS audit and review report and summarized in Section 3.5A.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff verified that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.5.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear

Power Plants," dated July 2001. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.5A.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.5A.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.5A.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the containment, structures and components supports system components.

Table 3.5A-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.5 that are addressed in the GALL Report.

Table 3.5A-1 Staff Evaluation for Containment, Structures and Component Supports in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Common Components of All Types of PWR and BWR Containment				
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-01)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.6A.
Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-02)	Cracking due to cyclic loading; crack initiation and growth due to SCC	Containment inservice inspection (ISI) and Containment leak rate test		Not Consistent with GALL (See Section 3.5A.2.2.1)
Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-03)	Loss of material due to corrosion	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Section 3.5A.2.1)
Personnel airlock and equipment hatch (Item Number 3.5.1-04)	Loss of material due to corrosion	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Section 3.5A.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Personnel airlock and equipment hatch (Item Number 3.5.1-05)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	Containment leak rate test and Plant Technical Specifications	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Section 3.5A.2.1)
Seal, gaskets, and moisture barriers (Item Number 3.5.1-06)	Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16); Work control process (B2.1.25)	Not Consistent with GALL (See Section 3.5A.2.2.1)
PWR Concrete (Reinforced and Prestressed) and Steel Containment BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment				
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-07)	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends further evaluation (See Section 3.5A.2.2.1)
Concrete elements: foundation (Item Number 3.5.1-08)	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring		Not Consistent with GALL (See Section 3.5A.2.2.1)
Concrete elements: foundation (Item Number 3.5.1-09)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring		Not Consistent with GALL (See Section 3.5A.2.2.1)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-10)	Reduction of strength and modulus due to elevated temperature	Plant-specific		Not Applicable (See Section 3.5A.2.2.1)
Prestressed containment: tendons and anchorage components (Item Number 3.5.1-11)	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.5

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel element: liner plate and containment shell (Item Number 3.5.1-12)	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends further evaluation (See Section 3.5A.2.2.1)
Steel elements: protected by coating (Item Number 3.5.1-14)	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	Inservice inspection program: containment inspections (B2.1.16)	Not Consistent with GALL (See Section 3.5A.2.2.1)
Prestressed containment: tendons and anchorage components (Item Number 3.5.1-15)	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Section . 3.5A.2.1)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-16)	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Section 3.5A.2.1)
Class I Structures				
All Groups except Group 6: accessible interior/exterior concrete steel components (Item Number 3.5.1-20)	All types of aging effects	Structures Monitoring	Structures monitoring program (B2.1.23); Infrequently accessed areas inspection program (B2.1.15)	Not Consistent with GALL (See Section 3.5A.2.2.2)
Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation (Item Number 3.5.1-21)	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant-specific	Structures monitoring program (B2.1.23)	Consistent with GALL, which recommends further evaluation (See Section 3.5A.2.2.2)
Group 6: all accessible / inaccessible concrete, steel, and earthen components (Item Number 3.5.1-22)	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance	Structures monitoring program (B2.1.23); Infrequently accessed areas inspection program (B2.1.15)	Not Consistent with GALL (See Section 3.5A.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Group 5: liners (Item Number 3.5.1-23)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Water chemistry and monitoring spent fuel pool water level	Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends no further evaluation (See Section 3.5A.2.1)
Groups 1-3, 5, 6: all masonry block walls (Item Number 3.5.1-24)	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry Wall	Structures monitoring program (B2.1.23)	Consistent with GALL, which recommends no further evaluation (See Section 3.5A.2.1)
Groups 1-3, 5, 7-9: foundation (Item Number 3.5.1-25)	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring		Not Consistent with GALL (See Section 3.5A.2.2.1)
Groups 1-3, 5-9: foundation (Item Number 3.5.1-26)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring		Not Consistent with GALL (See Section 3.5A.2.2.1)
Groups 1-5: concrete (Item Number 3.5.1-27)	Reduction of strength and modulus due to elevated temperature	Plant-specific		Not Applicable (See Section 3.5A.2.2.1)
Component Supports				
Groups 7, 8: liners (Item Number 3.5.1-28)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Plant-specific		Not Consistent with GALL (See Section 3.5A.2.2.2)
All Groups support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. (Item Number 3.5.1-29)	Aging of component supports	Structures Monitoring	Structures monitoring program (B2.1.23); General condition monitoring (B2.1.13); Battery rack inspections (B2.1.1); Infrequently accessed areas inspection program (B2.1.15)	Not Consistent with GALL (See Section 3.5A.2.2.3)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds (Item Number 3.5.1-30)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3A, Metal Fatigue

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
All Groups: support members: anchor bolts and welds (Item Number 3.5.1-31)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion (B2.1.3); General Condition Monitoring (B2.1.13)	Not Consistent with GALL (See Section 3.5A.2.3.25)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolaters (Item Number 3.5.1-32)	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	Inservice inspection program: systems, components and supports (B2.1.18); Structures monitoring program (B2.1.23); General condition monitoring (B2.1.13)	Consistent with GALL, which recommends no further evaluation (See Section 3.5A.2.1)
Group B1.1: high strength low-alloy bolts (Item Number 3.5.1-33)	Crack initiation and growth due to SCC	Bolting integrity		Not Consistent with GALL (See Section 3.5A.2.3.24)

The staff's review of the MPS containment, structures and component supports and associated components followed one of several approaches. One approach, documented in Section 3.5A.2.1, involves the staff's review of the AMR results for components in the containment, structures and component supports that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.5A.2.2, involves the staff's review of the AMR results for components in the containment, structures and component supports that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.5A.2.3, involves the staff's review of the AMR results for components in the containment, structures and component supports that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the containment, structures and component supports components is documented in Section 3.0.3 of this SER.

3.5A.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Sections 3.5.2.1.1 through 3.5.2.1.27 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the containment, structures and component supports components:

- boric acid corrosion program
- chemistry control for primary systems program
- general condition monitoring program
- inservice inspection program: containment inspections
- structures monitoring program
- work control process program

- Boraflex monitoring program
- infrequently accessed areas inspection program
- inservice inspection program: systems, components and supports
- battery rack inspections
- fire protection program
- inspection activities: load handling cranes and devices

Staff Evaluation. In Tables 3.5.2-1 through 3.5.2-27 of the LRA, the applicant provided a summary of AMRs for the containment and containment internals, auxiliary building, turbine building and intake structure, yard structures, and structural commodities, and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.5A.2.1.1 Aging of Component Supports

In LRA Table 3.5.2-25 (page 3-535), the applicant stated that the loss of material of carbon steel and low-alloy steel for structural support components in an air or atmosphere/weather environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," MPS AMP B2.1.23, "Structures Monitoring Program," and MPS AMP B2.1.13, "General Condition Monitoring," and GALL that Item III.B2.1-a is matched. During the audit and review, the staff asked the applicant to explain why Note E was used for the infrequently accessed areas inspection program, Note A used for the structures monitoring program, and Note C used for the general condition monitoring program. The applicant stated that Note C was incorrectly applied to the general condition monitoring line items. Note A should have been applied since the general condition monitoring program performs the same inspections of structural supports as the structures monitoring program and is considered equivalent to GALL AMP XI.S6, "Structures Monitoring Program." MPS AMP B2.1.23 is used to manage aging of non-ASME class, large equipment supports; and MPS AMP B2.1.13 is used to manage aging of other non-ASME class supports.

In an LRA supplement dated July 7, 2004, the applicant stated that Note C should be Note A for the general condition monitoring line items in LRA Table 3.5.2-25 (pages 3-532 through 3-538) since the general condition monitoring program performs the same inspections of structural supports as the structures monitoring program and is considered equivalent to GALL AMP XI.S6, "Structures Monitoring Program."

On the basis of its review of the applicant's response, the staff finds the response to be acceptable.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in LRA Table 3.5.1 (Table 1), the applicant's references to the GALL Report are acceptable, that the line items are consistent with GALL, and no further staff review is required.

Staff RAIs Pertaining to Recent Operating Experience and Emerging Issues. Because the GALL Report and SRP-LR were issued in July 2001, these documents do not reflect the most current recommendations for managing certain aging effects that have been the subject of recent operating experience or the topic of an emerging issue. As a result, the staff issued RAIs to determine how the applicant proposed to address these items for license renewal. The applicant's responses to these RAIs, and the staff's evaluations of the responses, are documented as follows.

In RAI 3.5-5, the staff requested information about the members of structures other than containments that uses the structures monitoring program as an AMP. Under column "Structural Member" in Table 3.5.2-x, structures and component supports, structures monitoring program is listed as an AMP for many structural members, such as doors, sliding bearings, metal siding sealants, roofing, siding, scuppers, miscellaneous steel, expansion joint/seismic gap material, and flood door/gate gasket. Item 18 in Table A6.0-1, License Renewal Commitments, states,"The Structures Monitoring Program and implementing procedures will be modified to include all in-scope structures." The staff assumes that the words "in-scope structures" include all structural members listed in Table 3.5.2-x that use the structures monitoring program as an AMP. Please confirm whether the staff's assumption is correct or not.

By letter dated November 9, 2004, the applicant stated that this assumption is correct. Any in scope structural members that are not currently in the structures monitoring program, such as those listed above, but are required to be inspected, will be added to the program prior to the period of extended operation.

The staff finds the applicant's response acceptable.

In RAI 3.5-6, the staff requested information about the work control process AMP. The work control process is listed as an AMP for many structural members, such as the rubber seal of the spent fuel pool gate, the carbon steel sump liner, and the neoprene gaskets in junction, terminal, and pull boxes. The staff did not find that these structural members were included in the scope of program of the b2.1.25 work control process or that Table A6.0-1 lists these structural members in the work control process as a license renewal commitment. The applicant was asked to explain how the work control process includes and tracks the structural members listed in Table 3.5.2-x that use the work control process as an AMP.

The applicant stated that the work control process inspects materials and environments in lieu of specific component types. Inspections are performed as part of preventive maintenance, corrective maintenance, predictive analysis, periodic surveillance, etc. A review of the work control process inspection opportunities for each material and environment group that is in scope of License Renewal was performed for Millstone Units 2 and 3. It demonstrated adequate inspection opportunities for the vast majority of material and environment combinations. A review of the work control process inspection opportunities for each material and environment group supplemental to the initial review conducted during the development of the LRA will be performed. Baseline inspections will be performed for the material and environment combinations that have not been inspected as part of the work control process. This commitment is identified in Appendix A, Table A6.0-1 License Renewal Commitments, Item 30 (Unit 2) and 31 (Unit 3). These inspections will address the above item if no opportunity for inspection has been provided, prior to the period of extended operation. Unacceptable inspection results will be identified in the corrective action process. Corrective actions will consider the extent of condition of all component types included in that material and environment combination.

The staff finds the applicant's response acceptable. The staff evaluation of the work control process AMP is documented in Section 3.0.3.3.4.

In RAI 3.5-11, the staff requested the applicant to discuss whether Millstone Units 2 or 3 had piping and component supports that are anchored to concrete by using bolts with yield strength greater than 150 ksi? If yes, identify the AMP for those bolts and provide basis for the selection of the AMP if Bolting Integrity program is not selected.

By letter dated November 9, 2004, the applicant stated that no piping or component supports in Millstone Unit 2 or 3 have been identified as being anchored to concrete using anchor bolts with specified yield strengths greater than 150 ksi.

The staff finds the applicant's response acceptable.

As a result of issues raised during the scoping and screening methodology audit (discussed in Section 2.1.3.1), the staff requested additional information concerning newly in scope structures. The following is a discussion of the applicant's responses and the staff evaluations.

In response to RAI 2.4-7 (Unit 2) and RAI 2.4-11 (Unit 3), the applicant stated that the post-tensioned anchorage system for the sea walls is within the scope of license renewal and the AMR result concluded that there are no aging effects requiring management. The staff reviewed the anchorage detail, as shown in FSAR Figure 2.5-15, and found that there are sufficient concrete surrounding the post-tensioned anchorage system to protect it from the environment and, therefore, concurs with the applicant's conclusion.

In response to RAI 2.4-1, the applicant added the condensate polishing service water strainer house to the scope of license renewal and stated that the aging effects are loss of material, cracking, and change of material properties for concrete and they will be monitored by the structures monitoring program AMP. The staff concurs with the applicant's proposal.

In response to RAI 2.4-1, the applicant added Unit 2 hydrogen cylinder storage area (building 226) to the scope of license renewal. The structural members of the building consists of reinforced concrete in soil and atmosphere/weather environments and masonry block walls in an atmosphere/weather environment. The applicant stated that the aging effects are loss of material, cracking, and change of material properties for concrete and cracking for masonry block walls, and they will be monitored by the structures monitoring program AMP. The staff concurs with the applicant's proposal.

In response to RAI 2.4-2, the applicant added Unit 2 sodium hypochlorite building to the scope of license renewal. The structure consists of structural reinforced concrete in soil, air, and atmosphere/weather environments and structural steel members in air. The applicant stated that the aging effects are loss of material, cracking, and change of material properties for concrete and loss of material for structural steel, and they will be monitored by the structures monitoring program AMP which is described in LRA Section B2.1.23. The staff concurs with the applicant's proposal.

In response to RAI 2.4-3, the applicant added thermal insulation around high temperature piping containment penetrations to the scope of license renewal. The applicant's AMR result concluded that there are no aging effects for the fiberglass, asbestos, and calcium silicate piping penetration thermal insulation. However, the applicant stated that the localized concrete temperature in the vicinity of high energy piping containment penetrations is maintained below the threshold value by the containment penetration cooling system, which consists of a ventilation system in Unit 2 (the containment penetration cooling system described in LRA Section 2.3.3.18) and a water cooling system in Unit 3 (as part of the reactor plant component cooling system described in LRA Section 2.3.3.6). Since the concrete temperature around the containment penetration is properly maintained, the staff considers the applicant's proposal acceptable.

In response to RAI 2.4-5, the applicant added the sealant and the penetration seals component types to the scope of license renewal, and stated that they will be monitored by the containment inspection AMP as modified by the response to RAI 3.5-1 provided in Dominion letter dated November 9, 2004. The staff accepts the AMP as discussed in Section 3.5A.2.3.1 and 3.5B.2.3.1 of this SER.

The staff accepts the applicant's clarification.

On the basis of its audit and review, the staff determined that, for AMRs not requiring further evaluation, as identified in LRA Table 3.5.1 (Table 1), the applicant's references to the GALL Report are acceptable, the line items are consistent with GALL, and no further staff review is required. On the basis of its audit and review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Conclusion</u>. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5A.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation Is Recommended

<u>Summary of Technical Information in the Application</u>. In Section 3.5.2.2 of the LRA, the applicant provides further evaluation of aging management as recommended by the GALL Report for containment, structures and component supports. Specifically, the applicant provided information concerning how it will manage the following aging effects:

- aging of inaccessible concrete areas

- cracking, distortion, and increase in component stress level due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundations, if not covered by structures monitoring program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to corrosion in inaccessible areas of steel containment shell or liner plate
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to cyclic loading and SCC
- aging of structures not covered by structures monitoring program
- aging management of inaccessible areas
- aging of supports not covered by structures monitoring program
- cumulative fatigue damage due to cyclic loading

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.5.2.2 of the Standard Review Plan for License Renewal. Details of the staff's audit and review are documented in the staff's MPS audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections of this SER.

3.5A.2.2.1 PWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which addresses several areas discussed below.

Aging of Inaccessible Concrete Areas. In LRA Section 3.5.2.2.1.1, the applicant addressed aging of inaccessible concrete areas of the containment.

For inaccessible portions of the containment structure, 10 CFR 50.55a(b)(2)(ix) requires that the applicant evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas.

The AMP recommended by the GALL Report for managing the aging of the accessible portions of the containment structures is GALL AMP XI.S2, "ASME Section XI, Subsection IWL." The applicant addressed this with MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections." The staff reviewed the inservice inspection program: containment inspections program and its evaluation is documented in Section 3.0.3.2.11 of this SER. ASME Subsection IWL exempts from examination those portions of the concrete containment that are inaccessible (e.g., foundation, below-grade exterior walls, or concrete covered by liner).

The applicant also used MPS AMP B2.1.23, "Structures Monitoring Program," to monitor accessible areas for evidence of aging effects that may be applicable to containment structures. This program, which is consistent with GALL AMP XI.S6, "Structures Monitoring Program," with enhancements, was reviewed by the staff and its evaluation is documented Section 3.0.3.2.16 of this SER. The applicant also credited the structures monitoring program for the examination of below-grade concrete when it is exposed by excavation.

In the GALL Report, Volume 2, Chapter II, Table A1 (as modified by ISG-3), further evaluation is recommended to manage the aging effects for containment concrete components located in inaccessible areas if the aging mechanisms of (1) freeze-thaw, (2) leaching of calcium hydroxide, (3) aggressive chemical attack, (4) reaction with aggregates, or (5) corrosion of embedded steel are significant. Possible aging effects for containment concrete structural components due to these five aging mechanisms are cracking, change in material properties, and loss of material.

(1) Freeze-thaw - SRP-LR Section 3.5.2.2.1.1 does not address freeze-thaw as an aging mechanism for concrete containments because no further evaluation is recommended in the GALL Report. However, ISG-3, "Chapters II and III of GALL Report on Aging Management of Concrete Elements," dated November 21, 2003, clarified the staff's position that further evaluation is appropriate if the applicant's facility is subject to moderate to severe weather conditions unless the concrete meets certain specifications and subsequent inspections have confirmed that the aging mechanism has not caused degradation of the concrete.

MPS is located in a region considered to be subject to severe weather conditions. In the LRA, the applicant stated that Unit 2 concrete structures are designed in accordance with ACI specification 318-63, "Building Code Requirements for Reinforced Concrete," which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

- high cement content
- low water-to-cement ratio
- proper curing
- adequate air entrainment

In the LRA, the applicant stated that Unit 2 concrete also meets requirements of the guideline ACI 201.2R-77, "Guide to Durable Concrete." ACI 318-63 and ACI 201.2R-77 use the same ASTM standards for selection, application, and testing of concrete.

During the audit and review, the staff interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that loss of material from freeze-thaw has not been observed, either through the inservice inspection - IWL program or the structures monitoring program.

On the basis of its review, the staff finds that loss of material and cracking due to freeze-thaw will be adequately managed by the containment inservice inspection program because: (1) concrete that satisfies the requirements of ACI 318-63 will meet the recommendations of ISG-3, (2) an audit of operating experience evaluated under the inservice inspection program: containment inspections and structures monitoring programs, and (3) the containment structure is protected from the elements by an enclosed structure.

(2) Leaching of calcium hydroxide - SRP-LR Section 3.5.2.2.1.1 states that cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report, as updated by ISG-3, recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria cannot be satisfied.

The GALL Report states that leaching of calcium hydroxide becomes significant only if the concrete is exposed to flowing water. Even if reinforced concrete is exposed to flowing water, such leaching is not significant if the concrete is constructed to ensure that it is dense, well-cured, has low permeability, and that cracking is well controlled.

In the LRA, the applicant stated that the Unit 2 concrete structures are designed in accordance with specification ACI 318-63 and meet the requirements of guideline ACI 201.2R-77.

The staff finds that because ACI 318-63 and ACI 201.2R-77 provide assurance that the criteria of the GALL Report and ISG-3 are met, leaching of calcium hydroxide is not significant at Unit 2, and therefore concludes that the inservice inspection program: containment inspections program will be sufficient to manage increases in porosity and permeability from this aging mechanism. A plant-specific aging management program is not required to address this aging effect.

(3) Aggressive chemical attack - SRP-LR Section 3.5.2.2.1.1 states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report and updated in ISG-3 cannot be satisfied.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than 1,500 ppm. ISG-3 also states that a plant-specific program is required to examine representative samples of below-grade concrete when excavated for any reason.

In the LRA, the applicant stated that the below-grade environment is not aggressive (pH is greater than 5.5, chlorides are less than 500 ppm, and sulfates are less than 1,500 ppm). In addition, the staff noted that the applicant uses the structures monitoring program to examine below-grade concrete when it is exposed by excavation.

On the basis of the information provided in the LRA and the guidelines provided in the SRP-LR, the GALL Report, and ISG-3, the staff finds that increases in porosity and permeability, loss of material (spalling, scaling), and cracking due to aggressive chemical attack are not significant for concrete in inaccessible areas of the Unit 2 containment. The applicant uses MPS AMP B2.1.23, "Structures Monitoring Program," to test the groundwater on a periodic basis, considering seasonal variations, to ensure the aging mechanism of aggressive chemical attack does not become significant in the future and also to examine below-grade concrete when it is exposed by excavation. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff finds that the structures monitoring program is an appropriate program for examination of below-grade concrete when it becomes accessible.

(4) Reaction with aggregates - SRP-LR Section 3.5.2.2.1.1 does not address reaction with aggregates as an aging mechanism for concrete containments because no further evaluation is recommended in the GALL Report. However, ISG-3 clarified the staff's position that further evaluation is appropriate if investigations, tests, or examinations have demonstrated that the aggregates are reactive.

In the LRA, the applicant stated that Unit 2 concrete structures are designed in accordance with specification ACI 318-63 and meet the recommendations of guideline ACI 201.2R-77. The ACI standard specifies the testing of aggregates at the time of construction.

Through interviews with the applicant's technical staff, the staff confirmed that the results of those tests show that the aggregates used for the Unit 2 concrete containment at MPS are not reactive. The staff finds that this aging effect does not require management at MPS. However, the applicant stated, in the LRA, that it will manage change of material properties as a potential aging effect on concrete structures. In the LRA, the applicant stated that change of material properties for the Unit 2 containment due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by AMP B2.1.16, "Inservice Inspection Program: Containment Inspections," and AMP B2.1.23 "Structures Monitoring Program." The staff reviewed these programs and its evaluations are documented in Sections 3.0.3.2.11 and 3.0.3.2.16 of this SER, respectively.

(5) Corrosion of embedded steel - SRP-LR Section 3.5.2.2.1.1 states that loss of material due to corrosion of embedded steel could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report (updated in ISG-3) recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

For cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel, the GALL Report states that a plant-specific program is only required if the below-grade environment is aggressive. ISG-3 also states that a plant-specific program is required to examine representative samples of below-grade concrete when excavated for any reason.

In the LRA, the applicant stated that the below-grade environment is not aggressive (pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1,500 ppm). The staff noted that the applicant credited the structures monitoring program for the examination of below-grade concrete when it is exposed by excavation. In addition, the applicant committed, in its structures monitoring program, to periodically monitor below-grade chemistry to ensure that the groundwater is not sufficiently aggressive to cause the below-grade concrete to degrade.

The staff finds that in accordance with the criteria of the GALL Report this aging effect is not significant and is adequately managed.

The staff reviewed the results of the applicant's AMR for inaccessible concrete areas. On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of aging of inaccessible concrete areas for the containment, as recommended in the GALL Report and ISG-3. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking, Distortion, and Increase in Component Stress Level Due to Settlement; Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program In LRA Section 3.5.2.2.1.2, the applicant addressed (1) cracking, distortion, and increase in component stress level due to settlement, and (2) reduction of foundation strength due to erosion of porous concrete subfoundations in the containment.

SRP-LR Section 3.5.2.2.1.2 states that cracking, distortion, and increase in component stress level due to settlement could occur in PWR concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR containments. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated, in the LRA, that aging effects (cracking, distortion, and increase in component stress level) due to settlement, and reduction of foundation strength due to erosion of porous concrete subfoundations are not expected at Unit 2. The applicant also stated that Unit 2 structures are founded on bedrock, well-consolidated in-situ material, or compacted fill. No structures utilize porous concrete subfoundations. Unit 2 has no de-watering system.

On the basis of its review, the staff concluded that foundation settlement is not an aging mechanism at Unit 2.

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. In LRA Section 3.5.2.2.1.3, the applicant addressed reduction of strength and modulus of concrete structures due to elevated temperature in containment.

SRP-LR Section 3.5.2.2.1.3 states that reduction of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments. The GALL Report calls for a plant-specific aging management program and recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits (i.e., general area temperature 66°C (150°F) and local area temperature 93°C (200°F)).

In LRA Section 3.5.2.2.1.3, the applicant stated that during normal operation, all areas within the containment building do not experience elevated temperatures greater than 150 °F general and greater than 200 °F local. Therefore, change in material properties due to elevated temperature is an aging effect not requiring management for the Unit 2 containment concrete.

On the basis of its review, the staff concurred with the applicant and concluded that change in material properties due to elevated temperature is an aging effect not requiring management for the Unit 2 containment concrete.

<u>Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate</u>. In LRA Section 3.5.2.2.1.4, the applicant addressed loss of material due to corrosion in inaccessible areas of the steel containment shell or the steel liner plate for the containment.

SRP-LR Section 3.5.2.2.1.4 states that loss of material due to corrosion could occur in inaccessible areas of the steel containment shell or the steel liner plate for all types of PWR containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if the following specific criteria defined in the GALL Report cannot be satisfied: (1) concrete meeting the requirements of ACI 318 or ACI 349 and the guidance of ACI 201.2R was used for the containment concrete in contact with the embedded containment shell or liner; (2) the accessible concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner; (3) the accessible portion of the moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with ASME Subsection IWE requirements; (4) borated water spills and water ponding on the containment concrete floor are not common and when detected are cleaned up in a timely manner.

In the LRA, the applicant stated that the containment concrete in contact with the steel liner plate is designed in accordance with ACI 318-63, and meets the recommendations or criteria of guideline ACI 201.2R-77. Accessible concrete of the containment structure is monitored for penetrating cracks under MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections." In addition, the applicant stated, in the LRA, that the accessible portions of the steel liner plate and moisture barrier where the liner becomes embedded are inspected in accordance with MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections." Spills (e.g., borated water spill) are cleaned up in a timely manner. The aging effect of loss of material due to corrosion has not been significant for the Unit 2 liner plate. The staff reviewed the inservice inspection program: containment inspections program, with exceptions, and its evaluation is documented in Section 3.0.3.2.11 of this SER.

On the basis of its review, the staff finds that all of the criteria identified in the GALL Report are satisfied. The staff finds that no additional, plant-specific aging management program is required to manage inaccessible areas of the steel containment liner plate.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving loss of material due to corrosion in inaccessible areas of the steel containment shell or the steel liner plate, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature. As stated in SRP-LR, loss of prestress due to relaxation, shrinkage, creep, and elevated temperature is a TLAA, as defined in 10 CFR 54.3, and TLAAs must be evaluated in accordance with 10 CFR 54.21(c)(1). The staff documents its review of the applicant's evaluation of this TLAA in Section 4.5 of this SER. In performing this review, the staff followed the guidance in Section 4.5 of the SRP-LR.

Cumulative Fatigue Damage. As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

Cracking Due to Cyclic Loading and Stress Corrosion Cracking. In LRA Section 3.5.2.2.1.7, the applicant addressed aging mechanisms that can lead to cracking of penetration sleeves and penetration bellows, such as cyclic loads and SCC.

SRP-LR Section 3.5.2.2.1.7 states that cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC could occur in containments. Further evaluation of inspection methods is recommended to detect cracking due to cyclic loading and SCC, since visual VT-3 examinations may be unable to detect this aging effect.

In LRA Section 3.5.2.2.1.7, the applicant stated that SCC is applicable to carbon and low-alloy steel in air only if the fabrication material is high yield-strength steel. SCC of stainless steel in air is only applicable to sensitized stainless steel that is exposed to intermittent wetting. Unit 2 containment penetrations, including penetration sleeves, bellows, and dissimilar metal welds, are not fabricated from high yield-strength steel and the stainless steel materials are not subject to intermittent wetting. Therefore, the applicant concluded that cracking due to SCC does not require aging management for the Unit 2 containment.

The staff reviewed and concurred with the applicant that cracking due to SCC is not an applicable aging effect for the Unit 2 containment, and augmented inspection to detect cracking is not necessary.

Cracking due to cyclic loading of the liner plate and penetrations is a TLAA which is evaluated and addressed in Section 4.6 of this SER.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of cracking due to SCC for containment components, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5A.2.2.2 Class 1 Structures

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which addressed several areas discussed below.

Aging of Structures Not Covered by Structures Monitoring Program. In LRA Section 3.5.2.2.2.1, the applicant addressed aging of Class 1 structures not covered by the structures monitoring program.

SRP-LR Section 3.5.2.2.2.1 states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring program. This is described in GALL Report Chapter III and includes (1) scaling, cracking, and spalling due to repeated freeze-thaw for Groups 1-3, 5, and 7-9 structures; (2) scaling, cracking, spalling and increase in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack for Groups 1-5 and 7-9 structures; (3) expansion and cracking due to reaction with aggregates for Groups 1-5 and 7-9 structures; (4) cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Groups 1-5 and 7-9 structures; (5) cracks, distortion, and increase in component stress level due to settlement for Groups 1-3, 5, and 7-9 structures; (6) reduction of foundation strength due to erosion of porous concrete subfoundations for Groups 1-3 and 5-9 structures; (7) loss of material due to corrosion of structural steel components for Groups 1-5 and 7-8 structures; (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1-5 structures; and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Groups 7 and 8 structures. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

Technical details of the aging management issue are presented in SRP-LR Subsection 3.5.2.2.1.2 for structure/aging effect combinations Items (5) and (6) and SRP-LR Subsection 3.5.2.2.1.3 for Item (8), above.

In LRA Table 3.5.1, Item 3.5.1-20 (page 3-432), the applicant credited MPS AMP B2.1.23, "Structures Monitoring Program," for all types of aging effects and all component groups, except Group 6, of accessible interior and exterior concrete and steel components of Class 1 structures. The staff reviewed the structures monitoring program and its evaluation is documented Section 3.0.3.2.16 of this SER. Additional discussion of specific structure/aging effect combinations follows.

(1) Freeze-thaw - SRP-LR Section 3.5.2.2.2.1 addresses freeze-thaw as an aging mechanism for Class 1 structures. ISG-3 clarifies the staff position that further evaluation is appropriate if the applicant's facility is subject to moderate to severe weather conditions, unless the concrete meets certain specifications and subsequent inspections have confirmed that the aging mechanism has not caused degradation of the concrete.

    MPS is located in a region considered to be subject to severe weather conditions. In the LRA, the applicant stated that Unit 2 structures are designed in accordance with specification ACI 318-63, which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

    - high cement content

- low water-to-cement ratio
- proper curing
- adequate air entrainment

In addition to ACI 318-63, the applicant stated that Unit 2 concrete also meets the guideline of ACI 201.2R-77. ACI 318-63 and ACI 201.2R-77 use the same ASTM standards for selection, application, and testing of concrete.

The staff interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that loss of material from freeze-thaw has not been observed through MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER.

Because the concrete satisfies the criteria of ACI 318-63 will meet the requirements of ISG-3, and on the basis of an audit of operating experience evaluated under the structures monitoring program, the staff finds that loss of material and cracking due to freeze-thaw will be adequately managed by the structures monitoring program.

(2a) Leaching of calcium hydroxide - SRP-LR Section 3.5.2.2.2.1 states that cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide could occur in Class 1 structures. The GALL Report requires a plant-specific AMP for inaccessible areas, unless the criteria of ACI 201.2R-77 for Class 1 structural concrete are met.

The GALL Report states that leaching of calcium hydroxide becomes significant only if the concrete is exposed to flowing water. Even if reinforced concrete is exposed to flowing water, such leaching is not significant if the concrete is constructed to ensure that it is dense, well-cured, has low permeability, and that cracking is well controlled.

In the LRA, the applicant stated that Unit 2 concrete structures are designed in accordance with specification ACI 318-63 and meet the criteria of guideline ACI 201.2R-77.

The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff finds that because ACI 318-63 provides assurance that the criteria of the GALL Report and ISG-3 are met, leaching of calcium hydroxide is not significant at Unit 2, and therefore concludes that the structures monitoring program will be sufficient for management of increases in porosity and permeability from this aging mechanism. A plant-specific aging management program is not required to address this aging effect.

(2b) Aggressive chemical attack - SRP-LR Section 3.5.2.2.2.1 states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack could occur in inaccessible areas of Class 1 structures. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report and updated in ISG-3 cannot be satisfied.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than 1,500 ppm. ISG-3 also states that a plant-specific program is recommended to examine representative samples of below-grade concrete when excavated for any reason.

In the LRA, the applicant stated that the below-grade environment is not aggressive (pH is greater than 5.5, chlorides are less than 500 ppm, and sulfates are less than 1,500 ppm). In addition, the staff noted that the applicant uses the structures monitoring program for the examination of below-grade concrete when it is exposed by excavation. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER.

On the basis of its review of the information provided in the LRA and the guidelines provided in the SRP-LR, the GALL Report, and ISG-3, the staff finds that increases in porosity and permeability, loss of material (spalling, scaling), and cracking due to aggressive chemical attack are not significant for concrete in inaccessible areas. The staff finds that an appropriate aging management program for examination of below-grade concrete (specifically, an enhancement to the structures monitoring program) has been identified.

(3) Reaction with aggregates - SRP-LR Section 3.5.2.2.2.1 addresses reaction with aggregates as an aging mechanism for Class 1 structures. ISG-3 clarifies the staff position that further evaluation is appropriate if investigations, tests, or examinations have demonstrated that the aggregates are reactive.

In the LRA, the applicant stated that Unit 2 concrete structures are designed in accordance with specification ACI 318-63 and meet the criteria of guideline ACI 201.2R-77. The ACI standard specifies testing of aggregates at the time of construction.

On the basis of interviews with the applicant's technical staff, the staff confirmed that the results of those tests showed that the aggregates used for concrete Class 1 structures at Unit 2 are not reactive. However, the applicant stated that it will manage cracking as a potential aging effect on concrete structures. In the LRA, the applicant stated that change of material properties and cracking due to alkali (cement)-aggregate reaction of concrete in various environments is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER.

(4) Corrosion of embedded steel - SRP-LR Section 3.5.2.2.2.1 states that cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas of Class 1 structures. The GALL Report (updated in ISG-3) recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

Also, for cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel, the GALL Report states that a plant-specific program is only necessary if the below-grade environment is aggressive. ISG-3 also states that a plant-specific program is recommended to examine representative samples of below-grade concrete when excavated for any reason.

The staff finds, in accordance with the criteria of the GALL Report, that these aging effects are not significant and are adequately managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also finds an enhancement to the structures monitoring program for examination of below-grade concrete to be acceptable.

(5) Settlement - SRP-LR Section 3.5.2.2.2.1 refers to Section 3.5.2.2.1.2 for the discussion of settlement. SRP-LR Section 3.5.2.2.1.2 states that cracking, distortion, and increase in component stress level due to settlement could occur in Class 1 structures. Some plants may rely on a de-watering system to lower the site groundwater level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated, in the LRA, that aging effects (cracking, distortion, and increase in component stress level) due to settlement, and reduction of foundation strength due to erosion of porous concrete subfoundations are not expected at Unit 2. The applicant stated that Unit 2 structures are founded on bedrock, well-consolidated in-situ material, or compacted fill. No structures utilize porous concrete subfoundations. Unit 2 has no de-watering system.

Based on the fact that Unit 2 structures are founded on bedrock, well-consolidated in-situ material or compacted fill without the use of porous concrete subfoundations, the staff concluded that foundation settlement is not an aging mechanism at Unit 2.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of settlement, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

(6) Erosion of porous concrete subfoundation - SRP-LR Section 3.5.2.2.2.1 refers to Section 3.5.2.2.1.2 for the discussion of erosion of porous concrete subfoundation. SRP-LR Section 3.5.2.2.1.2 states that reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of Class 1 structures. Some plants may rely on a de-watering system to lower the site groundwater level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated, in the LRA, that aging effects (cracking, distortion, and increase in component stress level) due to settlement, and reduction of foundation strength due to erosion of porous concrete subfoundations are not expected at Unit 2. Unit 2 structures are founded on bedrock, well-consolidated in-situ material, or compacted fill. No structures utilize porous concrete subfoundations. Unit 2 has no de-watering system.

Based on the fact that no Unit 2 structures utilize porous concrete subfoundations, the staff concluded that erosion of porous concrete subfoundation is not an aging mechanism at Unit 2.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of erosion of porous concrete subfoundation, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

(7) Corrosion of structural steel components - SRP-LR Section 3.5.2.2.2.1 states that corrosion of structural steel components could occur and that further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

In LRA Section 3.5.2.2.2.1, the applicant stated that the aging effects associated with structures are managed by MPS AMP B2.1.23, "Structures Monitoring Program." However, aging effects for infrequently accessed portions of the structures are managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program."

The staff reviewed the AMR results involving management of aging effects resulting from corrosion of structural steel components and confirmed that MPS AMP B2.1.23, "Structures Monitoring Program," and MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," address each of the affected structures and components. The staff reviewed these programs and its evaluations are documented in Sections 3.0.3.2.16 and 3.0.3.3.3 of this SER, respectively.

On the basis of this audit and review, the staff finds that the applicant has appropriately evaluated AMR results involving this aging effect and that corrosion of structural steel components is adequately managed by the structures monitoring program and infrequently accessed areas inspection program.

(8) Elevated temperatures - SRP-LR Section 3.5.2.2.2.1 refers to Section 3.5.2.2.1.3 for the discussion of elevated temperatures. SRP-LR Section 3.5.2.2.1.3 states that reduction of strength and modulus of elasticity due to elevated temperatures could occur in Class 1 structures in Groups 1-5. The GALL Report calls for a plant-specific AMP and recommends further evaluation if any portion of the concrete components exceeds specified temperature limits (i.e., general area temperature 66°C (150°F) and local area temperature 93°C (200°F)).

In LRA Section 3.5.2.2.1.3, the applicant stated that during normal operation, all general concrete areas in Class 1 structures remain below 150 °F and local area temperatures remain below 200 °F. Therefore, the applicant concluded that change in material properties due to elevated temperature is an aging effect not requiring management for Unit 2 Class 1 structures.

On the basis of its review, the staff concurred with the applicant and finds that change in material properties due to elevated temperature is an aging effect not requiring management for the Unit 2 Class 1 structures.

(9) Aging effects for stainless steel liners for tanks - SRP-LR Section 3.5.2.2.2.1 states that crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liners for Group 7 and 8 structures could occur and further evaluation is necessary only for structure/aging combinations not covered by the structures monitoring program.

The applicant stated, in the LRA, that no tanks with stainless steel liners are included in the structural AMRs. Tanks subject to an AMR are evaluated with their respective mechanical systems.

On the basis of its review, the staff concurred that no tanks with stainless steel liners are included in the structural AMRs.

Aging Management of Inaccessible Areas. In LRA Section 3.5.2.2.2.2, the applicant addressed aging of inaccessible areas of Class 1 structures.

SRP-LR Section 3.5.2.2.2.2 states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack, and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas. The GALL Report recommends further evaluation to manage these aging effects in inaccessible areas of Groups 1-3, 5, and 7-9 structures, if an aggressive below-grade environment exists. ISG-3 identifies additional recommendations.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack and corrosion of embedded steel is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than 1,500 ppm. ISG-3 also states that a plant-specific program is recommended to examine representative samples of below-grade concrete when excavated for any reason.

In LRA Section 3.5.2.2.2.2, the applicant stated that the below-grade environment is not aggressive (pH is greater than 5.5, chlorides are less than 500 ppm, and sulfates are less than 1,500 ppm). The applicant stated in the LRA that it credited the enhanced MPS AMP B2.1.23, "Structures Monitoring Program," to examine below-grade concrete when it is exposed by excavation. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff finds that the structures monitoring program, as enhanced, is an appropriate program for examination of below-grade concrete when it becomes accessible.

The applicant stated, in the LRA, that inspections of accessible concrete have not revealed degradation from aggressive chemical attack or corrosion of embedded steel.

Because the below-grade environment is not aggressive, the applicant performed periodic groundwater monitoring considering seasonal variations. The staff finds that increases in porosity and permeability, loss of material (spalling, scaling) cracking due to aggressive chemical attack, and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel are adequately managed for concrete in inaccessible areas.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of inaccessible areas, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5A.2.2.3 Component Supports

The staff reviewed LRA Section 3.5.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.3, which addresses several areas discussed below.

Aging of Supports Not Covered by Structures Monitoring Program. In LRA Section 3.5.2.2.3.1, the applicant addressed aging of component supports that are not managed by the structures monitoring program.

SRP-LR Section 3.5.2.2.3.1 states that the GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1-B5 supports; (2) loss of material due to environmental corrosion for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

The applicant, in the LRA, has included the GALL Report AMP under the applicant's general MPS AMP B2.1.23, "Structures Monitoring Program." However, this program is not consistent with the GALL Report since the component groups are not completely within the scope of the applicant's structures monitoring program, thus requiring further evaluation. The applicant stated in LRA Section 3.5.2.2.3.1 that the structures monitoring program only manages aging effects associated with large equipment supports. The applicant also stated that MPS AMP B2.1.13, "General Condition Monitoring," is used to manage aging effects for supports for other components and piping, and MPS AMP B2.1.1, "Battery Rack Inspections," is used to manage age-related degradation specific to battery supports. The aging effects for supports in infrequently accessed areas are managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program." The staff reviewed these programs and its evaluations are documented in Sections 3.0.3.3.2, 3.0.3.3.1, and 3.0.3.3.3 of this SER, respectively. The staff finds the structures monitoring program acceptable, in conjunction with the other three programs, for managing aging of component supports for all GALL Report component support groups.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of aging of components supports, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cumulative Fatigue Damage Due to Cyclic Loading. As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.5A.2.2.4 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's Quality Assurance Program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5A.2.3 AMR Results That Are Not Consistent With or Not Addressed In the GALL Report

Summary of Technical Information in the Application. In Tables 3.5.2-1 through 3.5.2-27 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, aging effect requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

In Tables 3.5.2-1 through 3.5.2-27, the applicant indicated, via Notes F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effect requiring management will be managed.

Staff Evaluation. For component type, material and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff evaluation is discussed below.

3.5A.2.3.1 Unit 2 Containment - Aging Management Evaluation -Table 3.5.2-1

The staff reviewed Table 3.5.2-1 of the LRA, which summarized the results of AMR evaluations for the Unit 2 containment system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for containment.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including fuel transfer tube gate valve, containment sump screen, neutron shield tank, reactor cavity seal ring, refueling cavity liner, pipe, valve bodies, fuel transfer tube, expansion bellows, and fuel transfer tube penetration component types. Air is not identified in the GALL Report as an environment for these components and material.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of an aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

The applicant stated, in the LRA, that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that, based on tests conducted on the aggregate and the low-alkali cement used at Unit 2, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

The applicant stated in the LRA that change of material properties for equipment pads/grout, jet impingement barriers, and structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, pedestals, and walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

The applicant stated in the LRA that change of material properties for containment shell (cylindrical wall and dome), and tendon gallery due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections," with exceptions. The staff reviewed the program and its evaluation is documented in Section 3.0.3.2.11 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

For item numbers 3.5.1-03 to 3.5.1-06 (Table 3.5.1) of the LRA, the applicant cited containment ISI and containment leak rate test as the aging management programs. A review of AMP B2.1.6 indicated that the Appendix J leak rate testing is part of the ISI Program: Containment Inspections. In the Appendix J program, the applicant takes credit for only Type A tests to measure the overall primary containment leakage rates. This is a major deviation from NUREG-1801, Section XI.S4 program. Also, the review indicated that the applicant was taking credit for the 1998 Edition of Subsections IWE of Section XI of the ASME Code, without citing compliance with the limitations and modifications associated with this Edition of the Code in 10 CFR 50.55a (67 FR 60520). The staff identified this as a major deviation from NUREG-1801 Section XI.S1 program and the requirements of the regulation. In view of these deviations, and the fact that the Type A leak rate testing may occur every 10 to 15 years, the applicant was requested to provide information as to how it planned to monitor the aging and leak-tightness of the components covered by item numbers 3.5.1-03 to 3.5.1-06. The applicant was also requested in RAI 3.5-1 to address seals and gaskets associated with equipment hatches, air locks, and, electrical and mechanical penetrations.

This item was identified as Audit Item 47 during the AMP/AMR Audit conducted the week of May 3, 2004. Dominion provided a supplemental response to Audit Item 47 as in a letter dated July 7, 2004. In this response, the applicant stated that the Millstone LRA has been supplemented to additionally credit Type B Local Leak Rate Tests (in accordance with 10 CFR 50, Appendix J) as part of the containment isi aging management program. Type B Local Leak Rate Testing will ensure that the containment pressure boundary function associated with the seals and gaskets for equipment hatches, air-locks, and, electrical and mechanical penetrations will be maintained during the period of extended operation.

The typical frequency for performing Type B Local Leak Rate tests is every four refueling outages (approximately every six years). Twenty-five percent of Type B electrical penetrations are performed on-line just prior to or following each refueling outage (approximately every 1 ½ years).

The staff finds the response to RAI 3.5-1 acceptable as the implementation of the revised process will assure the integrity of the containment pressure boundary penetrations during the period of extended operation.

In RAI 3.5-4, the staff inquired about the means of monitoring the temperatures of the containment concrete (around the high energy lines) and that of the concrete structures inside the containments, and the operating experience related to their degradation, as follows:

> In addressing item 3.5.1-27, for the reinforced concrete structures subjected to elevated temperatures (e.g., primary shield walls, pressurizer and steam generator enclosures, reactor vessel supports, and the containment concrete around high energy penetrations) the applicant stated: "NUREG-1801 is not applicable." Items IIA1.1-h and III.A4-1c of NUREG-1801 are directly applicable to Group 4 structural concrete. For these structures, the applicant is requested to provide the following information:
>
> 1. The method(s) of monitoring the concrete temperatures in these structures.
> 2. If the primary shield wall concrete, the containment concrete, or any other structural components within Millstone 2 and 3 containments are kept below the threshold temperature (i.e. 150°F) by means of air cooling, provide the operating experience related to the performance of the cooling system.
> 3. The results of the latest inspection of these structures, in terms of cracking, spalling, and condition of reactor vessel support structures, etc.

By letter dated November 9, 2004, the applicant stated as follows:

1. For Millstone Unit 2, the temperature of the primary shield wall concrete in the area of the reactor vessel supports is monitored and an alarm is provided in the control room if the temperature exceeds 150 °F. Embedded cooling coils are provided at these locations to remove heat from the concrete. Although not directly measured, the temperature of the concrete in other areas of the Unit 2 containment, and in the Unit 3 containment, is maintained below threshold values by the design of ventilation systems. The containment ventilation systems maintain average containment internal air temperature below 120 °F in accordance with Technical Specification requirements. Local ambient air temperatures in areas such as the steam generator cubicles and the pressurizer cubicle are maintained well below 150 °F. The localized concrete temperature in the vicinity of high energy piping containment penetrations is maintained below the threshold value by the containment penetration cooling system, which consists of a ventilation system in Unit 2 (the Containment Penetration Cooling System described in LRA Section 2.3.3.18) and a water cooling system in Unit 3 (as part of the Reactor Plant Component Cooling System described in LRA Section 2.3.3.6).

2. The containment ventilation systems operate consistently in order to provide compliance with Technical Specification containment average temperature limit of 120 °F. Failures of these systems to provide adequate cooling requires plant shutdown and, therefore, the threshold values for concrete temperature would not be exceeded. The containment concrete in the area of the Unit 2 high energy piping penetrations is cooled by the containment penetration cooling system. A review of plant operating experience has indicated that this system also operates consistently and there are no identified failures that would have resulted in local concrete temperatures exceeding threshold values.

3. The latest inspections of the containment structure were performed in March 2001 and October 2003 for Unit 2 and in September 2002 for Unit 3. These inspections did not identify instances of significant cracking or spalling in the primary shield wall, pressurizer and steam generator enclosures, reactor vessel support concrete, or the containment concrete around high-energy penetrations. These inspection results provide further assurance that elevated temperature of containment concrete is not a significant concern for Millstone Unit 2 and Unit 3 containments.

The staff finds the response acceptable, as the applicant employs positive means to control temperatures around the high energy containment penetrations as well as around the areas likely to be subjected to elevated temperatures in the concrete.

In RAI 3.5-14, the staff requested information regarding the operating experience related to corrosion of steel liner for Millstone Units 2 and 3. Specifically, in discussion of Item 3.5.1-12 in Section 3.5.2.2.1.4, the applicant noted that the moisture barrier is monitored under containment inspection program for aging degradation. The industry experience indicates that the moisture barrier degrades with time, and any moisture accumulation in the degraded barrier corrodes the steel liner. The applicant was requested to provide information regarding the operating experience related to the degradation of moisture barrier and the containment liner plate at

Millstone 2 and 3. The applicant was requested to include a discussion of acceptable liner plate corrosion before it was reinstated to the nominal thickness.

In response, the applicant provided the following responses.

The containment ISI program conforms to ASME XI Subsection IWE (1998 Edition) for monitoring the effects of aging associated with both the moisture barrier and the steel liner. The inspection of moisture barriers is intended to prevent undetected intrusion of moisture to inaccessible areas of the pressure retaining liner. Subsection IWE identifies the moisture barrier examination method (visual), and the examination extent and frequency (100% each inspection period). By Subsection IWE requirements, the acceptance standards are "owner defined." Millstone Units 2 and 3 have defined the general and detailed visual acceptance criteria in plant-specific procedures. For augmented examinations of the liner that involve Ultrasonic Testing (UT), ASME Section XI, Subparagraph IWE-3511.3 requires that loss of material in a local area projected to exceed 10% of the nominal wall thickness prior to the next examination shall be documented. Such areas are entered into the corrective action program and either accepted by engineering evaluation or corrected by performance of repair/replacement activities.

For Millstone Units 2 and 3, various examples of operating experience associated with the moisture barrier and the liner (such as the results of baseline examinations performed under the containment isi program) are available for review at the station. The extent of the visual examinations and the necessity of additional volumetric examinations have been as specified in the IWE Inspection Schedule. Examples of containment operating experience for Millstone Units 2 and 3 are provided in the License Renewal Application Appendix B (Section B2.1.16).

Millstone Unit 2

The moisture barrier for the Unit 2 containment liner was inspected in 2000 as part of the ASME Section XI, Subsection IWE examinations. The inspection revealed indications, which upon evaluation required that the moisture barrier material be removed, a detailed IWE examination of the liner be performed, the liner be recoated, and the moisture barrier be replaced. The work scope was completed in two phases, approximately 50% of the locations in outage 2R13 and the remainder in outage 2R15. During the examination, some pitting of the liner was observed and determined to be acceptable by engineering evaluation and the requirements of Subsection IWE of ASME Section XI and acceptable for continued service.

Millstone Unit 3

In 2000 the moisture barrier for the Unit 3 containment liner was inspected as part of the ASME Section XI, Subsection IWE examinations. The inspection revealed unacceptable results where, for specific areas, the moisture barrier had not been installed. These areas were documented and repaired in accordance with Subsection IWE requirements. Detailed visual examinations of the moisture barrier are performed as directed by IWE requirements and the Millstone containment ISI program. The liner surface for the depth of the exposed joint was acceptable and required no further supplemental examination.

Recognizing the susceptibility of the below grade portion of the containment liners to corrosion, in a follow-up request, the staff requested the applicant to provide information regarding corrosion of the liners above the bottom floor levels. By letter dated December 3, 2004, the applicant provided detailed descriptions of the liner corrosion, and the results of UT measurements taken for Unit 2 in April 2000, May 2000, March 2002, and in November 2003 for Unit 2, and in February 2001 for Unit 3. A typical evaluation of liner corrosion consisted of the following approach:

> Specifically, the UT examination results indicated that the area in question had a liner wall thickness of 0.239 inches. The design nominal thickness of the liner is 0.250 inches. In accordance with ASME Section XI, Subparagraph IWE 3122.3, local areas exhibiting less than 10% wall loss are acceptable for continued service. The reading of 0.239 inches was greater than the 0.225 inches minimum wall thickness allowable (for 10 % wall loss), and therefore, met the acceptance standards of ASME Section XI.

The description also included examples where the liner thickness was found to be more than 10% of the nominal thickness allowed by Subsection IWE of Section XI of the ASME Code. In those cases the applicant performed engineering analysis to demonstrate that the liner could perform its intended function.

The above description clearly indicates that the below grade portions of the liner plate have been subjected to corrosion, and the applicant was taking appropriate actions to monitor and control the future instances of corrosion. The staff believes that an appropriate implementation of AMP B.2.1.16, "Inservice Inspection Program: Containment Inspection," including its containment leak rate testing program will monitor and control corrosion of liner plates during the period of extended operation, and therefore, finds the process used by the applicant acceptable.

In RAI 3.5-15, for Millstone 2 only, the staff requested information regarding the condition of prestressing tendons located below the grade level. Specifically, a review of Appendix 5F of the Millstone 2 FSAR indicates that the hoop and vertical tendons located in the below-grade portion of the containment have experienced continuous problem of water leakage through them. The corrective action adopted for the hoop tendons is to keep the sheathing filler in the affected tendons at pressures slightly above hydrostatic pressure. For this sustained condition the applicant was requested to describe the conditions of vertical tendons affected by the water leakage. For the purpose of lift-off testing during tendon surveillance, the applicant was asked whether it selected some tendons from these affected tendons as additional samples. Third, the hydrostatic pressure on the hoop tendons at the bottom of the cylinder could be significant. Such high-sustained pressures could give rise to leakage of corrosion protection medium (CPM) from the sheathing (see Trojan Plant experience in NUREG-1522). The applicant was asked to provide an assessment of the CPM leakage and presence of water for the affected tendons in terms of the acceptance criteria in IWL-3221.2, IWL-3221.3, and IWL-3221.4.

By letter dated November 9, 2004, the applicant provided the following responses.

First, the Millstone Unit 2 containment structure is environmentally protected by an Enclosure Building, which eliminates most degradation mechanisms. Operating experience has been provided in LRA Appendix B (Section B2.1.16) regarding the long-term effects of water intrusion. The discussion specifically states that the condition of the tendon gallery has improved and water intrusion has decreased. This section also discusses the 25th year physical surveillance of Millstone Unit 2 containment post-tensioning performed in accordance with ASME Section XI, Subsection IWL requirements, and includes the results of the tendon surveillance examinations and tests. The section identifies that the losses in tendon forces were less than expected for a plant of its age, and concludes that the containment structure has experienced no abnormal degradation of the post tensioning system. The section identifies that a regression analysis of the tendon forces was performed, which predicts that the values will remain above minimum design requirements well beyond the next surveillance interval.

The 25th year physical surveillance for Millstone Unit 2 included the inspection of anchorage components. Grease caps were selected and removed in accordance with Subsection IWL requirements, and a complete grease coating was found for all tendon ends inspected including those vertical tendons selected. All wire samples were acceptable for diameter, corrosion condition, and physical properties. All tendons were resealed and regreased, with no more than 10% duct volume added.

The presence of water was found in one surveillance tendon (vertical tendon 31V24). The amount of free water present was 16 ounces (Note: The total grease net duct volume for this tendon is 191.94 gallons). This same vertical tendon had also been selected for lift-off testing with satisfactory results. The grease caps for the adjacent tendons (31V22, 31V23 and 31V25) were removed for examination of the tendon ends. No free water was present, and the CPM was tested with satisfactory results. The anchor head corrosion condition of all four tendons was excellent and no broken wires were found. In addition, the exterior of tendon anchorage grease cans (including all vertical tendons) were inspected for the presence of water and grease leaks and none were found."

Second, Millstone Unit 2 does not select any additional tendons from the affected hoop tendons for lift-off testing, and only tests those affected tendons that were selected to comply with ASME Section XI, Subsection IWL requirements. When affected tendons are lift-off tested in accordance with IWL requirements, Millstone Unit 2 lift-off tests the adjacent tendons as additional samples in accordance with Subsection IWL should unsatisfactory lift-off test results be identified for the affected tendons."

As a result of the Millstone Unit 2 tendon surveillance program, seventeen hoop tendons were identified as subject to groundwater intrusion. These tendons were modified to ensure that grease is continuously supplied at a pressure that is slightly above the hydrostatic pressure of the groundwater. The number of tendons containing water has significantly reduced from the ten tendons identified during the third and fourth tendon surveillances to only one tendon identified during each of the last two surveillances. For the tendon identified with free water during the last surveillance (12H01), an inspection of head revealed acceptable levels of corrosion with no button heads missing (other than those intentionally removed for corrosion inspection). The CPM for each of the identified seventeen hoop tendons was sampled and replaced during the 25th year physical surveillance. The analysis of the CPM samples taken from each tendon showed acceptable results for all tests (ions, water and neutralization number). These grease replacement tendons were also successfully filled with no more than 10% net duct volume added, as required in accordance with Subsection IWL.

As previously identified, the operating experience for Millstone Unit 2 identifies that the condition of the tendon gallery has improved, the water intrusion has decreased, and the containment structure has experienced no abnormal degradation of the post tensioning system.

The staff considers the inspection and maintenance activities associated with the below grade tendons acceptable, as the continuation of the process during the period of extended operation will manage the aging of these corrosion susceptible tendons. Additional discussion regarding the selection of these tendons for examination and lift-off testing is discussed in Section 4.5 of this SER.

3.5A.2.3.2 Unit 2 Containment Enclosure Building - Aging Management Evaluation - Table 3.5.2-2

The staff reviewed Table 3.5.2-2 of the LRA, which summarized the results of AMR evaluations for the Unit 2 containment enclosure building component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for Class 1 structures.

The applicant stated, in the LRA, that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 2, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

The applicant also stated in the LRA that change of material properties for flood/spill barriers including curbs, dike, toe plates and stop logs, and structural reinforced concrete (caisson, floor slabs, grade beams, slabs on grade, and walls), due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

The applicant stated, in the LRA, that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant also stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 2, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents the leaching of calcium hydroxide from Class 1 structures' concrete to be of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (caisson, floor slabs, grade beams, slabs on grade, and walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

Tables 3.5.2-2 of LRAs for both Units 2 and 3 are related to the aging management of the enclosure buildings surrounding the containments. For Unit 2, the applicant incorporated the aging management of blow-off panels. This was not the case for Unit 3. In RAI 3.5-16 the applicant was requested to discuss the reasons for the difference.

By letter dated December 3, 2004, the applicant stated that the main steam lines for Millstone Unit 2 go through the enclosure building, and the potential exists for excessive pressure to build-up inside this building during a main steam line leak. For this reason blow-off panels were incorporated into the Unit 2 enclosure building design, and the aging management of these blow-off panels has been included for License Renewal.

The applicant further stated that the main steam lines for Millstone Unit 3 go through the main steam valve building, and not the enclosure building. For this reason blow-off panels are installed in the main steam valve building, and the aging management of these blow-off panels has been included for License Renewal. Because the main steam lines for Millstone Unit 3 do not go through the enclosure building, the potential for excessive pressure to build-up inside this building does not exist, and blow-off panels were not installed.

The staff finds the clarification acceptable.

3.5A.2.3.3 Unit 2 Auxiliary Building - Aging Management Evaluation - Table 3.5.2-3

The staff reviewed Table 3.5.2-3 of the LRA, which summarized the results of AMR evaluations for the Unit 2 auxiliary building component groups. The staff interviewed the applicant's technical staff and reviewed Unit 2 Technical Report MP-LR-3602, "Class 1 Structures," Revision 3.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including miscellaneous steel (embedded steel exposed surfaces, shapes, plates, unistrut, etc.), ladders, platforms, grating, and stairs component types. Air is not identified in the GALL Report as an environment for these components and material.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of an aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for carbon steel components exposed to air, including metal smoke barrier and control room ceiling support component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to air, including the control room ceiling panel component type. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR, that for aluminum in an air or an atmosphere/weather environment, there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment, there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant also stated, however, that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant also stated that change of material properties for flood/spill barriers, including curbs, dikes, toe plates and stop logs, structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, slabs on grade, and walls), and tunnels component types due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant further stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents the leaching of calcium hydroxide from Class 1 structures' concrete from being of concern. Nevertheless, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, slabs on grade, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP

B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that loss of material for stainless steel spent fuel storage racks exposed to treated water is managed using AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The staff finds that this program is consistent with GALL AMP XI.M2, "Water Chemistry," with an acceptable exception. Since this program is consistent with the GALL Report recommendation for other components with the same material, environment, and aging effect, the staff finds this to be acceptable.

3.5A.2.3.4 Unit 2 Warehouse Building - Aging Management Evaluation - Table 3.5.2-4

The staff reviewed Table 3.5.2-4 of the LRA, which summarized the results of AMR evaluations for the Unit 2 warehouse building system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 2, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for flood/spill barriers, including curbs, dikes, toe plates and stop logs, structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, and walls), and tunnels component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 2, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents the leaching of calcium hydroxide from Class 1 structures' concrete to be of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including cask wash pit liner and new fuel rack assembly component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of an aggressive environment, stainless steel components are expected to experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.5A.2.3.5 Unit 2 Turbine Building - Aging Management Evaluation - Table 3.5.2-5

The staff reviewed Table 3.5.2-5 of the LRA, which summarized the results of AMR evaluations for the Unit 2 turbine building system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for flood/spill barriers, including curbs, dikes, toe plates and stop logs, structural reinforced concrete (floor slabs, footing and grade beams, pedestals, roof slabs, slabs on grade, spread footing, and turbine pedestal walls), and hatches component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from Class 1 structures' concrete from being of concern. Nevertheless, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, footing and grade beams, pedestals, roof slabs, slabs on grade, spread footing, and turbine pedestal walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.6 Unit 1 Turbine Building - Aging Management Evaluation - Table 3.5.2-6

The staff reviewed Table 3.5.2-6 of the LRA, which summarized the results of AMR evaluations for the Unit 1 turbine building system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 2, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, and walls) component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from Class 1 structures' concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring

Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant identified no aging effects for carbon steel H-piles components exposed to soil. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for Class 1 structures, that for carbon steel in a soil environment, there are no potential aging mechanisms for this carbon steel and environment combination. The applicant stated that test data indicated that undisturbed soils are deficient in oxygen at levels a few feet below the ground surface or below the water table. Carbon steel piles driven into undisturbed soils are not appreciably affected by corrosion, regardless of the soil type or the soil properties. The effects of corrosion are negligible for well-compacted soil because it does not contain sufficient oxygen. Therefore, the applicant finds that the loss of material due to corrosion is not a potential aging mechanism.

On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that loss of material due to corrosion is not a potential aging effect. Therefore, the staff finds that, for carbon steel in a soil environment, there is a negligible aging mechanism for this carbon steel and environment combination.

3.5A.2.3.7 Unit 1 Control Room and Radwaste Treatment Building - Aging Management Evaluation - Table 3.5.2-7

The staff reviewed Table 3.5.2-7 of the LRA, which summarized the results of AMR evaluations for the Unit 1 control room and radwaste treatment building system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, and walls) component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from Class 1 structures' concrete from being of concern. Nevertheless, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.8 Unit 2 Fire Pump House - Aging Management Evaluation - Table 3.5.2-8

The staff reviewed Table 3.5.2-8 of the LRA, which summarized the results of AMR evaluations for the Unit 2 fire pump house system component groups. The staff interviewed the applicant's technical staff and reviewed AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that cracking for concrete (masonry block walls) component types exposed to an atmosphere/weather environment is managed using AMP B2.1.23, "Structures Monitoring Program." The applicant also stated that cracking of masonry block walls due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms, which require aging management.

The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs and roof slabs) component types in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

3.5A.2.3.9 Unit 3 Fire Pump House - Aging Management Evaluation - Table 3.5.2-9

The staff reviewed Table 3.5.2-9 of the LRA, which summarized the results of AMR evaluations for the Unit 3 fire pump house system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that cracking for concrete (masonry block walls) component types exposed to an atmosphere/weather environment is managed using AMP B2.1.23, "Structures Monitoring Program." The applicant stated that cracking of masonry block walls due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms, which require aging management.

The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs, and roof slabs) component types in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

3.5A.2.3.10 SBO Diesel Generator Enclosure and Fuel Oil Tank Vault - Aging Management Evaluation - Table 3.5.2-10

The staff reviewed Table 3.5.2-10 of the LRA, which summarized the results of AMR evaluations for the SBO diesel generator enclosure and fuel oil tank vault system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant identified no aging effects for aluminum components exposed to air, including roofing and siding component types. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR miscellaneous structures, that for aluminum in an air or an atmosphere/weather environment, there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in its MAER that for aluminum material in an air or atmosphere/weather environment, there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including roofing and siding component types. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structures, that for aluminum in an air or an atmosphere/weather environment, there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in its MAER that for aluminum material in an air or atmosphere/weather environment, there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs) component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated, in the LRA, that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete to be of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.11 Unit 2 Condensate Polishing Facility and Warehouse No. 5 - Aging Management Evaluation - Table 3.5.2-11

The staff reviewed Table 3.5.2-11 of the LRA, which summarized the results of AMR evaluations for the Unit 2 condensate polishing facility and warehouse no. 5 system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, spread footing, and walls) component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, spread footing, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.12 Security Diesel Generator Enclosure - Aging Management Evaluation - Table 3.5.2-12

The staff reviewed Table 3.5.2-12 of the LRA, which summarized the results of AMR evaluations for the security diesel generator enclosure system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant identified no aging effects for aluminum components exposed to air, including roofing, siding, and structural framing component types. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structures, that for aluminum in an air environment, there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air environment, there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack from a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including roofing and siding component types. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structures, that for aluminum in an atmosphere/weather environment, there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in its MAER that for aluminum material in an atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack from a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete. However, the NRC staff has expressed concerns regarding aging of concrete. Therefore, the applicant will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.13 Stack Monitoring Equipment Building - Aging Management Evaluation - Table 3.5.2-13

The staff reviewed Table 3.5.2-13 of the LRA, which summarized the results of AMR evaluations for the stack monitoring equipment building system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that cracking for concrete (masonry block walls) component types exposed to an atmosphere/weather environment is managed using AMP B2.1.23, "Structures Monitoring Program." The applicant stated that cracking of masonry block walls due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms, which require aging management. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (roof slabs, slabs on grade, spread footing, and walls) component types in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (roof slabs, slabs on grade, spread footing, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.14 Millstone Stack - Aging Management Evaluation -Table 3.5.2-14

The staff reviewed Table 3.5.2-14 of the LRA, which summarized the results of AMR evaluations for the MPS stack system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, and walls) component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete to be of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures in infrequently accessed areas.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, and walls) component types in infrequently accessed areas in an air environment is managed by AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," which is a plant-specific program. The staff reviewed the infrequently accessed areas inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment for infrequently accessed areas.

3.5A.2.3.15 Switchyard Control House - Aging Management Evaluation - Table 3.5.2-15

The staff reviewed Table 3.5.2-15 of the LRA, which summarized the results of AMR evaluations for the switchyard control house system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that cracking of concrete (masonry block walls) component types exposed to an atmosphere/weather environment is managed using AMP B2.1.23, "Structures Monitoring Program." The applicant also stated that cracking of masonry block walls due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms which require aging management. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long-term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.16 Retaining Wall - Aging Management Evaluation - Table 3.5.2-16

The staff reviewed Table 3.5.2-16 of the LRA, which summarized the results of AMR evaluations for the retaining wall system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footing and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.17 345kV Switchyard - Aging Management Evaluation - Table 3.5.2-17

The staff reviewed Table 3.5.2-17 of the LRA, which summarized the results of AMR evaluations for the 345kV switchyard system component groups. The staff interviewed the applicant's technical staff and reviewed AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.18 Unit 2 Intake Structure - Aging Management Evaluation - Table 3.5.2-18

The staff reviewed Table 3.5.2-18 of the LRA, which summarized the results of AMR evaluations for the Unit 2 intake structure system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for intake and discharge structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, and walls) and hatches component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring

Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, and walls) and hatches component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in a sea water environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. During the audit and review, the staff expressed concerns regarding aging of concrete. The applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, and walls) component types in a sea water environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a sea water environment.

In RAI 3.5-7, the staff requested information about the members that will be monitored by the structures monitoring program and infrequently accessed area inspection program as follows:

> Structures Monitoring Program and Infrequently Accessed Area Inspection Program were listed as AMPs for Structural Reinforced Concrete (Beams, Columns, Floor slabs, Foundation mat slabs, Roof slabs, Walls) under column "Structural Member" and under

column "Notes" H, 20 in Tables 3.5.2-18 for Unit 2 and H, 23 in Table 3.5.2-27 for Unit 3. Please identify the structural components, such as beams and walls that are managed by either program or by both programs and provide basis for the selection of the program.

By letter dated November 9, 2004, the applicant stated that the structural member "Structural Reinforced Concrete" in Unit 2 LRA Table 3.5.2-18 and Unit 3 LRA Table 3.5.2-27 includes beams, columns, floor slabs, foundation mat slabs, roof slabs, and walls. The structural reinforced concrete components associated with the table line item with Note H, 20 (Unit 2) or H, 23 (Unit 3) are only the floor slabs, foundation mat slabs, and walls. As indicated in Note 20 in the Unit 2 LRA table (or Note 23 in the Unit 3 LRA table), the infrequently accessed area inspection program manages the effects of aging for structural members/components in the intake structure water bays between the waterline and the bottom of the intake structure operating deck since this area is infrequently accessed as described in LRA Appendix B, Section b2.1.15. The structures monitoring program manages the effects of aging for structural members/components in the water bay below the waterline since this area is inspected by the structures monitoring program AMP. The effects of aging for the walls are managed by both the infrequently accessed areas inspection program (above the waterline) and the structures monitoring program (below the waterline). The infrequently accessed area inspection program manages the effects of aging for the floor slabs (underside of the operating deck) and the structures monitoring program manages the effects of aging for the foundation mat slabs.

The staff finds the applicant's response acceptable because it identifies each structural component and its associated AMP.

3.5A.2.3.19 Sea Walls - Aging Management Evaluation - Table 3.5.2-19

The staff reviewed Table 3.5.2-19 of the LRA, which summarized the results of AMR evaluations in the SRP-LR for the sea walls system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for intake and discharge structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footings and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in a sea water environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. However, the NRC staff has expressed concerns regarding aging of concrete. Therefore, the applicant will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footings and walls) component types in a sea water environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation of this program is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. For these components, the staff finds this program acceptable for managing the aging effects of change in material properties due to alkali (cement)-aggregate reaction of concrete in a sea water environment.

3.5A.2.3.20 Unit 2 Discharge Tunnel and Discharge Structure - Aging Management Evaluation - Table 3.5.2-20

The staff reviewed Table 3.5.2-20 of the LRA, which summarized the results of AMR evaluations for the Unit 2 discharge tunnel and discharge structure system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for intake and discharge structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, roof slabs, and walls) component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in a sea water environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, roof slabs, and walls) component types in a sea water environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a sea water environment.

3.5A.2.3.21 Unit 2 Bypass Line - Aging Management Evaluation - Table 3.5.2-21

The staff reviewed Table 3.5.2-21 of the LRA, which summarized the results of AMR evaluations for the Unit 2 bypass line system component groups.

In RAI 3.5-13, the staff requested a clarification as to the reason Table 3.5.2-21 of Unit 2 and Table 3.5.2-31 of Unit 3 listed infrequently accessed area inspection program three times as the AMP for concrete pipes. The applicant was requested to explain the reason for listing the program three times.

By letter dated November 9, 2004, the applicant stated that each line item for concrete pipe in Unit 2 LRA Table 3.5.2-21 on page 3-507 and in Unit 3 Table 3.5.2-31 on page 3-613 was a unique line item with a corresponding NUREG-1801 Volume 2 Item and/or a note. As a result, some table data (such as the AMP) was repeated multiple times for these lines. For example, for the lines in the tables associated with the change of material properties aging effect for the concrete pipe, the first line is associated with NUREG-1801 item III.A6.1-b for the leaching of calcium hydroxide aging mechanism. The second line is associated with NUREG-1801 item III.A6.1-e for the aggressive chemical attack aging mechanism. Finally, the third line is not associated with a NUREG-1801 item since the alkali-aggregate reaction aging mechanism leading to a change of material properties is not included in NUREG-1801, although Dominion has conservatively included this aging mechanism as discussed in LRA Appendix C, Section C3.2.2. For each of these aging mechanisms that result in the change of material properties aging effect for the concrete pipe, the infrequently accessed areas inspection program AMP manages the identified aging effect.

The staff finds the applicant's response acceptable because it provided the reason for listing the infrequently accessed area inspection program as AMP three times for concrete pipes.

3.5A.2.3.22 Tank Foundations - Aging Management Evaluation - Tables 3.5.2-22 and 3.5.2-22a

The staff reviewed Table 3.5.2-22 of the LRA and Table 3.5.2-22a of the Applicant's supplement dated January 11, 2005, which summarized the results of AMR evaluations for the tank foundations system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs and walls) of the CST foundation and missile barrier, structural reinforced concrete (footing) of the fire water tanks 1 and 2 foundations, structural reinforced concrete of the diesel fuel oil storage tank foundation, and structural reinforced concrete (foundation mat slabs) of the RWST foundation and SBO diesel fuel oil storage tank foundation component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the Applicant's supplement dated January 11, 2005, the applicant stated that change of material properties of concrete for the structural reinforced concrete of the Unit 2 primary water storage tank in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effect of change in material properties of concrete in an atmosphere/weather environment.

3.5A.2.3.23 Yard Structures - Aging Management Evaluation - Table 3.5.2-23

The staff reviewed Table 3.5.2-23 of the LRA, which summarized the results of AMR evaluations for the yard structures system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structures.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including the lighting poles component type. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structures, that for aluminum in an air or an atmosphere/weather environment, there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in its MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack from a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs, roof slabs, and walls) of the RWST valve pit, hatches of pipe trenches, and structural reinforced concrete (foundation mat slabs and walls) of pipe trenches component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcements to control cracking, prevents the leaching of calcium hydroxide from structural concrete from being of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footings and walls) of transformer firewalls and dikes, structural reinforced concrete of the A700 switchgear enclosure dike, structural reinforced concrete (footing) of the diesel fuel oil storage tank dike, structural reinforced concrete (foundation mat slabs, roof slabs, and walls) of the RWST valve pit, hatches of pipe trenches, and structural reinforced concrete (footing) of security lighting supports component types due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5A.2.3.24 NSSS Equipment Supports - Aging Management Evaluation - Table 3.5.2-24

The staff reviewed Table 3.5.2-24 of the LRA, which summarized the results of AMR evaluations for the NSSS equipment supports system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for NSSS equipment supports.

In the LRA, the applicant stated that the GALL Report does not include a borated water leakage environment for the copper alloy steam generator support sliding support assembly component type. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for NSSS equipment supports, that for copper alloys in a borated water leakage environment, boric acid corrosion Is an aging mechanism for loss of material. The applicant stated that these components do not exceed the temperature threshold of 350 °F. Therefore, boric acid corrosion is a potential aging mechanism for copper alloys. On the basis of its review of the applicant's document, the staff concurred with the applicant and finds that boric acid corrosion is a potential aging mechanism for copper alloys.

In the LRA, the applicant stated that loss of material for the copper alloy steam generator support sliding support assembly component type in a borated water leakage environment is managed by AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The general condition monitoring program manages these aging effects by visual inspections for evidence of degradation or adverse conditions and includes heath physics inspections of radiologically controlled areas, system walkdowns by system engineering, and daily inspections of accessible areas of the plant by plant operators. Evidence of boron precipitation and active radioactive system leaks is identified during area observations made by health physics technicians while performing radiologically controlled area surveys. On the basis of its review, the staff finds the general condition monitoring program acceptable to manage the aging effect of loss of material for copper alloys for this environment.

In the discussion section of LRA Table 3.5.1, Item 3.5.1-33, the applicant stated, for Group B1.1: high strength low-alloy bolts in structures and component support systems, that cracking due to SCC is not an aging effect requiring management for NSSS equipment support bolting.

During the audit and review, the staff noted that SRP-LR Table 3.5-1 recommended GALL AMP XI.M18, "Bolting Integrity," for managing high strength bolting for NSSS components supports for crack initiation and growth due to SCC.

By letter dated January 11, 2005, the applicant stated:

> For NSSS component supports, bolting material with estimated maximum yield strength that marginally exceeds 150 ksi is used in limited applications. This bolting is located inside the Containment in areas where the environment is typically dry and not subject to high levels of contaminants, such as halogens and sulfur compounds, that result in the potential for SCC. Leakage within the Containment is monitored and strictly controlled during plant operation and is investigated and corrected such that the potential for wetting of NSSS component support bolting is minimal. Based on the marginally susceptible bolting materials and a dry, non-conducive (benign) service environment, cracking due to SCC is not an aging effect requiring management for this bolting.
>
> As identified in Millstone Power Station Unit 2 LRA Table 3.5.2-24 and Millstone Power Station Unit 3 LRA Table 3.5.2-35, loss of material is conservatively considered an aging effect requiring management for NSSS component support bolting and is managed by

the Inservice Inspection Program: Systems, Components and Supports AMP (which includes the elements of the ASME Section XI, Subsection IWF requirements as described in LRA Appendix B2.1.18). In addition, loss of material due to the potential for borated water leakage from nearby components is managed by the boric acid corrosion and general condition monitoring AMPs.

Since the boric acid corrosion and general condition monitoring programs ensure a dry, non-conducive (benign) service environment and the bolting material is managed by the inservice inspection program, the staff finds this acceptable.

3.5A.2.3.25 General Structural Supports - Aging Management Evaluation - Table 3.5.2-25

The staff reviewed Table 3.5.2-25 of the LRA, which summarizes the results of AMR evaluations for the general structural supports system component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for general structural supports.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including structural support components (plate structural shapes, etc.), vendor-supplied specialty items (spring hangers, struts, clamps, vibration isolators, etc.), and sliding support bearing and sliding surfaces component types.

During the audit and review, the staff questioned the applicant as to why the AMP B.2.1.18, "Inservice Inspection Program: Systems, Components and Supports," was not credited to manage loss of mechanical function, as described in the GALL Report. By letter dated January 11, 2005, the applicant stated that the inspection requirements for these supports associated with ASME XI IWF that are part of the CLB will carry forward to the period of extended operation.

On the basis of its review, the staff concurred with the applicant concerning the adequacy of inspections in accordance with ASME XI IWF.

The applicant also stated in the LRA that the sliding support assemblies within this component group include parts that are subject to relative motion. Therefore, the components may be exposed to hard particles that slide or roll across component surfaces under pressure. The portions of the support assembly that experience relative motion are in contact with Teflon based Fluorogold pads for low friction. Additionally, the relative motion is a result of thermal growth of the piping systems due to plant heat-up and cool-down cycles. The plant thermal cycles occur relatively infrequently and result in limited actual motion for wear to occur. Erosion (wear) of the surfaces is expected to be insignificant and erosion is not a potential aging mechanism. Therefore, no aging effects are applicable to this component/commodity group. On the basis of its review, the staff concurred with the applicant and finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for galvanized steel components exposed to air, including electrical conduit and cable tray component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant corrosion of carbon (galvanized steel) steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including electrical conduit and cable tray component types. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for general structural supports, that for aluminum in an air or an atmosphere/weather environment, there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in its MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack from a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

In the LRA, the applicant stated that the GALL Report does not include a borated water leakage environment for copper alloy sliding support bearing and sliding surfaces component types. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for general structural supports, that for copper alloys in a borated water leakage environment, boric acid corrosion is an aging mechanism for loss of material. The applicant stated that these components do not exceed the temperature threshold of 350 °F. On the basis of its review of the applicant's document, the staff concurred with the applicant and finds that boric acid corrosion is a potential aging mechanism for copper alloys.

In the LRA, the applicant stated that loss of material for copper alloy sliding support bearing and sliding surfaces component types in a borated water leakage environment is managed by AMP B2.1.13, "General Condition Monitoring," which is a plant-specific program. The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The general condition monitoring program manages these aging effects by visual inspections for evidence of degradation or adverse conditions, and includes heath physics inspections of radiologically controlled areas, system walkdowns by system engineering, and daily inspections of accessible areas of the plant by plant operators. Evidence of boron precipitation and active radioactive system leaks is identified during area observations made by health physics technicians while performing radiologically controlled area surveys. On the basis of its review, the staff finds that the general condition monitoring program is acceptable for managing the aging effect of loss of material for copper alloys for this environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an air environment, including electrical conduit and cable tray component types. The GALL Report does not include this material for these components.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for general structural supports, that for aluminum in an air or an atmosphere/weather environment, there are no potential aging mechanisms for this material and environment combination. The applicant stated in its MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 2. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack from a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

In RAI 3.5-12, the staff requested the information about the boric acid corrosion program on galvanized steel electrical conduit and cable trays. Table 3.5.2-25 of Unit 2 and Table 3.5.2-36 of Unit 3 list boric acid corrosion as an MP for galvanized steel electrical conduit and cable trays. The staff did not find that alvanized steel was included in the boric acid corrosion program as described in 2.1.3, and requested that the applicant address the discrepancy.

By letter dated November 9, 2004, the applicant stated the electrical conduit and cable trays listed in Unit 2 LRA Table 3.5.2-25 and Unit 3 LRA Table 3.5.2-36 are fabricated from carbon steel material that was galvanized for corrosion protection, and has been termed "galvanized steel" in the tables. Since no credit has been taken for the galvanized coating as described in LRA Appendix C, Section C2.4, the electrical conduit and cable trays loss of material aging effect due to boric acid corrosion is managed with the boric acid corrosion program. Accordingly, the applicant concluded that this material is in the category of materials termed "carbon and low alloy steel" in the boric acid corrosion program as described in B2.1.3.

The staff finds the applicant's response acceptable.

3.5A.2.3.26 Miscellaneous Structural Commodities - Aging Management Evaluation - Table 3.5.2-26

The staff reviewed Table 3.5.2-26 of the LRA, which summarized the results of AMR evaluations for the miscellaneous structural commodities component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for miscellaneous structural commodities.

In the LRA, the applicant stated that the GALL Report does not include silicone rubber for expansion joint/seismic gap material (between adjacent buildings/structures) component types in an air environment. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that for silicone rubber in an air environment, irradiation and thermal exposure are aging mechanisms for change of material properties. The applicant stated that expansion joint/seismic gap material may be exposed to ionizing radiation values greater than the threshold radiation of 10E6 rads and temperatures greater than the threshold of 95 °F. On the basis of its review of the applicant's document, the staff concurred with the applicant and finds that irradiation and thermal exposure are potential aging mechanisms for silicone rubber.

In the LRA, the applicant stated that change of material properties for expansion joint/seismic gap material (between adjacent buildings/structures) component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that structural monitoring activities are intended to assess the overall integrity and condition of structures, components, support systems, and specified architectural details. Qualified personnel perform periodic inspections to identify any changes in the structural condition, such as change in material properties. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to irradiation and thermal exposure of silicone rubber in an air environment.

In the LRA, the applicant stated that the GALL Report does not include silicone rubber for expansion joint/seismic gap material (between adjacent buildings/structures) component types in an air environment. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that for silicone rubber in an air environment, irradiation and thermal exposure are aging mechanisms for cracking. The applicant stated that expansion joint/seismic gap material may be exposed to ionizing radiation values greater than the threshold radiation of 10E6 rads and temperatures greater than the threshold of 95 °F. On the basis of its review of the applicant's document, the staff concurred with the applicant and finds that irradiation and thermal exposure are potential aging mechanisms for silicone rubber.

In the LRA, the applicant stated that cracking for expansion joint/seismic gap material (between adjacent buildings/structures) component types in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. Structural monitoring activities are intended to assess the overall integrity and condition of structures, components, support systems, and specified architectural details. Qualified personnel perform periodic inspections to identify any changes in the structural condition, such as cracking. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of cracking due to irradiation and thermal exposure of silicone rubber in an air environment.

In the LRA, the applicant stated that the GALL Report does not include Pyrocrete for fire-resistant coatings component types in an air environment. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that for Pyrocrete in an air environment, irradiation is an aging mechanism for change of material properties. The applicant stated that fire-resistant coatings material may be exposed to ionizing radiation values greater than the threshold radiation of 10E6 rads. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that irradiation is a potential aging mechanism for Pyrocrete.

In the LRA, the applicant stated that change of material properties for fire-resistant coatings in an air environment is managed by AMP B2.1.10, "Fire Protection Program," with an exception. The staff reviewed the fire protection program and its evaluation is documented in Section

3.0.3.2.7 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that the fire protection program, with an exception, manages, through periodic inspection and tests, the aging effects on penetration seals, fire barrier walls, ceilings, floors, and all fire-rated doors that perform a fire barrier intended function. Qualified personnel perform periodic inspections to identify any changes in condition, such as change in material properties. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to irradiation of Pyrocrete in an air environment.

In the LRA, the applicant stated that the GALL Report does not include Pyrocrete for fire-resistant coating component types in an air environment. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that for Pyrocrete in an air environment, differential movement, shrinkage, and vibration are aging mechanisms for cracking. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that differential movement, shrinkage, and vibration are potential aging mechanisms for Pyrocrete.

In the LRA, the applicant stated that cracking for fire-resistant coatings in an air environment is managed by AMP B2.1.10, "Fire Protection Program," with an exception. The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that the fire protection program, with an exception, manages, through periodic inspection and tests, the aging effects on penetration seals, fire barrier walls, ceilings, floors, and all fire-rated doors that perform a fire barrier intended function. Qualified personnel perform periodic inspections to identify any changes in condition, such as cracking. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of cracking due to differential movement, shrinkage, and vibration of Pyrocrete in an air environment.

In the LRA, the applicant stated that there are no aging effects for ceramic fire/EQ barrier penetration seals and concluded that no AMPs are required. The applicant stated that its AMR conclusion for the material is consistent with the GALL Report, which only calls for aging management of ceramic fire-barrier penetration seals that are exposed to an outdoor environment. On the basis of its review of the applicant's documentation and the fact that the ceramic materials are exposed only to indoor environments, the staff concurred with the applicant and finds that ceramic fire/EQ barrier penetration seals do not require aging management for the period of extended operation.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including fire boot component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of an aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff concludes that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant identified no aging effects for carbon steel components exposed to air, including cable tray cover and assembly; junction, terminal, and pull boxes; panels and cabinets; switchgear enclosures; and electrical component supports within cabinets and panels component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant stated that the GALL Report does not include marinite radiant energy shields component types in an air environment. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that for marinite radiant energy shields in an air environment, irradiation is a potential aging mechanism for change of material properties. The applicant stated that marinite radiant energy shields may be exposed to ionizing radiation values greater than the threshold radiation level of 10E6 rads. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that irradiation is a potential aging mechanism for marinite radiant energy shields.

In the LRA, the applicant stated that change of material properties for marinite radiant energy shields in an air environment is managed by AMP B2.1.10, "Fire Protection Program," with an exception. The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that the fire protection program, with an exception, manages, through periodic inspection and tests, the aging effects on penetration seals, fire barrier walls, ceilings, floors, and all fire-rated doors that perform a fire barrier intended function. Qualified personnel perform periodic inspections to identify any changes in condition, such as change in material properties. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to irradiation of marinite radiant energy shields in an air environment.

In the LRA, the applicant stated that the GALL Report does not include marinite radiant energy shields component types in an air environment. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that for marinite radiant energy shields in an air environment, differential movement, shrinkage, and vibration as aging mechanisms for cracking. The applicant stated that marinite radiant energy shields are subject to cracking due to differential movement, shrinkage, and vibration. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that differential movement, shrinkage, and vibration are potential aging mechanisms for marinite radiant energy shields.

In the LRA, the applicant stated that cracking for marinite radiant energy shields in an air environment is managed by AMP B2.1.10, "Fire Protection Program," with an exception. The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that the fire protection program, with an acceptable exception, manages, through periodic inspection and tests, the aging effects on penetration seals, fire barrier walls, ceilings, floors, and all fire-rated doors that perform a fire barrier intended function. Qualified personnel perform periodic inspections to identify any changes in condition, such as cracking. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of cracking due to differential movement, shrinkage, and vibration of marinite radiant energy shields in an air environment.

In the LRA, the applicant stated that the GALL Report does not include cracking of rubber for flood prevention plugs component types in an air environment. The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that for rubber in an air environment, thermal exposure is an aging mechanism for cracking. The applicant stated that rubber for flood prevention plugs may be exposed to temperatures greater than the threshold of 95 °F. On the basis of its review of the applicant's documentation, the staff concurred with the applicant and finds that thermal exposure is a potential aging mechanism for rubber.

In the LRA, the applicant stated that cracking for rubber flood prevention plugs in an air environment is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that structural monitoring activities are intended to assess the overall integrity and condition of structures, components, support systems, and specified architectural details. Qualified personnel perform periodic inspections to identify any changes in condition, such as cracking. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of cracking due to thermal exposure of rubber in an air environment.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities, that the MAER includes an evaluation of aluminum material in an air or an atmosphere/weather environment, and concluded that there are no potential aging mechanisms for these material/environment combinations. During the audit and review, the staff asked the applicant to explain why the evaluation is not in the MAER and the basis for its conclusions. The applicant stated to the staff that the MAER addresses aluminum material in an air or atmosphere/weather environment, and concluded that there are no potential aging mechanisms for these material/environment combinations at Unit 2. This conclusion is based on engineering test references, "Handbook of Corrosion Data," and "Uhlig's Corrosion Handbook." The "Handbook of Corrosion Data" indicates that aluminum and its alloys resist attack by a wide range of environments and many chemical compounds. Consequently, aluminum is one of the metals most thought of by the public and engineering community when lower temperature corrosion resistance is considered. "Uhlig's Corrosion Handbook" indicates that aluminum-based alloys as a class are highly resistant to normal outdoor exposure conditions. This conclusion in the MAER is also based on staff determinations, as presented in the SERs for other applicants' LRAs for plants that have environments, particularly outdoor environments, similar to MPS. Further, this conclusion is also supported by a review of Unit 2 plant-specific operating experience, which identifies no instances of loss of material for aluminum in an air or atmosphere/weather environment. The applicant stated to the staff that the conclusions in the LRA remain valid and unchanged. However, the applicant initiated a document modification request revise the MAER. Specifically, the MAER was revised to include the cited references in the aluminum/air and aluminum/atmosphere/weather sections. On the basis of its review, the staff finds the applicant's response to be acceptable.

The applicant stated, as documented in the staff's MPS audit and review report for the AMR for miscellaneous structural commodities that, for fire/EQ barrier penetration seals (including ceramic damming material) indicates N/A for the evaluation group. During the audit and review, the staff asked the applicant to explain how the ceramic damming material was evaluated for aging effects. The applicant stated to the staff that ceramic materials are similar to the glass and porcelain that are described in the MAER as having no aging effects. In its review, the staff finds that the applicant did not properly document this conclusion and the MAER does not specifically address ceramics. The applicant stated that the conclusions in the LRA remain valid and unchanged. However, the applicant initiated document modification request to revise the MAER to include ceramic along with glass and porcelain as having no aging effects that require evaluation for any application or environment to which it is exposed. In addition, the applicant initiated document modification requests to revise the AMR for miscellaneous structural commodities to indicate, in Section 4.0, that the MAER indicates no potential aging effects and no aging management required for ceramics. Therefore, the AMR does not evaluate aging mechanisms for the ceramic blanket or ceramic board in an air environment. On the basis of its review, the staff finds the applicant's response to be acceptable.

3.5A.2.3.27 Load Handling Cranes and Devices - Aging Management Evaluation - Table 3.5.2-27

The staff reviewed Table 3.5.2-27 of the LRA, which summarized the results of AMR evaluations for the load handling cranes and devices component groups. The staff interviewed the applicant's technical staff and reviewed the AMR technical justification for load handling cranes and devices.

In LRA, the applicant identified no aging effects for stainless steel components exposed to air, including fuel transfer machine and tilting mechanism support members (structural frame, tracks, and anchorage) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of an aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff concluded that there are no aging effects requiring management for metal in an air environment.

3.5A.2.3.28 Unit 2 Condensate Polishing Service Water Strainer House, Unit 2 Hydrogen Cylinder Storage Area, Unit 2 Sodium Hypochlorite Building

In its LRA supplement dated December 3, 2004, the applicant stated that changes of material properties in the structural reinforced concrete in an air or atmosphere/weather is managed by the AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that structural monitoring activities are intended to assess the overall integrity and condition of structures, components, support systems, and specified architectural details. Qualified personnel perform periodic inspections to identify any changes in condition, such as cracking. On the basis of its review, the staff finds this program acceptable for managing the aging effects of changes of material properties for the above component.

In the LRA supplement dated December 3, 2004, the applicant also stated that cracking of the concrete masonry block walls in atmosphere/weather environment is is managed by AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that structural monitoring activities are intended to assess the overall integrity and condition of structures, components, support systems, and specified architectural details. Qualified personnel perform periodic inspections to identify any changes in condition, such as cracking. On the basis of its review, the staff finds this program acceptable for managing the aging effects of cracking for the above component.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5A.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment, structures and component supports systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they are adequately describe the AMPs credited for managing aging of the containment, structures and component supports systems, as required by 10 CFR 54.21(d).

3.5B Unit 3 Aging Management of Containment, Structures and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the containment, structures and component supports associated with the following structures:

- containment
- structures and structural components
  - Unit 3 containment enclosure building
  - Unit 3 auxiliary building
  - Unit 3 control building
  - Unit 3 fuel building
  - railroad canopy
  - Unit 3 hydrogen recombiner building
  - Unit 3 engineered safety features building
  - Unit 3 main steam valve building
  - Unit 3 emergency generator enclosure and fuel oil tank vault
  - Unit 2 fire pump house
  - Unit 3 fire pump house
  - Unit 3 service building
  - Unit 3 turbine building
  - Unit 3 auxiliary boiler enclosure
  - Unit 3 technical support center
  - Unit 3 maintenance shop
  - Unit 3 Waste Disposal Building
  - SBO diesel generator enclosure and fuel oil tank vault
  - Unit 3 condensate polishing enclosure
  - Unit 2 condensate polishing facility and warehouse no. 5
  - security diesel generator enclosure
  - stack monitoring equipment building
  - millstone stack
  - switchyard control house
  - 345kV switchyard
  - Unit 3 circulating and service water pumphouse
  - Unit 3 west retaining wall
  - sea wall
  - Unit 3 circulating water discharge tunnel and discharge structure
  - Unit 3 recirculation tempering line
  - vacuum priming pumphouse
  - tank foundations
  - yard structures
- NSSS equipment supports
- general structural supports
- miscellaneous structural commodities
- load handling cranes and devices

3.5B.1 Summary of Technical Information in the Application

In LRA Section 3.5, the applicant provided AMR results for containment, structures and component supports components and component groups. In LRA Table 3.5.1, "Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Structures and Component Supports," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the containment, structures and component supports components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5B.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the containment, structures and components supports system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluation are documented in the staff's MPS audit report and summarized in Section 3.5B.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff verified that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.5.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluations are documented in the staff's MPS audit report and summarized in Section 3.5B.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the staff's MPS audit report and summarized in Section 3.5B.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.5B.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the containment, structures and components supports system components.

Table 3.5B-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.5 that are addressed in the GALL Report.

Table 3.5B-1 Staff Evaluation for Containment, Structures and Component Supports in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Common Components of All Types of PWR and BWR Containment				
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-01)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.6B.
Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-02)	Cracking due to cyclic loading; crack initiation and growth due to SCC	Containment inservice inspection (ISI) and Containment leak rate test		Not Consistent with GALL (See Section 3.5B.2.2.1)
Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-03)	Loss of material due to corrosion	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Section 3.5B.2.1)
Personnel airlock and equipment hatch (Item Number 3.5.1-04)	Loss of material due to corrosion	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Sections 3.0.3.2.11 and 3.5B.2.1)
Personnel airlock and equipment hatch (Item Number 3.5.1-05)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	Containment leak rate test and Plant Technical Specifications	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Sections 3.0.3.2.11 and 3.5B.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Seal, gaskets, and moisture barriers (Item Number 3.5.1-06)	Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16); Work control process (B2.1.25)	Not Consistent with GALL (See Sections 3.0.3.2.11 and 3.0.3.3.4)
PWR Concrete (Reinforced and Prestressed) and Steel Containment **BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment**				
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-07)	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends further evaluation (See Section 3.5B.2.2.1)
Concrete elements: foundation (Item Number 3.5.1-08)	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring	Structures monitoring program (B2.1.23)	Consistent with GALL (See Section 3.5B.2.2.1)
Concrete elements: foundation (Item Number 3.5.1-09)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring	Structures monitoring program (B2.1.23)	Consistent with GALL (See Section 3.5B.2.2.1)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-10)	Reduction of strength and modulus due to elevated temperature	Plant-specific		Not Applicable (See Section 3.5B.2.2.1)
Prestressed containment: tendons and anchorage components (Item Number 3.5.1-11)	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA	Not Applicable. This TLAA is evaluated in Section 4.5.1.
Steel element: liner plate and containment shell (Item Number 3.5.1-12)	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and Containment leak rate test	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends further evaluation (See Section 3.5B.2.2.1)
Steel elements: protected by coating (Item Number 3.5.1-14)	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	Inservice inspection program: containment inspections (B2.1.16)	Not Consistent with GALL (See Section 3.5B.2.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Prestressed containment: tendons and anchorage components (Item Number 3.5.1-15)	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	Inservice inspection program: containment inspections (B2.1.16)	Not applicable, containment is not a prestressed structure. (See Section 3.5B.2.2.1)
Concrete elements: foundation, dome, and wall (Item Number 3.5.1-16)	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	Inservice inspection program: containment inspections (B2.1.16)	Consistent with GALL, which recommends no further evaluation (See Section 3.5B.2.2.1)
Class I Structures				
All Groups except Group 6: accessible interior/exterior concrete steel components (Item Number 3.5.1-20)	All types of aging effects	Structures Monitoring	Structures monitoring program (B2.1.23); Infrequently accessed areas inspection program (B2.1.15)	Not Consistent with GALL (See Section 3.5B.2.2.2)
Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation (Item Number 3.5.1-21)	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant-specific	Structures monitoring program (B2.1.23)	Consistent with GALL, which recommends further evaluation (See Section 3.5B.2.2.2)
Group 6: all accessible / inaccessible concrete, steel, and earthen components (Item Number 3.5.1-22)	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance	Structures monitoring program (B2.1.23); Infrequently accessed areas inspection program (B2.1.15)	Not Consistent with GALL (See Sections 3.0.3.2.16 and 3.0.3.3.3)
Group 5: liners (Item Number 3.5.1-23)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Water chemistry and monitoring spent fuel pool water level	Chemistry control for primary systems program (B2.1.5)	Consistent with GALL, which recommends no further evaluation (See Section 3.5B.2.1)
Groups 1-3, 5, 6: all masonry block walls (Item Number 3.5.1-24)	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry Wall	Structures monitoring program (B2.1.23)	Consistent with GALL, which recommends no further evaluation (See Section 3.5B.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Groups 1-3, 5, 7-9: foundation (Item Number 3.5.1-25)	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring		Not Consistent with GALL (See Section 3.5B.2.2.1)
Groups 1-3, 5-9: foundation (Item Number 3.5.1-26)	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring		Not Consistent with GALL (See Section 3.5B.2.2.1)
Groups 1-5: concrete (Item Number 3.5.1-27)	Reduction of strength and modulus due to elevated temperature	Plant-specific		Not Applicable (See Section 3.5B.2.2.1)
Component Supports				
Groups 7, 8: liners (Item Number 3.5.1-28)	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Plant-specific	Work control process (B2.1.25)	Not Consistent with GALL (See Section 3.5B.2.2.2)
All Groups support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. (Item Number 3.5.1-29)	Aging of component supports	Structures Monitoring	Structures monitoring program (B2.1.23); General condition monitoring (B2.1.13); Battery rack inspections (B2.1.1); Infrequently accessed areas inspection program (B2.1.15)	Not Consistent with GALL (See Section 3.5B.2.2.3)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds (Item Number 3.5.1-30)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3B, Metal Fatigue
All Groups: support members: anchor bolts and welds (Item Number 3.5.1-31)	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion (B2.1.3); General condition monitoring (B2.1.13)	Not Consistent with GALL (See Sections 3.5B.2.3.35 and 3.5B.2.3.36)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolaters (Item Number 3.5.1-32)	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	Inservice inspection program: systems, components and supports (B2.1.18); Structures monitoring program (B2.1.23); General condition monitoring (B2.1.13)	Not Consistent with GALL, which recommends no further evaluation (See Section 3.5B.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Group B1.1: high strength low-alloy bolts (Item Number 3.5.1-33)	Crack initiation and growth due to SCC	Bolting integrity		Consistent with GALL (See Section 3.5B.2.3.35)

The staff's review of the MPS containment, structures and component supports and associated components followed one of several approaches. One approach, documented in Section 3.5B.2.1, involves the staff's review of the AMR results for components in the containment, structures and component supports that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.5B.2.2, involves the staff's review of the AMR results for components in the containment, structures and component supports that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.5B.2.3, involves the staff's review of the AMR results for components in the containment, structures and component supports that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the containment, structures and component supports components is documented in Section 3.0.3 of this SER.

3.5B.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Sections 3.5.2.1.1 through 3.5.2.1.38 of the LRA, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the containment, structures and component supports components:

- boric acid corrosion program
- chemistry control for primary systems program
- general condition monitoring program
- inservice inspection program: containment inspections
- structures monitoring program
- work control process program
- infrequently accessed areas inspection program
- inservice inspection program: systems, components and supports
- battery rack inspections
- fire protection program
- inspection activities: load handling cranes and devices

Staff Evaluation. In Tables 3.5.2-1 through 3.5.2-38 of the LRA, the applicant provided a summary of AMRs for the containment and containment internals, auxiliary building, turbine building and circulating and service water pumphouse,, yard structures, and structural commodities, and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

3.5B.2.1.1 Aging of Component Supports

In LRA Table 3.5.2-37 (page 3-655), the applicant stated that change of material properties and cracking of rubber material for watertight door gaskets in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The applicant also referenced GALL Item III. Item B4.2-a which specifies GALL AMP XI.S6, "Structures Monitoring Program" to manage these aging effects. The staff noted that Note E was used and that the component listed in the GALL Report is for vibration isolation elements while the component listed in the LRA table is a watertight door gasket. During the audit and review, the staff asked the applicant to explain why Note E was used instead of Note C.

In an LRA supplement dated July 7, 2004, the applicant stated that Note E should be Note C for the rubber material of the watertight door gasket structural member. In addition, the applicant made the same correction in the Unit 3 technical report for miscellaneous structural commodities. On the basis of its review, the staff finds the applicant's response acceptable.

In LRA Table 3.5.2-25 (page 3-535), the applicant stated that loss of material of carbon steel and low-alloy steel for structural support components in an air or atmosphere/weather environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Program," MPS AMP B2.1.23, "Structures Monitoring Program," and MPS AMP B2.1.13, "General Condition Monitoring" and GALL Item III.B2.1-a is matched. During the audit and review, the staff asked the applicant to explain why Note E was used for the infrequently accessed areas inspection program, Note A used for the structures monitoring program, and Note C was used for the general condition monitoring program. The applicant stated in that the Note C was incorrectly applied to these general condition monitoring line items and includes similar line items in LRA Table 3.5.2-36. Note A should have been applied since the general condition monitoring program performs the same inspections of structural supports as the structures monitoring program and is considered equivalent to GALL AMP XI.S6, "Structures Monitoring Program." MPS AMP B2.1.23 is used to manage aging of non-ASME class, large equipment supports; and MPS AMP B2.1.13 is used to manage aging of other non-ASME class supports.

In an LRA supplement dated July 7, 2004, the applicant stated that Note C should be Note A for the general condition monitoring line items in Unit 3 Table 3.5.2-36 (pages 3-643 through 3-648) since the general condition monitoring program performs the same inspections of structural supports for the structures monitoring program and is considered equivalent to GALL AMP XI.S6, "Structures Monitoring Program."

On the basis of its review of the applicant response, the staff finds the response acceptable.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in LRA Table 3.5.1 (Table 1), the applicant's reference to the GALL Report are acceptable, that the line items are consistent with GALL, and no further staff review is required.

Staff RAIs Pertaining to Recent Operating Experience and Emerging Issues. Because the GALL Report and SRP-LR were issued in July 2001, these documents do not reflect the most current recommendations for managing certain aging effects that have been the subject of recent operating experience or the topic of an emerging issue. As a result, the staff issued RAIs to determine how the applicant proposed to address these items for license renewal.

In RAI 3.5-5, the staff requested information about the members of structures other than containments that uses the structures monitoring program as an AMP. Under column "Structural Member" in Table 3.5.2-x, structures and component supports, structures monitoring program was listed as an AMP for many structural members, such as doors, sliding bearings, metal siding sealants, roofing, siding, scuppers, miscellaneous steel, expansion joint/seismic gap material, and flood door/gate gasket. Item 18 in Table A6.0-1, License Renewal Commitments, stated, "The Structures Monitoring Program and implementing procedures will be modified to include all in-scope structures." The staff assumed that the words "in-scope structures" included all structural members listed in Table 3.5.2-x that use the structures monitoring program as an AMP. The staff requested that the applicant confirm whether the staff's assumption is correct.

By letter dated November 9, 2004, the applicant stated that this assumption is correct. Any in scope structural members that are not currently in the structures monitoring program, such as those listed above, but are required to be inspected, will be added to the program prior to the period of extended operation.

The staff finds the applicant's response acceptable.

In RAI 3.5-11, the staff requested the applicant to discuss whether Millstone Units 2 or 3 had piping and component supports that are anchored to concrete by using bolts with yield strength greater than 150 ksi. If yes, the applicant was requested to identify the AMP for those bolts and provide basis for the selection of the AMP if bolting integrity program is not selected.

By letter dated November 9, 2004, the applicant stated that no piping or component supports in Millstone Unit 2 or 3 have been identified as being anchored to concrete using anchor bolts with specified yield strengths greater than 150 ksi.

The staff finds the applicant's response acceptable.

As a result of issues raised during the scoping and screening methodology audit (discussed in Section 2.1.3.1), the staff requested additional information concerning newly in-scope structures. The following is a discussion of the applicant's responses and the staff evaluations.

In response to RAI 2.4-7 (Unit 2) and RAI 2.4-11 (Unit 3), the applicant stated that the post-tensioned anchorage system for the sea walls is in scope and the AMR result concluded that there are no aging effects requiring management. The staff reviewed the anchorage detail, as shown in FSAR Figure 2.5-15, and found that there is sufficient concrete surrounding the post-tensioned anchorage system to protect it from the environment and, therefore, concurs with the applicant's conclusion.

In response to RAI 2.4-3, the applicant added thermal insulation around high temperature piping containment penetrations to the scope of license renewal. The applicant's AMR result concluded that there are no aging effects for the fiberglass, asbestos, and calcium silicate piping penetration thermal insulation. However, the applicant stated that the localized concrete temperature in the vicinity of high energy piping containment penetrations is maintained below the threshold value by the containment penetration cooling system, which consists of a ventilation system in Unit 2 (the containment penetration cooling system described in LRA Section 2.3.3.18) and a water cooling system in Unit 3 (as part of the reactor plant component cooling system described in LRA Section 2.3.3.6). Since the concrete temperature around the containment penetration is properly maintained, the staff considers the applicant's proposal acceptable.

In response to RAI 2.4-5, the applicant added the sealant and the penetration seals component types to the scope of license renewal, and stated that they will be monitored by containment Inspection AMP as modified by the response to RAI 3.5-1 provided in Dominion letter SN 04-674, dated November 9, 2004. The staff accepts the AMP as discussed in Section 3.5B.2.3.1 of this SER.

In response to RAI 2.4-13, the applicant stated that the groundwater underdrains storage tank and associated piping have bee added to the scope of license renewal. The staff evaluation is documented in Section 2.4B.1.2 of this SER.

In response to RAI 2.4-14, the applicant stated that rock dowels and rock anchors are in scope and are included in the structural member "Structural Reinforced Concrete" in LRA Tables 2.4.2-2, 2.4.2-12, and 2.4.2-13 and subject to aging management. The applicant was requested to identify the (1) the difference between rock dowels and rock anchors, and (2) the respective AMR/AMP sections in the LRA, if they were already included, or provide the AMR/AMP if they did not exist.

The applicant stated in its January 11, 2005 response that the rock dowels were designed as a passive support system (not pre-stressed). The rock anchors were stressed and locked off at a permanent load (pre-stressed) during installation. The rock dowels and rock anchors are not uniquely identified in the license renewal application, but are considered to be embedded steel in concrete, similar to reinforcing steel, plates, and anchor bolts, as described in LRA Section C3.3.3 "Corrosion of Embedded Steel – Concrete. The rock dowels and rock anchors are included with the structural reinforced concrete structural member in the aging management review results tables for the applicable structures. Rock dowels are part of the Auxiliary Building foundation mat slab and the aging management review results are provided in LRA Table 3.5.2-3 as structural reinforced concrete in a soil environment. Rock anchors are part of the foundation mat slab for the Service Building and part of the footing and grade beams for the Turbine Building and the aging management review results are provided in LRA Tables 3.5.2-13 and 3.5.2-14 as structural reinforced concrete in a soil environment.

The staff accepts the applicant's clarification.

On the basis of its audit and review, the staff determined that for AMRs not requiring further evaluation, as identified in LRA Table 3.5.1 (Table 1), the applicant's references to the GALL Report are acceptable, that the line items are consistent with GALL, and no further staff review is required.

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL

Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5B.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In Section 3.5.2.2 of the LRA, the applicant provided further evaluation of aging management as recommended by the GALL Report for containment, structures and component supports. The applicant provided information concerning how it will manage the following aging effects:

- aging of inaccessible concrete areas
- cracking, distortion, and increase in component stress level due to settlement; reduction of foundation strength due to erosion of porous concrete subfoundations, if not covered by structures monitoring program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to corrosion in inaccessible areas of steel containment shell or liner plate
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to cyclic loading and SCC
- aging of structures not covered by structures monitoring program
- aging management of inaccessible areas
- aging of supports not covered by structures monitoring program
- cumulative fatigue damage due to cyclic loading

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff audited the applicant's further evaluations against the criteria contained in Section 3.5.2.2 of the Standard Review Plan for License Renewal. Details of the staff's audit review are documented in the staff's MPS audit and review report.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.5B.2.2.1 PWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which addresses several areas discussed below.

Aging of Inaccessible Concrete Areas. The staff reviewed LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1. In LRA Section 3.5.2.2.1.1, the applicant addressed aging of inaccessible concrete areas for the Unit 3 containment.

For inaccessible portions of the containment structure, 10 CFR 50.55a(b)(2)(ix) requires that the applicant evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas.

The AMP recommended by the GALL Report for managing the aging of the accessible portions of the containment structures is GALL AMP XI.S2, "ASME Section XI, Subsection IWL." The applicant addressed this with MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections." The staff reviewed the inservice inspection program: containment inspections and its evaluation is documented in Section 3.0.3.2.11 of this SER. Subsection IWL exempts from examination those portions of the concrete containment that are inaccessible (e.g., foundation, below-grade exterior walls, or concrete covered by liner).

The applicant also used MPS AMP B2.1.23, "Structures Monitoring Program" where accessible areas are monitored for evidence of aging effects that may be applicable to containment structures. This program, which is consistent with GALL AMP XI.S6, "Structures Monitoring Program," with enhancements, was reviewed by the staff and its evaluation is documented Section 3.0.3.2.16 of this SER. The applicant also credited the structures monitoring program for the examination of below-grade concrete when it is exposed by excavation.

In the GALL Report, Volume 2, Chapter II, Table A1 (as modified by ISG-3), further evaluation is recommended to manage the aging effects for containment concrete components located in inaccessible areas if the aging mechanisms of (1) freeze-thaw, (2) leaching of calcium hydroxide, (3) aggressive chemical attack, (4) reaction with aggregates, or (5) corrosion of embedded steel are significant. Possible aging effects for containment concrete structural components due to these five aging mechanisms are cracking, change in material properties, and loss of material.

(1) Freeze-thaw - SRP-LR Section 3.5.2.2.1.1 does not address freeze-thaw as an aging mechanism for concrete containments because no further evaluation is recommended in the GALL Report. However, ISG-3, "Chapters II and III fo GALL Report on Aging Management of Concrete Elements," clarifies the staff position that further evaluation is appropriate if the applicant's facility is subject to moderate to severe weathering conditions unless the concrete meets certain specifications and subsequent inspections have confirmed that the aging mechanism has not caused degradation of the concrete.

    Unit 3 is located in a region considered to be subject to severe weather conditions. In the LRA, the applicant stated that Unit 3 concrete structures are designed in accordance with specification ACI 318-63, "Building Code Requirements for Reinforced Concrete," which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

    - high cement content
    - low water-to-cement ratio
    - proper curing
    - adequate air entrainment

In addition to ACI 318-63, the applicant stated that Unit 3 concrete also meets the criteria of guidelines ACI 201.2R-77, "Guide to Durable Concrete." ACI 318-63 and ACI 201.2R-77 use the same ASTM standards for selection, application, and testing of concrete.

The Unit 3 containment structure is protected from precipitation by an enclosure building which also prevents potential freeze-thaw action. During the audit and review, the staff interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that loss of material from freeze-thaw has not been observed, either through the inservice inspection - IWL program or the structures monitoring program.

On the basis of its review, the staff finds that loss of material and cracking due to freeze-thaw will be adequately managed by the containment inservice inspection program because: (1) that concrete that satisfies the requirements of ACI 318-63 will meet the requirements of ISG-3, (2) an audit of operating experience evaluated under the inservice inspection program: containment inspections and structures monitoring programs, and (3) the containment structure is protected from the elements by an enclosure structure.

(2) Leaching of calcium hydroxide - SRP-LR Section 3.5.2.2.1.1 states that cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report, as updated by ISG-3, recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria cannot be satisfied.

The GALL Report states that leaching of calcium hydroxide becomes significant only if the concrete is exposed to flowing water. Even if reinforced concrete is exposed to flowing water, such leaching is not significant if the concrete is constructed to ensure that it is dense, well-cured, has low permeability, and that cracking is well controlled.

In the LRA, the applicant stated that Unit 3 concrete structures are designed in accordance with specification ACI 318-63 and meet the criteria of guideline ACI 201.2R-77.

The staff finds that because ACI 318 and ACI 201.2R-77 provides assurance that the criteria of the GALL Report and ISG-3 are met, leaching of calcium hydroxide is not significant at Unit 3. The staff therefore concludes that the inservice inspection program: containment inspections program will be sufficient for management of increases in porosity and permeability from this aging mechanism. A plant-specific AMP is not required to address this aging effect.

(3) Aggressive chemical attack - SRP-LR Section 3.5.2.2.1.1 states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report and ISG-3 cannot be satisfied.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than 1,500 ppm. ISG-3 also states that a plant-specific program is required to examine representative samples of below-grade concrete when excavated for any reason.

In the LRA, the applicant stated that the below-grade environment is not aggressive (pH is less than 5.5, chlorides are less than 500 ppm, and sulfates are less than 1,500 ppm). In addition, the staff noted that the applicant used the structures monitoring program for the examination of below-grade concrete when it is exposed by excavation.

On the basis of the information provided in the LRA and the guidelines provided in the SRP-LR, the GALL Report, and ISG-3, the staff finds that increases in porosity and permeability, loss of material (spalling, scaling) and cracking due to aggressive chemical attack are not significant for concrete in Unit 3 containment inaccessible areas. The applicant used MPS AMP B2.1.23, "Structures Monitoring Program" to test the ground water on a periodic basis, considering seasonal variations to ensure the aging mechanism of aggressive chemical attack does not become significant in the future and also to examine below-grade concrete when it is exposed by excavation. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff finds that the structures monitoring program is an appropriate program for examination of below-grade concrete when it becomes accessible.

(4) Reaction with aggregates - SRP-LR Section 3.5.2.2.1.1 does not address reaction with aggregates as an aging mechanism for concrete containments because no further evaluation is recommended in the GALL Report. However, ISG-3 clarifies the staff position that further evaluation is appropriate if investigations, tests, or examinations have demonstrated that the aggregates are reactive.

In the LRA, the applicant stated that Unit 3 concrete structures are designed in accordance with specification ACI 318-63 and meet the criteria of guideline ACI 201.2R-77. The ACI standards call for the testing of aggregates at the time of construction.

On the basis of interviews with the applicant's technical staff, the staff confirmed that the results of those tests show that the aggregates used for the Unit 3 concrete containment at MPS are not reactive. The staff finds that this aging effect does not require management at MPS. However, the applicant stated, in the LRA, that it will manage change of material properties as a potential aging effect on concrete structures. In the LRA, the applicant stated that change of material properties for the Unit 3 containment due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections" and MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed these programs and its evaluation is documented in Sections 3.0.3.2.11 and 3.0.3.2.16 of this SER, respectively.

(5) Corrosion of embedded steel - SRP-LR Section 3.5.2.2.1.1 states that loss of material due to corrosion of embedded steel could occur in inaccessible areas of PWR concrete and steel containments. The GALL Report (updated in ISG-3) recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

For cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel, the GALL Report states that a plant-specific program is only recommended if the below-grade environment is aggressive. ISG-3 also states that a plant-specific program is recommended to examine representative samples of below-grade concrete when excavated for any reason.

In the LRA, the applicant stated that the below-grade environment is not aggressive (pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1,500 ppm). The staff noted that the applicant credited the structures monitoring program for the examination of below-grade concrete when it is exposed by excavation. In addition, the applicant committed, in its structures monitoring program, to periodically monitor below-grade chemistry to ensure that the groundwater is not sufficiently aggressive to cause the below-grade concrete to degrade.

The staff finds that, in accordance with the criteria of the GALL Report, this aging effect is not significant and is adequately managed.

The staff reviewed the results of the applicant's AMR for inaccessible concrete areas. On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of aging of inaccessible concrete areas for containment, as recommended in the GALL Report and ISG-3. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Cracking, Distortion, and Increase in Component Stress Level Due to Settlement; Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program</u>. The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2.

In LRA Section 3.5.2.2.1.2, the applicant addressed (1) cracking, distortion and increase in component stress level due to settlement and (2) reduction of foundation strength due to erosion of porous concrete subfoundations in the containment.

SRP-LR Section 3.5.2.2.1.2 states that cracking, distortion, and increase in component stress level due to settlement could occur in PWR concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR containments. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated, in the LRA, that aging effects (cracking, distortion, and increase in component stress level) due to settlement; and reduction of foundation strength due to erosion of porous concrete subfoundations are not expected at Unit 3. The applicant also stated that Unit 3 structures are founded on bedrock, well-consolidated in-situ material, or compacted fill. A porous concrete subfoundation is installed beneath the reinforced concrete foundation mat for Unit 3 containment and a portion of the ESF building to control groundwater seepage through or around the waterproof membrane. Breaches in the waterproof membrane around the Unit 3 containment have been identified, which has resulted in water seepage through the membrane and the porous concrete subfoundation. Aging effects associated with porous concrete subfoundation degradation and the resulting potential for settlement of Unit 3 containment are managed by MPS AMP B2.1.23, "Structures Monitoring Program." An installed de-watering system removes water that seeps through the membrane. Most of the ESF building is founded on bedrock and only a small portion of the ESF building is founded on a porous concrete subfoundation that is placed on the bedrock. Therefore, cracking due to settlement is not a concern associated with the ESF building. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed the AMR results involving management of aging effects resulting from settling and erosion of porous concrete subfoundations and confirmed that the structures monitoring program addressed each of the affected structures and components.

In RAI 3.5-3, the staff requested information regarding the erosion of high-alumina cement from the porous concrete sub-foundation as follows:

> In item number 3.5.1-08, the applicant asserts that settlement is not expected to occur during the period of extended operation. Further evaluation provided in Subsection 3.5.2.2.1.2 indicates that the containment and part of the engineering safety feature building foundation mats are sitting on porous concrete foundation. During years 1996-1997, it was revealed that drainage water through the porous foundation consisted of significant amount of high alumina cement, and that the applicant was monitoring depletion of cement and settlement of the affected structures (see NRC Info Notice 97-11). The applicant was requested to provide a summary of the quantitative assessment of the depletion of cement and its affects on the settlement of the structures during the period of extended operation. Also, the applicant was requested to justify why this item should not require a TLAA.

By letter dated December 3, 2004, the applicant stated:

> Settlement of the Millstone Unit 3 containment structure is not considered a TLAA. This analysis does not involve time-limited assumptions since even assuming the worst case situation represented by a complete loss of all concrete in the porous concrete subfoundation, the resultant change in frequency characteristics are within the uncertainty range allowed for the peak broadened spectra used in the design of the containment structure (M. H. Brothers to NRC, Millstone Power Station Unit No. 3 – Response to Request for Additional Information on Erosion of Cement from the Underlying Porous Concrete Drainage System, Millstone Unit No. 3, Letter B16403 dated April 30, 1997).
>
> Millstone Unit 3 has performed extensive analysis of the condition of the porous concrete subfoundation, including the effect of cement erosion, the potential loss of strength of the

subfoundation due to conversion of the high alumina cement, the effect of cement erosion on the load bearing capacity of the porous concrete, and the functional integrity of the containment structure (J. A. Price to NRC, Millstone Power Station Unit No. 3 License Renewal – Request for Exemption From the Requirements of 10 CFR 54.17(c), Response to Request for Additional Information, Letter B18948 dated September 3, 2003). The mass loss of high alumina (calcium-alumina) residue discharged into the ESF sumps has been monitored since the startup of Millstone Unit 3 in 1986. A commitment (captured in the structures monitoring program) to continue this periodic monitoring was made as a means of insuring that no new or adverse changes are occurring in the porous concrete subfoundation (M. L. Bowling to NRC, Millstone Nuclear Power Station Unit 3, Response to Request for Additional Information – Erosion of Cement From the Underlying Porous Concrete Drainage System, Letter B17115 dated April 16, 1998). ESF sump sample results can be found in Table 1. These results are conservatively projected to year 2026 (480 months) in Figure 1. The 480 months represents the current 40-year license x 12 months/year. By 2026 approximately 3,600 pounds (or 0.5%) of the 670,000 pounds of calcium-alumina cement in the porous media could be lost. This loss is not expected to adversely affect the function of the porous media (NRC to M. L. Bowling, NRC Combined Inspection 50-245/98-208; 50-336/98-208; 50-423/98-208 and Notice of Violation, Letter A13866 dated August 12, 1998).

As a result of a follow-up question related to the cumulative effect of the erosion and its effects on the settlement of the Millstone 3 containment structure, the applicant provided a detailed summary of the analyses and inspections it had performed, and commitments it has made to NRC. The essential items of the commitments (Table 2) as applicable during the period of extended operation are as follows:

Table 2 Millstone Unit 3 - Containment Basemat Commitments Made in Previous Correspondence

Number	Commitment	Status
B17115-01	Monitoring of the HAC porous concrete and portland cement porous concrete groundwater chemistry to confirm the subcontainment chemical and environmental conditions	Yearly
B17115-02	Measuring of the white residue/mass-loss of calcium-alumina in the ESF sumps	Semi-annually
B17115-03	Inspection of the sub-containment drainage piping in the ESF sumps	Yearly
B17115-04	Containment structure settlement monitoring	External surveys every 2 years; internal ISI every 3 years

Based on the trend line drawn by the applicant, the cumulative projected loss of high alumina cement is about half a percent of the calcium alumina cement in porous media by the year 2026. Based on the review of a number of analyses (including seismic analysis) performed by the applicant during CLB, the staff agrees with the applicant's assertion that containment will perform its intended function during the period of extended operation. The staff believes that this item is a candidate for a TLAA. However, based on the commitments made by the applicant to monitor the magnitude of erosion of the porous concrete from the subfoundation and monitoring the containment structures for signs of differential settlement, the staff finds the applicant's program for managing the erosion of the containment subfoundation acceptable.

On the basis of this review, the staff concludes that the applicant has appropriately evaluated AMR results involving cracking, distortion, and increase in component stress level from settlement and reduction of foundation strength from erosion, as recommended in the GALL Report.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. In LRA Section 3.5.2.2.1.3, the applicant addressed reduction of strength and modulus of concrete structures due to elevated temperature in containments.

SRP-LR Section 3.5.2.2.1.3 states that reduction of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments. The GALL Report calls for a plant-specific aging management program and recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits (i.e., general area temperature 66°C (150°F) and local area temperature 93°C (200°F)).

In LRA Section 3.5.2.2.1.3, the applicant stated that during normal operation, all areas within the containment building do not experience elevated temperatures greater than 150 °F general and greater than 200 °F local. Therefore, change in material properties due to elevated temperature is an aging effect not requiring management for the Unit 3 containment concrete.

On the basis of its review, the staff concurs with the applicant and concludes that change in material properties due to elevated temperature is an aging effect not requiring management for the Unit 3 containment concrete.

Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate. The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4.

In LRA Section 3.5.2.2.1.4, the applicant addressed loss of material due to corrosion in inaccessible areas of the steel containment shell or the steel liner plate for the containment.

SRP-LR Section 3.5.2.2.1.4 states that loss of material due to corrosion could occur in inaccessible areas of the steel containment shell or the steel liner plate for all types of PWR containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if the following specific criteria defined in the GALL Report cannot be satisfied: (1) concrete meeting the guidelines of ACI 318 or ACI 349 and the guidance of 201.2R was used for the containment concrete in contact with the embedded containment shell or liner; (2) the accessible concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner; (3) the accessible portion of the moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with IWE requirements; (4) borated water spills and water ponding on the containment concrete floor are not common and when detected are cleaned up in a timely manner.

In the LRA, the applicant stated that the containment concrete in contact with the steel liner plate is designed in accordance with ACI 318-63, and meets the guideline ACI 201.2R-77. Accessible concrete of the containment structure is monitored for penetrating cracks under MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections." The staff reviewed the inservice inspection program: containment inspections program, with exceptions, and its evaluation is documented in Section 3.0.3.2.11 of this SER. In addition, the applicant stated, in the LRA, that the accessible portions of the steel liner plate and moisture barrier where the liner becomes embedded are inspected in accordance with MPS AMP B2.1.16, "Inservice Inspection

Program: Containment Inspections." Spills (e.g., borated water spill) are cleaned up in a timely manner. The aging effect of loss of material due to corrosion has not been significant for Unit 3 liner plate.

On the basis of its review, the staff finds that all of the criteria identified in the GALL Report are satisfied. The staff finds that no additional, plant-specific AMP is required to manage inaccessible areas of the steel containment liner plate.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving loss of material due to corrosion in inaccessible areas of the steel containment shell or the steel liner plate, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature. In LRA Section 3.5.2.2.1.5, the applicant stated that the Unit 3 containment is not a prestressed structure therefore, this item is not applicable.

The staff concurs with the applicant and finds that this aging effect is not applicable to MPS Unit 3.

Cumulative Fatigue Damage. As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.6 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.6 of the SRP-LR.

Cracking Due to Cyclic Loading and Stress Corrosion Cracking. The staff reviewed LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7.

In LRA Section 3.5.2.2.1.7, the applicant addressed aging mechanisms that can lead to cracking of penetration sleeves and penetration bellows such as cyclic loads and SCC.

SRP-LR Section 3.5.2.2.1.7 states that cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC could occur in containments. Further evaluation of inspection methods is recommended to detect cracking due to cyclic loading and SCC since visual VT-3 examinations may be unable to detect this aging effect.

In LRA Section 3.5.2.2.1.7, the applicant stated that stress corrosion cracking is applicable to carbon and low-alloy steel in air only if the fabrication material is high yield strength steel. SCC of stainless steel in air is only applicable to sensitized stainless steel that is exposed to intermittent wetting. Unit 3 containment penetrations, including penetration sleeves, bellows, and dissimilar metal welds, are not fabricated form high yield strength steel and the stainless steel materials are not subject to intermittent wetting. Therefore, cracking due to SCC does not require aging management for the Unit 3 containment.

The staff reviewed and concurs with the applicant that cracking due to SCC is not an applicable aging effect for MPS, and augmented inspection to detect cracking is not necessary.

In RAI 3.5-2, the staff requested information about the containment pressure boundary bellows as follows:

> In discussing item number 3.5.1-03 (Table 3.5.1) of the LRA, the applicant asserted that the Millstone AMR results are consistent with NUREG-1801. NUREG-1801 under item A3.1 (page II A3.6) recommends further evaluation regarding the stress corrosion cracking of containment bellows. Table 3.5.2, under "Expansion Bellows" makes reference to the Table items 3.2.1-05 and 3.2.1-06. However, they did not address the expansion bellows associated with the containment pressure boundary. Normally, applicants take credit for properly designed Type B tests to ensure the leak tight behavior of the bellows. However, in AMP B2.1.6, the applicant does not take credit for Type B testing. The applicant was requested to provide additional information regarding the containment pressure boundary bellows at Millstone 2 and 3, relevant operating experience, and method(s) used to detect their age related degradation.

By letter dated December 3, 2004, the applicant provided the following response:

> As identified in the response to RAI 3.5-1, Dominion will credit Local Leak Rate Tests in accordance with 10 CFR 50 Appendix J requirements for Type B penetrations. Both Millstone Units 2 and 3 have bellows type penetrations associated with the design of their respective fuel transfer tubes. These are the only examples of bellows type penetrations for either unit. The Millstone Unit 2 bellows type penetration does not form any portion of the Containment pressure boundary, and therefore, does not require leak rate testing in accordance with Appendix J requirements. Millstone Unit 3 includes the bellows type penetration for the fuel transfer tube in its Appendix J program as a Type B containment penetration. In accordance with Appendix J requirements, each time a Type B penetration has been opened, it must have a Type B test performed after closure to reestablish the containment boundary integrity. As such, this bellows type penetration is Local Leak Rate Tested during each refueling outage after completion of refueling activities and after the penetration flange has been reinstalled and verified as leak tight to establish the containment boundary.

The staff finds the response to RAI 3.5-2 acceptable, as the leak rate testing provisions will adequately ensure the integrity of the Millstone 3 containment penetration bellows.

Cracking due to cyclic loading of the liner plate and penetrations is a TLAA which is evaluated and addressed in Section 4.6 of this SER.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of cracking due to SCC for containment components, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5B.2.2.2 Class 1 Structures.

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which addresses several areas discussed below.

Aging of Structures Not Covered by Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1. In LRA Section 3.5.2.2.2.1, the applicant addressed aging of Class 1 structures not covered by the structures monitoring program.

SRP-LR Section 3.5.2.2.2.1 states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring program. This is described in GALL Report Chapter III and includes (1) scaling, cracking, and spalling due to repeated freeze-thaw for Groups 1-3, and 5, and 7-9 structures; (2) scaling, cracking, spalling and increase in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack for Groups 1-5 and 7-9 structures; (3) expansion and cracking due to reaction with aggregates for Groups 1-5 and 7-9 structures; (4) cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Groups 1-5 and 7-9 structures; (5) cracks, distortion, and increase in component stress level due to settlement for Groups 1-3, 5,and 7-9 structures; (6) reduction of foundation strength due to erosion of porous concrete subfoundations for Groups 1-3, 5-9 structures; (7) loss of material due to corrosion of structural steel components for Groups 1-5 and 7-8 structures; (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1-5; and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Groups 7 and 8 structures. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

Also, technical details of the aging management issue are presented in SRP-LR Subsection 3.5.2.2.1.2 for structure/aging effect combinations Items (5) and (6) and SRP-LR Subsection 3.5.2.2.1.3 for Item (8), above.

In LRA Table 3.5.1, Item 3.5.1-20 (page 3-502), the applicant credits MPS AMP B2.1.23, "Structures Monitoring Program" for all types of aging effects and all component groups except Group 6 of accessible interior and exterior concrete and steel components of Class 1 structures. The staff reviewed the structure monitoring program and its evaluation is documented Section 3.0.3.2.16 of this SER. Additional discussion of specific structure/aging effect combinations follows.

(1) Freeze-thaw - SRP-LR Section 3.5.2.2.2.1 addresses freeze-thaw as an aging mechanism for Class 1 structures. ISG-3 clarifies the staff position that further evaluation is appropriate if the applicant's facility is subject to moderate to severe weathering conditions unless the concrete meets certain specifications and subsequent inspections have confirmed that the aging mechanism has not caused degradation of the concrete.

    Unit 3 is located in a region considered to be subject to severe weather conditions. In the LRA, the applicant stated that Unit 3 structures are designed in accordance with specification ACI 318-63, which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

- high cement content
- low water-to-cement ratio
- proper curing
- adequate air entrainment

In addition to ACI 318-63, the applicant stated that Unit 3 concrete also meets criteria of the guideline of ACI 201.2R-77. ACI 318-63 and ACI 201.2R-77 use the same ASTM standards for selection, application and testing of concrete.

The staff interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that loss of material from freeze-thaw has not been observed through MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER.

On the basis that concrete that satisfies the criteria of ACI 318-63 will meet the guidelines of ISG-3, and on the basis of an audit of operating experience evaluated under the structures monitoring program, the staff finds that loss of material and cracking due to freeze-thaw will be adequately managed by the structures monitoring program.

(2a) Leach's of calcium hydroxide - SRP-LR Section 3.5.2.2.2.1 states that cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide could occur in Class 1 structures. The GALL Report recommends a plant-specific AMP for inaccessible areas, unless the criteria of ACI 201.2R-77 for Class 1 structural concrete are met.

The GALL Report states that leaching of calcium hydroxide becomes significant only if the concrete is exposed to flowing water. Even if reinforced concrete is exposed to flowing water, such leaching is not significant if the concrete is constructed to ensure that it is dense, well-cured, has low permeability, and that cracking is well controlled.

In the LRA, the applicant stated that Unit 3 concrete structures are designed in accordance with specification ACI 318-63 and meet the criteria of guideline ACI 201.2R-77.

The staff finds that because ACI 318 provides assurance that the criteria of the GALL Report and ISG-3 are met, leaching of calcium hydroxide is not significant at Unit 3, and therefore concludes that the structures monitoring program will be sufficient for management of increases in porosity and permeability from this aging mechanism. A plant-specific AMP is not required to address this aging effect.

(2b) Aggressive chemical attack - SRP-LR Section 3.5.2.2.2.1 states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack could occur in inaccessible areas of Class 1 structures. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report and updated in ISG-3 cannot be satisfied.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than 1,500 ppm. ISG-3 also states that a plant-specific program is required to examine representative samples of below-grade concrete when excavated for any reason.

In the LRA, the applicant stated that the below-grade environment is not aggressive (pH is greater than 5.5, chlorides are less than 500 ppm, and sulfates are less than 1,500 ppm). In addition, the staff noted that the applicant used the structures monitoring program for the examination of below-grade concrete when it is exposed by excavation.

On the basis of its review of the information provided in the LRA and the guidelines provided in the SRP-LR, the GALL Report, and ISG-3, the staff finds that increases in porosity and permeability, loss of material (spalling, scaling) and cracking due to aggressive chemical attack are not significant for concrete in inaccessible areas. The staff finds that an appropriate AMP for examination of below-grade concrete (specifically, an enhancement to the structures monitoring program) has been identified.

(3) Reaction with aggregates - SRP-LR Section 3.5.2.2.2.1 addresses reaction with aggregates as an aging mechanism for Class 1 structures. ISG-3 clarifies the staff position that further evaluation is appropriate if investigations, tests, or examinations have demonstrated that the aggregates are reactive.

In the LRA, the applicant stated that Unit 3 concrete structures are designed in accordance with specification ACI 318-63 and meets the requirements of guideline ACI 201.2R-77. The ACI standards call for the testing of aggregates at the time of construction.

On the basis of interviews with the applicant's technical staff, the staff confirmed that the results of those tests showed that the aggregates used for concrete Class 1 structures at Unit 3 are not reactive. However, the applicant stated that it will manage cracking as a potential aging effect on concrete structures. In the LRA, the applicant stated that change of material properties and cracking due to alkali (cement)-aggregate reaction of concrete in various environments is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER.

(4) Corrosion of embedded steel - SRP-LR Section 3.5.2.2.2.1 states that cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas of Class 1 structures. The GALL Report (updated in ISG-3) recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

Also, for cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel, the GALL Report states that a plant-specific program is only recommended if the below-grade environment is aggressive. ISG-3 also states that a plant-specific program is recommended to examine representative samples of below-grade concrete when excavated for any reason.

The staff finds that, in accordance with the criteria of the GALL Report, these aging effects are not significant and are adequately managed by MPS AMP B2.1.23 "Structures

Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also finds an enhancement to the structures monitoring program for examination of below-grade concrete to be acceptable.

(5) Settlement - SRP-LR Section 3.5.2.2.2.1 refers to Section 3.5.2.2.1.2 for discussion of settlement. SRP-LR Section 3.5.2.2.1.2 states that cracking, distortion, and increase in component stress level due to settlement could occur in Class 1 structures. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated, in the LRA, that aging effects (cracking, distortion, and increase in component stress level) due to settlement; and reduction of foundation strength due to erosion of porous concrete subfoundations are not expected at Unit 3 for Class 1 structures. The applicant stated that Unit 3 Class 1 structures are founded on bedrock, well-consolidated in-situ material, or compacted fill. Also, no Class 1 structures utilize porous concrete subfoundations, other than a portion of the ESF building, which is on bedrock. In addition, the applicant stated that Unit 3 has a dewatering system under some Class 1 structures which is monitored by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER.

On the basis of its review, the staff concludes that foundation settlement is not an aging mechanism at Unit 3.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of settlement, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

(6) Erosion of porous concrete subfoundation - SRP-LR Section 3.5.2.2.2.1 refers to Section 3.5.2.2.1.2 for discussion of erosion of porous concrete subfoundation. SRP-LR Section 3.5.2.2.1.2 states that reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of Class 1 structures. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

The applicant stated, in the LRA, that aging effects (cracking, distortion, and increase in component stress level) due to settlement; and reduction of foundation strength due to erosion of porous concrete subfoundations are not expected at Unit 3 for Class 1 structures. The applicant stated that Unit 3 Class 1 structures are founded on bedrock, well-consolidated in-situ material, or compacted fill. No structures utilize porous concrete subfoundations, other than a portion of the ESF building, which is on bedrock. In addition, the applicant stated that Unit 3 has a dewatering system under some Class 1 structures which is monitored by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER.

Based on the fact that no Unit 3 structures utilize porous concrete subfoundations, other than a portion of the ESF building which is on bedrock and that Unit 3 has a dewatering system under some Class 1 structures, the staff concludes that foundation settlement is not an aging mechanism at Unit 3.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of erosion of porous concrete subfoundation, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

(7) Corrosion of structural steel components - The SRP-LR Section 3.5.2.2.2.1 states that corrosion of structural steel components for Groups 1-5 and 7-8 could occur and that further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

In LRA Section 3.5.2.2.2.1, the applicant stated that the aging effects associated with structures are managed by MPS AMP B2.1.23, "Structures Monitoring Program." However, aging effects for infrequently accessed portions of the structure are managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program."

The staff reviewed the AMR results involving management of aging effects resulting from corrosion of structural steel components and confirmed that MPS AMP B2.1.23, "Structures Monitoring Program" and MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program" address each of the affected Structures and components. The staff reviewed these programs and its evaluation of these programs is documented in Sections 3.0.3.2.16 and 3.0.3.3.3 of this SER, respectively.

On the basis of its audit and review, the staff finds that the applicant has appropriately evaluated AMR results involving this aging effect and that corrosion of structural steel components is adequately managed by the structures monitoring program and infrequently accessed area's inspection program.

(8) Elevated temperatures - SRP-LR Section 3.5.2.2.2.1 refers to Section 3.5.2.2.1.3 for discussion of elevated temperatures. SRP-LR Section 3.5.2.2.1.3 states that reduction of strength and modulus of elasticity due to elevated temperatures could occur in Class 1 structures in Groups 1-5. The GALL Report calls for a plant-specific aging management program and recommends further evaluation if any portion of the concrete component exceeds specified temperature limits (i.e., general area temperature 66°C (150°F) and local area temperature 93°C (200°F)).

In LRA Section 3.5.2.2.1.3, the applicant stated that during normal operation, all general concrete areas in Class 1 structures remain below 150 °F and local area temperatures remain below 200 °F. Therefore, change in material properties due to elevated temperature is an aging effect not requiring management for Unit 3 Class 1 structures.

On the basis of its review, the staff concurs with the applicant and concludes that change in material properties due to elevated temperature is an aging effect not requiring management for the Unit 3 Class 1 structures.

(9) Aging effects for stainless steel liners for tanks - The SRP-LR Section 3.5.2.2.2.1 states that crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liners for Group 7 and 8 structures could occur and further evaluation is necessary only for structure/aging combinations not covered by the structures monitoring program.

In LRA Table 3.5.1, Item 3.5.1-28 (page 3-505), the applicant stated that there are no steel-lined concrete tanks at Unit 3 in GALL Structures Group 7, requiring aging management. The applicant also stated that all other tanks (steel tanks, Structures Group 8) are evaluated as part of the associated plant system. During the audit and review, the staff noted that, for sump liner of stainless steel material in LRA Table 3.5.2-5 (page 3-538) and Unit 3 Table 3.5.2-8 (page 3-549), the applicant references Item 3.5.1-28. It appears that the applicant does not evaluate all steel tanks as part of the associated plant system. During the audit, the staff asked the applicant to explain why further evaluation is not provided.

The applicant responded that the Unit 3 Table 3.5.2-5 and Unit 3 Table 3.5.2-8 for sump liner of stainless steel material roll up to LRA Table 3.5.1, Item 3.5.1-28; however, the discussion column only stated that there are no steel lined concrete tanks. The applicant stated that the discussion column should be revised to indicate that loss of material for stainless steel sump liners is managed by MPS AMP B2.1.25, "Work Control Process."

In an LRA supplement dated July 7, 2004, the applicant stated that LRA Table 3.5.1, Item 3.5.1-28, the "Discussion" column, should have included a statement that loss of material of steel lined concrete sumps is managed by the work control process program. In addition, a "further evaluation recommended discussion" should have been included in LRA Section 3.5.2.2 as follows:

There are no in-scope steel lined concrete tanks at MPS. Loss of material for steel lined concrete sumps is managed by the Work Control Process AMP.

The applicant initiated a document change to revise the Unit 3 technical report for SRP items recommended for further evaluation, to add a discussion in LRA Section 3.5.2.2.

On the basis of its review, the staff finds the applicant's response acceptable.

Aging Management of Inaccessible Areas. The staff reviewed LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2.

In LRA Section 3.5.2.2.2.2, the applicant addressed aging of inaccessible areas of Class 1 structures.

SRP-LR Section 3.5.2.2.2.2 states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas. The GALL Report recommends further evaluation to manage these aging effects in inaccessible areas of Groups 1-3, 5, and 7-9 structures, if an aggressive below-grade environment exists. ISG-3 identifies additional guidance.

The GALL Report, as updated by ISG-3, states that aggressive chemical attack and corrosion of embedded steel is not significant unless pH is less than 5.5, chlorides are greater than 500 ppm, or sulfates are greater than 1,500 ppm. ISG-3 also states that a plant-specific program is required to examine representative samples of below-grade concrete when excavated for any reason.

In LRA Section 3.5.2.2.2.2, the applicant stated that the below-grade environment is not aggressive (pH is greater than 5.5, chlorides are less than 500 ppm, and sulfates are less than 1,500 ppm). The applicant stated in the LRA that it used the enhanced MPS AMP B2.1.23, "Structures Monitoring Program" to examine below-grade concrete when it is exposed by excavation. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 in this SER. The staff finds that the structures monitoring program, as enhanced, is an appropriate program for examination of below-grade concrete when it becomes accessible.

The applicant stated, in the LRA, that inspections of accessible concrete have not revealed degradation from aggressive chemical attack or corrosion of embedded steel.

On the basis that the below-grade environment is not aggressive with periodic groundwater monitoring considering seasonal variations and that excavated concrete has been and will continue to be monitored, the staff finds that increases in porosity and permeability, loss of material (spalling, scaling) and cracking due to aggressive chemical attack and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel are adequately managed for concrete in inaccessible areas.

On the basis of its audit and review, the staff finds that the applicant appropriately evaluated AMR results involving management of inaccessible areas, as recommended in the GALL Report. Since the applicant's AMR results are otherwise consistent with the GALL Report, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5B.2.2.3 Component Supports

The staff reviewed LRA Section 3.5.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.3, which addresses two areas discussed below.

Aging of Supports Not Covered by Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.3.1 against the criteria in SRP-LR Section 3.5.2.2.3.1.

In LRA Section 3.5.2.2.3.1, the applicant addressed aging of component supports that are not managed by the structures monitoring program.

SRP-LR Section 3.5.2.2.3.1 states that the GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; (2) loss of material due to environmental corrosion, for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

The applicant, in the LRA, has included the GALL Report AMP under the applicant's general MPS AMP B2.1.23, "Structures Monitoring Program." However, this program is not consistent with the GALL Report since the component groups are not completely within the scope of the applicant's structures monitoring program, thus requiring further evaluation. The applicant stated, in LRA Section 3.5.2.2.3.1, that the structures monitoring program only manages aging effects associated with large equipment supports. The applicant also stated that MPS AMP B2.1.13, "General Condition Monitoring" is used to manage aging effects for supports for other components and piping and MPS AMP B2.1.1, "Battery Rack Inspections," is used to manage age-related degradation specific to battery supports. The aging effects for supports in infrequently accessed areas are managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program." The staff reviewed these programs and its evaluation is documented in Sections 3.0.3.3.2, 3.0.3.3.1, and 3.0.3.3.3 in the SER, respectively. The staff finds the structures monitoring program acceptable, in conjunction with the other three programs, for managing aging of component supports for all GALL Report component support groups.

<u>Cumulative Fatigue Damage Due to Cyclic Loading</u>. As stated in the SRP-LR, fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.3 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.3 of the SRP-LR.

3.5B.2.2.4 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides a separate evaluation of the applicant's quality assurance program.

<u>Conclusion</u>. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5B.2.3 AMR Results That Are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In Tables 3.5.2-1 through 3.5.2-38 of the LRA, the staff reviewed additional details of the results of the AMRs for material, environment, aging effects requiring management, and AMP combinations that are not consistent with the GALL Report or are not addressed in the GALL Report.

In Tables 3.5.2-1 through 3.5.2-38, the applicant indicated, via Note F through J, that neither the identified component nor the material and environment combination is evaluated in the GALL Report and provided information concerning how the aging effects requiring management will be managed.

Staff Evaluation. For component type, material and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The staff evaluation is discussed below.

3.5B.2.3.1 Unit 3 Containment - Aging Management Evaluation - Table 3.5.2-1

The staff reviewed Table 3.5.2-1 of the LRA, which summarizes the results of AMR evaluations for the Unit 3 containment system component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for containment.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including fuel transfer tube gate valve, containment sump screen, neutron shield tank, reactor cavity seal ring, refueling cavity liner, pipe, valve bodies, fuel transfer tube, expansion bellows and fuel transfer tube penetration component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of an aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

The applicant stated, in the LRA, that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that, based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on concrete structures.

The applicant stated, in the LRA, that change of material properties for equipment pads/grout, jet impingement barriers, and structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, pedestals, walls) due to alkali (cement)-aggregate reaction of concrete in a protected air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a protected air environment.

The applicant stated, in the LRA, that change of material properties for containment shell (cylindrical wall and dome), due to alkali (cement)-aggregate reaction of concrete in a protected air environment is managed by MPS AMP B2.1.16, "Inservice Inspection Program: Containment Inspections," with exceptions. The staff reviewed the inservice inspection program: containment inspections program and its evaluation is documented in Section 3.0.3.2.11 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 containment concrete structures in infrequently accessed areas. The applicant stated, in the LRA, that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, pedestals, walls) in an air environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," which is a plant-specific program. The staff reviewed the infrequently accessed area inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a protected air environment for infrequently accessed areas.

In RAI 3.5-1, the staff requested the following information:

> For item numbers 3.5.1-03 to 3.5.1-06 (Table 3.5.1) of the LRA, the applicant cited Containment ISI and Containment leak rate test as the aging management programs. A review of AMP B2.1.6 indicates that the Appendix J leak rate testing is part the ISI Program: Containment Inspections. In Appendix J program, the applicant takes credit for only Type A tests to measure the overall primary containment leakage rates. This is a major deviation from NUREG-1801, Section XI.S4 program. Also, the review indicated that the applicant is taking credit for the 1998 Edition of Subsections IWE of Section XI of the ASME Code, without citing compliance with the limitations and modifications associated with this Edition of the Code in 10 CFR 50.55a (67 FR 60520). This was a major deviation from NUREG-1801 Section XI.S1 program and requirements of the regulation. In view of these deviations, and the fact that the Type A leak rate testing may occur every 10 to 15 years, the applicant was requested to provide information as to how it plans to monitor the aging and leak-tightness of the components covered by item

numbers 3.5.1-03 to 3.5.1-06. The applicant was requested to address seals and gaskets associated with equipment hatches, air locks, and, electrical and mechanical penetrations.

By letter dated November 9, 2004, the applicant stated:

> This item was identified as Audit Item 47 during the AMP/AMR Audit conducted the week of May 3, 2004. Dominion provided a supplemental response to Audit Item 47 as documented in the Dominion letter (Serial Number 04-320) dated July 7, 2004. In this letter, it was stated that the Millstone LRA has been supplemented to additionally credit Type B Local Leak Rate Tests (in accordance with 10 CFR 50, Appendix J) as part of the Containment ISI Aging Management Program. Type B Local Leak Rate Testing will ensure that the Containment pressure boundary function associated with the seals and gaskets for equipment hatches, air-locks, and, electrical and mechanical penetrations will be maintained during the period of extended operation.
>
> The typical frequency for performing Type B Local Leak Rate tests is every four refueling outages (approximately every six years). Twenty-five percent of Type B electrical penetrations are performed on-line just prior to or following each refueling outage (approximately every 1 ½ years).

The staff finds the response to RAI 3.5-1 acceptable as the implementation of the revised process will assure the integrity of the containment pressure boundary penetrations during the period of extended operation.

In RAI 3.5-4, the staff inquired about the means of monitoring the temperatures of the containment concrete (around the high energy lines) and that of the concrete structures inside the containments, and the operating experience related to their degradation, as follows:

> In addressing item 3.5.1-27, for the reinforced concrete structures subjected to elevated temperatures (e.g., primary shield walls, pressurizer and steam generator enclosures, reactor vessel supports, and the containment concrete around high energy penetrations) the applicant stated: "NUREG-1801 is not applicable." Items IIA1.1-h and III.A4-1c of NUREG-1801 are directly applicable to Group 4 structural concrete. For these structures, the applicant was requested to provide the following information:
>
> 1. The method(s) of monitoring the concrete temperatures in these structures.
> 2. If the primary shield wall concrete, the containment concrete, or any other structural components within Millstone 2 and 3 containments are kept below the threshold temperature (i.e., 150°F) by means of air cooling, provide the operating experience related to the performance of the cooling system.
> 3. The results of the latest inspection of these structures, in terms of cracking, spalling, and condition of reactor vessel support structures, etc.

By letter dated November 9, 2004, the applicant stated:

> 1. For Millstone Unit 2, the temperature of the primary shield wall concrete in the area of the reactor vessel supports is monitored and an alarm is provided in the control room if the temperature exceeds 150°F. Embedded cooling coils are

provided at these locations to remove heat from the concrete. Although not directly measured, the temperature of the concrete in other areas of the Unit 2 containment, and in the Unit 3 containment, is maintained below threshold values by the design of ventilation systems. The containment ventilation systems maintain average containment internal air temperature below 120 °F in accordance with Technical Specification requirements. Local ambient air temperatures in areas such as the steam generator cubicles and the pressurizer cubicle are maintained well below 150 °F. The localized concrete temperature in the vicinity of high energy piping containment penetrations is maintained below the threshold value by the containment penetration cooling system, which consists of a ventilation system in Unit 2 (the Containment Penetration Cooling System described in LRA Section 2.3.3.18) and a water cooling system in Unit 3 (as part of the Reactor Plant Component Cooling System described in LRA Section 2.3.3.6).

2. The containment ventilation systems operate consistently in order to provide compliance with Technical Specification containment average temperature limit of 120 °F. Failures of these systems to provide adequate cooling requires plant shutdown and, therefore, the threshold values for concrete temperature would not be exceeded. The containment concrete in the area of the Unit 2 high energy piping penetrations is cooled by the containment penetration cooling system. A review of plant operating experience has indicated that this system also operates consistently and there are no identified failures that would have resulted in local concrete temperatures exceeding threshold values.

3. The latest inspections of the containment structure were performed in March 2001 and October 2003 for Unit 2 and in September 2002 for Unit 3. These inspections did not identify instances of significant cracking or spalling in the primary shield wall, pressurizer and steam generator enclosures, reactor vessel support concrete, or the containment concrete around high-energy penetrations. These inspection results provide further assurance that elevated temperature of containment concrete was not a significant concern for Millstone Unit 2 and Unit 3 containments.

The staff finds the response acceptable, as the response indicates that the applicant employs positive means to control temperatures around the high energy containment penetrations as well as around the areas likely to be subjected to elevated temperatures in the concrete.

In RAI 3.5-14 (Audit Item AFI-1), the staff requested information on the operating experience related to corrosion of steel liner for Millstone Units 2 and 3, as follows:

> In discussion of Item 3.5.1-12 in Section 3.5.2.2.1.4, the applicant notes that the moisture barrier is monitored under containment inspection program for aging degradation. The industry experience indicates that the moisture barrier degrades with time, and any moisture accumulation in the degraded barrier corrodes the steel liner. The applicant is requested to provide information regarding the operating experience related to the degradation of moisture barrier and the containment liner plate at Millstone 2 and 3. The applicant is requested to include a discussion of acceptable liner plate corrosion before it is reinstated to the nominal thickness.

In response, the applicant provided the following information:

> The containment ISI program conforms to ASME XI Subsection IWE (1998 Edition) for monitoring the effects of aging associated with both the moisture barrier and the steel liner. The inspection of moisture barriers is intended to prevent undetected intrusion of moisture to inaccessible areas of the pressure retaining liner. Subsection IWE identifies the moisture barrier examination method (visual), and the examination extent and frequency (100% each inspection period). By Subsection IWE requirements, the acceptance standards are "owner defined." Millstone Units 2 and 3 have defined the general and detailed visual acceptance criteria in plant-specific procedures. For augmented examinations of the liner that involve Ultrasonic Testing (UT), ASME Section XI, Subparagraph IWE-3511.3 requires that loss of material in a local area projected to exceed 10% of the nominal wall thickness prior to the next examination shall be documented. Such areas are entered into the corrective action program and either accepted by engineering evaluation or corrected by performance of repair/replacement activities.
>
> For Millstone Units 2 and 3, various examples of Operating Experience associated with the moisture barrier and the liner (such as the results of baseline examinations performed under the containment ISI program) are available for review at the station. The extent of the visual examinations and the necessity of additional volumetric examinations have been as specified in the IWE Inspection Schedule. Examples of Containment operating experience for Millstone Units 2 and 3 are provided in the License Renewal Application Appendix B (Section B2.1.16).
>
> <u>Millstone Unit 2</u>
>
> The moisture barrier for the Unit 2 Containment liner was inspected in 2000 as part of the ASME Section XI, Subsection IWE examinations. The inspection revealed indications, which upon evaluation required that the moisture barrier material be removed, a detailed IWE examination of the liner be performed, the liner be recoated, and the moisture barrier be replaced. The work scope was completed in two phases, approximately 50% of the locations in outage 2R13 and the remainder in outage 2R15. During the examination, some pitting of the liner was observed and determined to be acceptable by engineering evaluation and the requirements of Subsection IWE of ASME Section XI and acceptable for continued service.
>
> <u>Millstone Unit 3</u>
>
> In 2000 the moisture barrier for the Unit 3 Containment liner was inspected as part of the ASME Section XI, Subsection IWE examinations. The inspection revealed unacceptable results where, for specific areas, the moisture barrier had not been installed. These areas were documented and repaired in accordance with Subsection IWE requirements. Detailed visual examinations of the moisture barrier are performed as directed by IWE requirements and the Millstone containment ISI program. The liner surface for the depth of the exposed joint was acceptable and required no further supplemental examination.

Recognizing the susceptibility of the below grade portion of the containment liners to corrosion, in a follow-up request, the staff requested the applicant to provide information regarding corrosion of the liners above the bottom floor levels. By letter dated December 3, 2004, the applicant provided detailed descriptions of the liner corrosion, and the results of UT measurements taken for Unit 2 in April 2000, May 2000, March 2002, and in November 2003 for Unit 2, and in February 2001 for Unit 3. A typical evaluation of liner corrosion consisted of the following approach:

> Specifically, the UT examination results indicated that the area in question had a liner wall thickness of 0.239 inches. The design nominal thickness of the liner is 0.250 inches. In accordance with ASME Section XI, Subparagraph IWE 3122.3, local areas exhibiting less than 10% wall loss are acceptable for continued service. The reading of 0.239 inches was greater than the 0.225 inches minimum wall thickness allowable (for 10 % wall loss), and therefore, met the acceptance standards of ASME Section XI.

The description also included examples where the liner thickness was found to be more than 10% of the nominal thickness allowed by Subsection IWE of Section XI of the ASME Code. In those cases the applicant performed engineering analysis to demonstrate that the liner could perform its intended function.

The above description clearly indicates that the below grade portions of the liner plate have been subjected to corrosion, and the applicant was taking appropriate actions to monitor and control the future instances of corrosion. The staff believes that an appropriate implementation of AMP B.2.1.16, "Inservice Inspection Program: Containment Inspection," including its containment leak rate testing program will monitor and control corrosion of liner plates during the period of extended operation, and therefore, finds the process used by the applicant acceptable.

3.5B.2.3.2 Unit 3 Containment Enclosure Building - Aging Management Evaluation - Table 3.5.2-2

The staff reviewed Table 3.5.2-2 of the LRA, which summarized the results of AMR evaluations for the Unit 3 containment enclosure building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

The applicant stated, in the LRA, that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. However, the applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (grade beams, slabs on grade) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

The applicant stated, in the LRA, that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant also stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents the leaching of calcium hydroxide from Class 1 structures' concrete to be of concern. Therefore, the applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures.

In the LRA, the applicant stated that change of material properties for structural reinforced concrete (grade beams, slabs on grade) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

Tables 3.5.2-2 of Units 2 and 3 are related to the aging management of the enclosure buildings surrounding the containments. For Unit 2, the applicant has incorporated the aging management of blow-off panels. This is not the case for Unit 3. The applicant was requested to discuss the reasons for the difference.

By letter dated December 3, 2004, the applicant provided the following response:

> The main steam lines for Millstone Unit 2 go through the enclosure building, and the potential exists for excessive pressure to build-up inside this building during a main steam line leak. For this reason blow-off panels were incorporated into the Unit 2 enclosure building design, and the aging management of these blow-off panels has been included for License Renewal.
>
> The main steam lines for Millstone Unit 3 go through the main steam valve building, and not the enclosure building. For this reason blow-off panels are installed in the main steam valve building, and the aging management of these blow-off panels has been included for License Renewal. Because the main steam lines for Millstone Unit 3 do not go through the enclosure building, the potential for excessive pressure to build-up inside this building does not exist, and blow-off panels were not installed.

The staff finds the clarification acceptable.

3.5B.2.3.3 Unit 3 Auxiliary Building - Aging Management Evaluation - Table 3.5.2-3

The staff reviewed Table 3.5.2-3 of the LRA, which summarized the results of AMR evaluations for the Unit 3 auxiliary building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that the GALL Report does not include stainless steel sump liners in a raw water environment. The applicant stated that loss of material due to crevice corrosion/under deposit attack of stainless steel is possible in a raw water environment. The sump liners have either the necessary geometry or the material deposits and oxygen greater than 100 ppb, which are required to support crevice corrosion/under deposit attack. The applicant concludes crevice corrosion/under-deposit attack is a potential aging mechanism. On the basis of it review, the staff agrees with the applicant's conclusion.

The applicant stated, in the LRA, that sump liners are exposed to an aqueous environment with temperatures less than 210 °F and a pH of less than 10. Therefore, the applicant concludes that MIC is a potential aging mechanism. The applicant stated, in the LRA, that the sump liners are exposed to low flow conditions with an aggressive environment. Therefore, the applicant concludes that pitting corrosion is a potential aging mechanism. On the basis of its review, the staff agrees with the applicant's conclusion.

In the LRA, the applicant stated that loss of material for sump liners due to crevice corrosion/under-deposit attack, MIC, and pitting corrosion of stainless steel in a raw water environment is managed by MPS AMP B2.1.25, "Work Control Process," which is a plant-specific program. The staff reviewed the work control process program and its evaluation is documented in Section 3.0.3.3.4 of this SER. The staff finds that the work control process program credits visual inspection for the detection of loss of material in structures. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of loss of material due to crevice corrosion/under-deposit attack, MIC, and pitting corrosion of stainless steel in a raw water environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers, including curbs, dikes, toe plates, and stop logs; hatches, missile barriers, structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls) and tunnel due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 Structures' concrete. The applicant will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs), hatches, and missile barriers due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, for change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures in infrequently accessed areas. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls) and tunnel in an air environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," which is a plant-specific program. The staff reviewed the infrequently accessed area inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment for infrequently accessed areas.

3.5B.2.3.4 Unit 3 Control Building - Aging Management Evaluation - Table 3.5.2-4

The staff reviewed Table 3.5.2-4 of the LRA, which summarized the results of AMR evaluations for the Unit 3 control building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers, including curbs, dikes, toe plates, and stop logs; structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, walls) and hatches due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 structures' concrete. The applicant will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, walls), hatches, and missile barriers due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant identified no aging effects for carbon steel components exposed to air, including control room ceiling support component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant corrosion of carbon steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, carbon steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

3.5B.2.3.5 Unit 3 Fuel Building - Aging Management Evaluation - Table 3.5.2-5

The staff reviewed Table 3.5.2-5 of the LRA, which summarized the results of AMR evaluations for the Unit 3 fuel building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that loss of material for stainless steel spent fuel storage racks exposed to treated water is managed using MPS AMP B2.1.5, "Chemistry Control for Primary Systems Program." The staff reviewed the chemistry control for primary systems program and its evaluation is documented in Section 3.0.3.2.2 of this SER. The staff finds this program is consistent which is consistent with GALL AMP XI.M2, "Water Chemistry," with an acceptable exception. On the basis of its review, the staff finds this line item acceptable since this program is consistent with the GALL Report recommendation for other components with the same material, environment, and aging effect.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including miscellaneous steel (embedded steel-exposed surfaces, shapes, plates, unistrut, etc., ladders, platforms and grating, stairs), cask wash pit liner and new fuel storage rack component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended

operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of the aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers, including curbs, dikes, toe plates, and stop logs; hatches, structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls) and hatches due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 structures' concrete. The applicant will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls), and hatches due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures in infrequently accessed areas. In the LRA, the applicant stated that change of material properties for tunnel in an air environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," which is a plant-specific program. The staff reviewed the infrequently accessed area inspection program and its evaluation is documented in

Section 3.0.3.3.3 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment for infrequently accessed areas.

3.5B.2.3.6 Railroad Canopy - Aging Management Evaluation - Table 3.5.2-6

The staff reviewed Table 3.5.2-6 of the LRA, which summarized the results of AMR evaluations for the railroad canopy component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 structures' concrete. The applicant will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16. The staff has reviewed this program with respect to the SRP-LR and found it acceptable. For these components, the staff finds this program acceptable for managing the aging effects of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.7 Unit 3 Hydrogen Recombiner Building - Aging Management Evaluation - Table 3.5.2-7

The staff reviewed Table 3.5.2-7 of the LRA, which summarized the results of AMR evaluations for the Unit 3 hydrogen recombiner building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, foundation mat slabs, roof slabs) and hatches due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 structures' concrete. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, foundation mat slabs, roof slabs), missile barriers and hatches due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.8 Unit 3 Engineered Safety Features Building - Aging Management Evaluation - Table 3.5.2-8

The staff reviewed Table 3.5.2-8 of the LRA, which summarized the results of AMR evaluations for the Unit 3 engineered safety features building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers including curbs, dikes, toe plates and stop logs, hatches, and structural reinforced concrete (beams, floor slabs, foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures

Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 structures' concrete. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for hatches, and structural reinforced concrete (beams, floor slabs, foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.9 Unit 3 Main Steam Valve Building - Aging Management Evaluation - Table 3.5.2-9

The staff reviewed Table 3.5.2-9 of the LRA, which summarized the results of AMR evaluations for the MPS Unit 3 main steam valve building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers including curbs, dikes, toe plates and stop logs, and structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 structures' concrete. The applicant will manage change of material properties as a potential aging effect on Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, roof slabs, walls) and missile barriers due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.10 Unit 3 Emergency Generator Enclosure and Fuel Oil Tank Vault - Aging Management Evaluation - Table 3.5.2-10

The staff reviewed Table 3.5.2-10 of the LRA, which summarized the results of AMR evaluations for the MPS Unit 3 emergency generator enclosure and fuel oil tank vault component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for Class 1 structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers, including curbs, dikes, toe plates, and stop logs; fuel oil tank vault, structural reinforced concrete (beams, floor slabs, footing, foundation mat slabs, roof slabs, slabs on grade walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from Class 1 structures' concrete. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, footing, foundation mat slabs, roof slabs,

slabs on grade walls), and hatches due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 Class 1 concrete structures in infrequently accessed areas. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, footing, foundation mat slabs, roof slabs, slabs on grade walls), and hatches in an air environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," which is a plant-specific program. The staff reviewed the infrequently accessed area inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment for infrequently accessed areas.

3.5B.2.3.11 Unit 2 Fire Pumphouse - Aging Management Evaluation - Table 3.5.2-11

The staff reviewed Table 3.5.2-11 of the Unit 3LRA, which summarized the results of AMR evaluations for the Unit 2 fire pumphouse component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs, roof slabs) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that cracking for concrete component types (masonry block walls) exposed to an atmosphere/weather environment is managed using MPS AMP B2.1.23, "Structures Monitoring Program." The applicant stated that cracking of masonry block walls due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms which require aging management. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

3.5B.2.3.12 Unit 3 Fire Pumphouse - Aging Management Evaluation - Table 3.5.2-12

The staff reviewed Table 3.5.2-12 of the LRA, which summarized the results of AMR evaluations for the Unit 3 fire pumphouse component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs, roof slabs) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that cracking for concrete component types (masonry block walls) exposed to an atmosphere/weather environment is managed using MPS AMP B2.1.23, "Structures Monitoring Program." The applicant stated that cracking of masonry block walls due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms which require aging management. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

3.5B.2.3.13 Unit 3 Service Building - Aging Management Evaluation - Table 3.5.2-13

The staff reviewed Table 3.5.2-13 of the LRA, which summarized the results of AMR evaluations for the Unit 3 service building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated change of material properties for structural reinforced concrete (beams, columns, floor slabs, footing, foundation mat slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, footing, foundation mat slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.14 Unit 3 Turbine Building - Aging Management Evaluation - Table 3.5.2-14

The staff reviewed Table 3.5.2-14 of the LRA, which summarized the results of AMR evaluations for the Unit 3 turbine building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers including curbs, dikes, toe plates and stop logs, structural reinforced concrete (beams, columns, floor slabs, footing, and grade beams, walls) and turbine pedestal due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, footing, and grade beams, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.15 Unit 3 Auxiliary Boiler Enclosure - Aging Management Evaluation - Table 3.5.2-15

The staff reviewed Table 3.5.2-15 of the LRA, which summarized the results of AMR evaluations for the Unit 3 auxiliary boiler enclosure component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS

AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.16 Unit 3 Technical Support Center - Aging Management Evaluation - Table 3.5.2-16

The staff reviewed Table 3.5.2-16 of the LRA, which summarized the results of AMR evaluations for the Unit 3 technical support center component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, footing, roof slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, footing, roof slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.17 Unit 3 Maintenance Shop - Aging Management Evaluation - Table 3.5.2-17

The staff reviewed Table 3.5.2-17 of the LRA, which summarized the results of AMR evaluations for the Unit 3 maintenance shop component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, spread footings, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, spread footings, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.18 Unit 3 Waste Disposal Building - Aging Management Evaluation - Table 3.5.2-18

The staff reviewed Table 3.5.2-18 of the LRA, which summarized the results of AMR evaluations for the MPS Unit 3 waste disposal building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, spread footings, slabs on grade, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, floor slabs, spread footings, slabs on grade, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that cracking for concrete component types (masonry block walls) exposed to an atmosphere/weather environment is managed using MPS AMP B2.1.23, "Structures Monitoring Program." The applicant stated that cracking of masonry block walls due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms which require aging management. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

3.5B.2.3.19 SBO Diesel Generator Enclosure and Fuel Oil Tank Vault - Aging Management Evaluation - Table 3.5.2-19

The staff reviewed Table 3.5.2-19 of the LRA, which summarized the results of AMR evaluations for the SBO diesel generator enclosure and fuel oil tank vault component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation, mat slabs) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation, mat slabs) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to air, including roofing and siding component types. The GALL Report does not include this material for these components.

The applicant concludes, as documented in the staff's MPS audit and review report for the AMR for the Unit 3 miscellaneous structures, for aluminum in an air or an atmosphere/weather environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment, there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

In the LRA, the applicant also identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including roofing and siding component types. The GALL Report does not include this material for these components.

The applicant concludes, as documented in the staff's MPS audit and review report for the AMR for the Unit 3 miscellaneous structures, for aluminum in an air or an atmosphere/weather environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment, there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

3.5B.2.3.20 Unit 3 Condensate Polishing Enclosure - Aging Management Evaluation - Table 3.5.2-20

The staff reviewed Table 3.5.2-20 of the LRA, which summarized the results of AMR evaluations for the Unit 3 condensate polishing enclosure component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, spread footing, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, spread footing, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.21 Unit 2 Condensate Polishing Facility and Warehouse No. 5 - Aging Management Evaluation - Table 3.5.2-21

The staff reviewed Table 3.5.2-21 of the LRA, which summarized the results of AMR evaluations for the Unit 2 condensate polishing facility and warehouse No. 5 component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.22 Security Diesel Generator Enclosure - Aging Management Evaluation - Table 3.5.2-22

The staff reviewed Table 3.5.2-22 of the LRA, which summarized the results of AMR evaluations for the security diesel generator enclosure component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to air, including roofing, siding and structural framing component types. The GALL Report does not include this material for these components.

The applicant concludes, as documented in the staff's MPS audit and review report for the Unit 3 miscellaneous structures, for aluminum in an air or an atmosphere/weather environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including roofing and siding component types. The GALL Report does not include this material for these components.

The applicant concludes, as documented in the staff's MPS audit and review report for the AMR for Unit 3 miscellaneous structures, for aluminum in an air or an atmosphere/weather environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

3.5B.2.3.23 Stack Monitoring Equipment Building - Aging Management Evaluation - Table 3.5.2-23

The staff reviewed Table 3.5.2-23 of the LRA, which summarized the results of AMR evaluations for the stack monitoring equipment building component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (roof slabs, slabs on grade, spread footing, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (roof slabs, slabs on grade, spread footing, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that cracking for concrete component types (masonry block walls) exposed to an atmosphere/weather environment is managed using MPS AMP B2.1.23, "Structures Monitoring Program." The applicant stated that cracking of masonry block walls due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms which require aging management. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

3.5B.2.3.24 Unit 3 Stack - Aging Management Evaluation - Table 3.5.2-24

The staff reviewed Table 3.5.2-24 of the LRA, which summarized the results of AMR evaluations for the Unit 3 stack component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat, slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat, slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures in infrequently accessed areas. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, foundation mat, slabs, walls) in an air environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," a plant-specific program. The staff reviewed the infrequently accessed area inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment for infrequently accessed areas.

3.5B.2.3.25 Switchyard Control House - Aging Management Evaluation - Table 3.5.2-25

The staff reviewed Table 3.5.2-25 of the LRA, which summarized the results of AMR evaluations for the switchyard control house component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.3.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that cracking for concrete component types (masonry block walls) exposed to an atmosphere/weather environment is managed using MPS AMP B2.1.23, "Structures Monitoring Program." The applicant stated that cracking of masonry block walls due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction, is possible in an atmosphere/weather environment. Masonry block walls are subject to all of these aging mechanisms which require aging management. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of concrete cracking due to long term creep and variation in stiffness, dry shrinkage of concrete, and expansion or contraction in this environment.

3.5B.2.3.26 345kV Switchyard - Aging Management Evaluation - Table 3.5.2-26

The staff reviewed Table 3.5.2-26 of the LRA, which summarized the results of AMR evaluations for the 345 kV switchyard component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated change of material properties for structural reinforced concrete due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.27 Unit 3 Circulating and Service Water Pumphouse - Aging Management Evaluation - Table 3.5.2-27

The staff reviewed Table 3.5.2-27 of the LRA, which summarized the results of AMR evaluations for the Unit 3 circulating and service water pumphouse component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for intake and discharge structures.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an air environment, including miscellaneous aluminum (embedded aluminum exposed surfaces) (shapes, plates, unistrut, etc. ladders, platforms and grading) component types. The GALL Report does not include this material for these components.

The applicant concludes, as documented in the staff's MPS audit and review report for the AMR for Unit 3 intake and discharge structures, for aluminum in an air or an air environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for flood/spill barriers including curbs, dikes, toe plates, and stop logs; structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls) and hatches due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls) and hatches due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in a sea water environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction of concrete in a sea water environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a sea water environment.

Structures monitoring program and infrequently accessed area inspection program were listed as AMPs for structural reinforced concrete (beams, columns, floor slabs, foundation mat slabs, roof slabs, walls) under column "Structural Member" and under column "Notes" H, 20 in Tables 3.5.2-18 for Unit 2 and H, 23 in Table 3.5.2-27 for Unit 3. In RAI 3.5-7, the applicant was requested to identify the structural components, such as beams and walls that are managed by either program or by both programs and provide basis for the selection of the program.

By letter dated November 9, 2004, the applicant stated that the structural member "Structural Reinforced Concrete" in Unit 2 LRA Table 3.5.2-18 and Unit 3 LRA Table 3.5.2-27 includes beams, columns, floor slabs, foundation mat slabs, roof slabs, and walls. The structural reinforced concrete components associated with the table line item with Note H, 20 (Unit 2) or H, 23 (Unit 3) are only the floor slabs, foundation mat slabs, and walls. As indicated in Note 20 in the Unit 2 LRA table (or Note 23 in the Unit 3 LRA table), the infrequently accessed area inspection program manages the effects of aging for structural members/components in the intake structure water bays between the waterline and the bottom of the intake structure operating deck since this area is infrequently accessed as described in LRA Appendix B, Section B2.1.15. The structures monitoring program manages the effects of aging for structural members/components in the water bay below the waterline since this area is inspected by the structures monitoring program AMP. The effects of aging for the walls are managed by both the infrequently accessed areas inspection program (above the waterline) and the structures monitoring program (below the waterline). The infrequently accessed area inspection program manages the effects of aging for the floor slabs (underside of the operating deck) and the structures monitoring program manages the effects of aging for the foundation mat slabs.

The staff finds the applicant's response acceptable because it identifies each component and its associated AMP.

3.5B.2.3.28 Unit 3 West Retaining Rail - Aging Management Evaluation - Table 3.5.2-28

The staff reviewed Table 3.5.2-28 of the LRA, which summarized the results of AMR evaluations for the Unit 3 west retaining rail component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for intake and discharge structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footings, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in a sea water environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at MPS Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footing, walls) due to alkali (cement)-aggregate reaction of concrete in a sea water environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a sea water environment.

3.5B.2.3.29 Sea Wall - Aging Management Evaluation - Table 3.5.2-29

The staff reviewed Table 3.5.2-29 of the LRA, which summarized the results of AMR evaluations for the sea wall component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for intake and discharge structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footings, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program. The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in a sea water environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at

MPS Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on MPS Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footing, walls) due to alkali (cement)-aggregate reaction of concrete in a sea water environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a sea water environment.

3.5B.2.3.30 Unit 3 Circulating Water Discharge Tunnel and Discharge Structure - Aging Management Evaluation - Table 3.5.2-30

The staff reviewed Table 3.5.2-30 of the LRA, which summarized the results of AMR evaluations for the Unit 3 circulating water discharge tunnel and discharge structure component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for intake and discharge structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in a sea water environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (floor slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction of concrete in a sea water environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in a sea water environment.

3.5B.2.3.31 Unit 3 Recirculation Tempering Line - Aging Management Evaluation - Table 3.5.2-31

The staff reviewed Table 3.5.2-31 of the LRA, which summarized the results of AMR evaluations for the Unit 3 recirculation tempering line component groups.

In RAI 3.5-13, the staff requested a clarification as to the reason of listing infrequently accessed area inspection program three times as the AMP for concrete pipes.

By letter dated November 9, 2004, the applicant stated Each line item for concrete pipe in Unit 2 LRA Table 3.5.2-21 on page 3-507 and in Unit 3 Table 3.5.2-31 on page 3-613 is a unique line item with a corresponding NUREG-1801 Volume 2 Item and/or a note. As a result, some table data (such as the AMP) is repeated multiple times for these lines. For example, for the lines in the tables associated with the change of material properties aging effect for the concrete pipe, the first line is associated with NUREG-1801 item III.A6.1-b for the leaching of calcium hydroxide aging mechanism. The second line is associated with NUREG-1801 item III.A6.1-e for the aggressive chemical attack aging mechanism. Finally, the third line is not associated with a NUREG-1801 item since the alkali-aggregate reaction aging mechanism leading to a change of material properties is not included in NUREG-1801, although Dominion has conservatively included this aging mechanism as discussed in LRA Appendix C, Section C3.2.2. For each of these aging mechanisms that result in the change of material properties aging effect for the concrete pipe, the infrequently accessed areas inspection program AMP manages the identified aging effect.

The staff finds the applicant's response acceptable.

3.5B.2.3.32 Vacuum Priming Pumphouse - Aging Management Evaluation - Table 3.5.2-32

The staff reviewed Table 3.5.2-32 of the LRA, which summarized the results of AMR evaluations for the vacuum priming pumphouse component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for intake and discharge structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (beams, foundation mat slabs, roof slabs, walls) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.33 Tank Foundations - Aging Management Evaluation - Table 3.5.2-33

The staff reviewed Table 3.5.2-33 of the LRA, which summarized the results of AMR evaluations for the tank foundations component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for the structural reinforced concrete (foundation mat slabs, walls) (Unit 3 Boron Recovery Tanks and Enclosure) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs) (condensate storage tank foundation); structural reinforced concrete (footing) (fire water tanks 1 and 2 foundations); structural reinforced concrete (foundation mat slabs) (refueling water storage tank foundation); structural reinforced concrete (foundation mat slabs) (SBO diesel fuel oil storage tank foundation); structural reinforced concrete (foundation mat slabs, roof slabs, walls) (demineralized water storage tank foundation and enclosure); structural reinforced concrete (foundation mat slabs) (carbon dioxide tank foundation); and structural reinforced concrete (foundation mat slabs, walls) (boron recovery tank foundation and enclosure) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

3.5B.2.3.34 Yard Structures - Aging Management Evaluation - Table 3.5.2-34

The staff reviewed Table 3.5.2-34 of the LRA, which summarized the results of AMR evaluations for the yard structures component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structures.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including lighting pole component types. The GALL Report does not include this material for these components.

The applicant concludes, as documented in the Unit 3 technical report for miscellaneous structures, for aluminum in an air or an air environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for the access covers (yard valve pits and enclosure); structural reinforced concrete (foundation mat slabs, roof slabs, walls) (yard valve pits and enclosure); structural reinforced concrete (foundation mat slabs, roof slabs, walls) (pipe tunnel); and structural reinforced concrete (foundation mat slabs, roof slabs, walls) (manholes) due to alkali (cement)-aggregate reaction of concrete in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete is possible in an atmosphere/weather environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that the use of high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking, prevents significant leaching of calcium hydroxide from concrete structures. The applicant will manage change of material properties as a potential aging effect on Unit 3 concrete structures. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (footing, walls) (transformer firewalls and dikes); access covers (yard valve pits and enclosure); structural reinforced concrete (foundation mat slabs, roof slabs, walls) (yard valve pits and enclosure); structural reinforced concrete (foundation mat slabs, roof slabs, walls) (Pipe Tunnel); structural reinforced concrete (foundation mat slabs, roof slabs, walls) (Manholes); duct banks; structural reinforced concrete (security lighting supports); and structural reinforced concrete (footing, walls) (technical support building) due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction and leaching of calcium hydroxide of concrete in an atmosphere/weather environment.

In the LRA, the applicant stated that change of material properties due to alkali (cement)-aggregate reaction of concrete is possible in an air environment. The applicant stated that based on tests conducted on the aggregate and the low-alkali cement used at Unit 3, alkali (cement)-aggregate reaction is not a significant concern. The applicant stated that it will manage change of material properties as a potential aging effect on Unit 3 concrete structures in infrequently accessed areas. In the LRA, the applicant stated that change of material properties for structural reinforced concrete (foundation mat slabs, roof slabs, walls) (yard valve pits and enclosure) in an air environment is managed by MPS AMP B2.1.15, "Infrequently Accessed Areas Inspection Program," which is a plant-specific program. The staff reviewed the infrequently accessed area inspection program and its evaluation is documented in Section 3.0.3.3.3 of this SER. The staff also reviewed this program with respect to the SRP-LR. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to alkali (cement)-aggregate reaction of concrete in an air environment for infrequently accessed areas.

3.5B.2.3.35 NSSS Equipment Supports - Aging Management Evaluation - Table 3.5.2-35

The staff reviewed Table 3.5.2-35 of the LRA, which summarized the results of AMR evaluations for the NSSS equipment supports component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for NSSS equipment supports.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including pressurizer support: bolting component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of the aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant stated that the GALL Report does not include a borated water leakage environment for reactor vessel support: sliding support plate of copper alloy material.

The applicant identifies, in the Unit 3 technical report for NSSS equipment supports, for copper alloys in a borated water leakage environment, that boric acid corrosion as an aging mechanism for loss of material. The applicant stated that these components do not exceed the temperature threshold of 350 °F. Therefore, boric acid corrosion is a potential aging mechanism for copper alloys. On the basis of its review of the applicant's document, the staff concurs with the applicant and finds that boric acid corrosion is a potential aging mechanism for copper alloys.

In the LRA, the applicant stated that loss of material for copper alloy reactor vessel support: sliding support plate in a borated water leakage environment is managed by MPS AMP B2.1.13, "General Condition Monitoring." The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The general condition monitoring program, manages these aging effects by visual inspections for evidence of degradation or adverse conditions and includes heath physics inspections of radiologically controlled areas, system walkdowns by system engineering, and daily inspections of accessible areas of the plant by plant operators. Evidence of boron precipitation and active radioactive system leaks is identified during area observations made by health physics technicians while performing radiologically controlled area surveys. On the basis of its review, the staff finds the general condition monitoring program acceptable for managing the aging effect of loss of material for copper alloys for this component.

In the discussion section of LRA Table 3.5.1, Item 3.5.1-33, the applicant stated, for Group B1.1: high strength low-alloy bolts in structures and component support systems, that cracking due to SCC is not an aging effect requiring management for NSSS equipment support bolting.

During the review, the staff noted that SRP-LR Table 3.5-1 recommended GALL AMP XI.M18, "Bolting Integrity," for managing high strength bolting for NSSS components supports for crack initiation and growth due to SCC.

By letter dated January 11, 2005, the applicant stated:

> For NSSS component supports, bolting material with estimated maximum yield strength that marginally exceeds 150 ksi is used in limited applications. This bolting is located inside the Containment in areas where the environment is typically dry and not subject to high levels of contaminants, such as halogens and sulfur compounds, that result in the

potential for SCC. Leakage within the Containment is monitored and strictly controlled during plant operation and is investigated and corrected such that the potential for wetting of NSSS component support bolting is minimal. Based on the marginally susceptible bolting materials and a dry, non-conducive (benign) service environment, cracking due to SCC is not an aging effect requiring management for this bolting.

As identified in Millstone Power Station Unit 2 LRA Table 3.5.2-24 and Millstone Power Station Unit 3 LRA Table 3.5.2-35, loss of material is conservatively considered an aging effect requiring management for NSSS component support bolting and is managed by the Inservice Inspection Program: Systems, Components and Supports AMP (which includes the elements of the ASME Section XI, Subsection IWF requirements as described in LRA Appendix B2.1.18). In addition, loss of material due to the potential for borated water leakage from nearby components is managed by the Boric Acid Corrosion and General Condition Monitoring AMPs.

*Since the boric acid corrosion and general condition monitoring programs ensure a dry, non-*conducive (benign) service environment and the bolting material is managed by the inservice inspection program, the staff finds this acceptable.

3.5B.2.3.36 General Structural Supports - Aging Management Evaluation - Table 3.5.2-36

The staff reviewed Table 3.5.2-36 of the LRA, which summarized the results of AMR evaluations for the general structural supports component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for general structural supports.

The GALL Report does not include this material for these components. The applicant concluded, as documented in the staff's MPS audit and review report for the AMR for the Unit 3 miscellaneous structures, for aluminum in an air or an air environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and concludes that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

In the LRA, the applicant has identified no aging effects for aluminum components exposed to an air environment, including electrical conduit and cable tray component types. The GALL Report does not include this material for these components. The applicant concludes, as documented in the Unit 3 technical report for miscellaneous structures, for aluminum in an air or an air environment, the applicant concludes that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and concludes that there are no aging effects requiring management for aluminum in an air environment.

In the LRA, the applicant identified no aging effects for stainless steel components exposed to air, including sliding support bearing and sliding surfaces, structural support components (plate structural shapes, etc.) and vendor supplied specialty items (spring hangers, struts, clamps, vibration isolators, etc.) component types.

During the audit and review, the staff asked the applicant why the MPS AMP B.2.1.18, "Inservice Inspection Program: Systems, Components and Supports," was not credited to mange loss of mechanical function, as described in the GALL Report. By letter dated January 11, 2005, the applicant stated that the inspection requirements for these supports associated with ASME XI IWF that are part of the CLB will carry forward to the period of extended operation.

On the basis of its review, the staff concurred with the applicant concerning the adequacy of inspections in accordance with ASME XI IWF.

In the LRA, the applicant stated that the GALL Report does not include a borated water leakage environment for sliding support bearing and sliding surfaces of copper alloy material.

The applicant identified, as documented in Unit 3 Technical Report, MP-LR-4651, "General Structural Supports," Revision 2, for copper alloys in a borated water leakage environment, that boric acid corrosion as an aging mechanism for loss of material. The applicant stated that these components do not exceed the temperature threshold of 350 °F. Therefore, boric acid corrosion is a potential aging mechanism for copper alloys. On the basis of its review of the applicant's document, the staff concurred with the applicant and concluded that boric acid corrosion is a potential aging mechanism for copper alloys. In the LRA, the applicant stated that loss of material for copper alloy reactor vessel support: sliding support plate in a borated water leakage environment is managed by MPS AMP B2.1.13, "General Condition Monitoring." The staff reviewed the general condition monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER. The general condition monitoring program, managed these aging effects by visual inspections for evidence of degradation or adverse conditions and included heath physics inspections of radiologically controlled areas, system walkdowns by system engineering, and daily inspections of accessible areas of the plant by plant operators. Evidence of boron precipitation and active radioactive system leaks is identified during area observations made by health physics technicians while performing radiologically controlled area surveys. On the basis of its review, the staff finds the general condition monitoring program acceptable for managing the aging effect of loss of material for copper alloys for this component.

In the LRA, the applicant identified no aging effects for galvanized steel components exposed to air, including electrical conduit and cable tray component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant corrosion of carbon (galvanized steel) and low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff concluded that there are no aging effects requiring management for metal in an air environment.

Table 3.5.2-25 of Unit 2 and Table 3.5.2-36 of Unit 3 list boric acid corrosion as an AMP for galvanized steel electrical conduit and cable trays. The staff did not find that galvanized steel was included in the boric acid corrosion program as described in B2.1.3. In RAI 3.5-12, the staff requested the applicant to address this discrepancy.

By letter dated November 9, 2004, the applicant provided the following response:

> The electrical conduit and cable trays listed in Unit 2 LRA Table 3.5.2-25 and Unit 3 LRA Table 3.5.2-36 are fabricated from carbon steel material that was galvanized for corrosion protection, and has been termed "galvanized steel" in the tables. Since no credit has been taken for the galvanized coating as described in LRA Appendix C, Section C2.4, the electrical conduit and cable trays loss of material aging effect due to boric acid corrosion is managed with the Boric Acid Corrosion program. Accordingly, this material is in the category of materials termed "carbon and low alloy steel" in the Boric Acid Corrosion program as described in B2.1.3.

The staff finds the applicant's response acceptable.

3.5B.2.3.37 Miscellaneous Structural Commodities - Aging Management Evaluation - Table 3.5.2-37

The staff reviewed Table 3.5.2-37 of the LRA, which summarized the results of AMR evaluations for the miscellaneous structural commodities component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for miscellaneous structural commodities.

In the LRA, the applicant stated that the GALL Report does not include Pyrocrete for fire resistant coating in an air environment. The applicant identified, as documented in the staff's MPS audit and review report for the AMR for the Unit 3 miscellaneous structural commodities, for Pyrocrete in an air environment, irradiation as an aging mechanism for change of material properties. The applicant stated that fire resistant coating material may be exposed to ionizing radiation values greater than the threshold radiation of 10E6 Rads. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that irradiation is a potential aging mechanism for Pyrocrete. In the LRA, the applicant stated that change of material properties for fire resistant coatings in an air environment is managed by MPS AMP B2.1.10, "Fire Protection Program," with exception. The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that the fire protection program, with an exception, manages, through periodic inspection and tests, the aging effects on penetration seals, fire barrier walls, ceilings, floors, and all fire rated doors that perform a fire barrier intended function. Qualified personnel perform periodic inspections to identify any changes in the condition such as change in material properties. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of change in material properties due to irradiation of Pyrocrete in an air environment.

In the LRA, the applicant stated that the GALL Report does not include Pyrocrete for fire resistant coating in an air environment. The applicant identified, as documented in the staff's MPS audit and review report for the AMR for Unit 3 miscellaneous structural commodities, for Pyrocreter in an air environment, differential movement, shrinkage, and vibration as an aging mechanisms for cracking. The applicant stated that fire resistant coating materials are subject to cracking due to differential movement, shrinkage, and vibration. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that differential movement, shrinkage, and vibration are potential aging mechanisms for Pyrocrete. In the Unit 3 LRA, the applicant stated that cracking for fire resistant coatings in an air environment is managed by MPS AMP B2.1.10, "Fire Protection Program," with exception. The staff reviewed the fire protection program and its evaluation is documented in Section 3.0.3.2.7 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that the fire protection program, with an exception, manages, through periodic inspection and tests, the aging effects on penetration seals, fire barrier walls, ceilings, floors, and all fire rated doors that perform a fire barrier intended function. Qualified personnel perform periodic inspections to identify any changes in the condition such as change in material properties. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of cracking due to differential movement, shrinkage, and vibration of Pyrocrete in an air environment.

In the LRA, the applicant stated that there are no aging effects for ceramic fire/equipment qualification barrier penetration seals and concludes that no AMPs are required. The applicant stated that its AMR conclusion for the material is consistent with the GALL Report, which only calls for aging management of ceramic fire barrier penetration seals that are exposed to an outdoor environment. On the basis of its review of the applicant's documentation and that the ceramic materials are exposed only to indoor environments, the staff concurs with the applicant and finds that ceramic fire/equipment qualification barrier penetration seals do not require aging management for the period of extended operation.

In the LRA, the applicant identified no aging effects for carbon steel components exposed to air, including cable tray cover and assembly; junction, terminal, and pull boxes; bus duct enclosures; panels and cabinets; switchgear enclosures; and electrical component supports within cabinets and panels component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Significant corrosion of carbon and low-alloy steel requires an electrolytic environment, and a simultaneous presence of oxygen and moisture. Without the presence of the aggressive environment, low-alloy steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

In the LRA, the applicant stated that the GALL Report does not include cracking of rubber for flood prevention plugs in an air environment. The applicant identifies, in the Unit 3 technical report for miscellaneous structural commodities, for rubber in an air environment, thermal exposure as an aging mechanism for cracking. The applicant stated that rubber for flood prevention plugs may be exposed to temperatures greater than the threshold of 95 °F. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that thermal exposure is a potential aging mechanism for rubber.

In the LRA, the applicant also stated that cracking for rubber flood prevention plugs in an air environment is managed by MPS AMP B2.1.23, "Structures Monitoring Program." The staff reviewed the structures monitoring program and its evaluation is documented in Section 3.0.3.2.16 of this SER. The staff also reviewed this program with respect to the SRP-LR. The staff finds that structural monitoring activities are intended to assess the overall integrity and condition of structures, components, support systems and specified architectural details. Qualified personnel perform periodic inspections to identify any changes in the condition such as cracking. On the basis of its review, the staff finds this program acceptable for managing the aging effects, for the above components, of cracking due to thermal exposure of rubber in an air environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an atmosphere/weather environment, including bus duct enclosure component types. The GALL Report does not include this material for these components. In the Unit 3 technical report for miscellaneous structural commodities, for aluminum in an air environment, the applicant concludes that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an atmosphere/weather environment.

In the LRA, the applicant identified no aging effects for aluminum components exposed to an air environment, including cable tray cover assemblies and bus duct enclosure component types. The GALL Report does not include this material for these components. The applicant concludes, in the Unit 3 technical report for miscellaneous structural commodities, for aluminum in an air environment, that there are no potential aging mechanisms for this aluminum and environment combination. The applicant stated in the MAER that for aluminum material in an air or atmosphere/weather environment there are no potential aging mechanisms for this material and environment combination at Unit 3. This conclusion is based on engineering text references that indicate that aluminum and its alloys resist attack to a wide range of environments and many chemical compounds. On the basis of its review of the applicant's documentation, the staff concurs with the applicant and finds that there are no aging effects requiring management for aluminum in an air environment.

The applicant stated, as documented in the "Miscellaneous Structural Commodities" section of the Unit 3 technical report for miscellaneous structural commodities, as follows:

> The MAER includes an evaluation of aluminum material in an air or an atmosphere/weather environment, and concludes that there are no potential aging mechanisms for these material/environment combinations.

During the audit and review, the staff asked the applicant to explain why the evaluation is not in the MAER and provide the basis for its conclusions. The applicant that the MAER addressed aluminum material in an air or atmosphere/weather environment, and concluded that there are no potential aging mechanisms for these material/environment combinations at Unit 3. The applicant stated that this conclusion is based on engineering test references, "Handbook of

Corrosion Data" and "Uhlig's Corrosion Handbook." The Handbook of Corrosion Data indicates that aluminum and its alloys resist attack by a wide range of environments and many chemical compounds. Consequently, aluminum is one of the metals most thought of by the public and engineering community when lower temperature corrosion resistance is considered. Uhlig's Corrosion Handbook indicates that aluminum-based alloys as a class are highly resistant to normal outdoor exposure conditions. This conclusion in the MAER is also based on other nuclear power stations license renewal safety evaluation reports (SERs) (i.e., Turkey Point, St. Lucie, and Surry) that have environments, particular as outdoor environments, similar to Unit 3. Further, this conclusion is also supported by a review of Unit 3 plant-specific operating experience, which identifies no instances of loss of material for aluminum in an air or atmosphere/weather environment. The applicant also stated that the conclusions in the LRA remain valid and unchanged. However, the applicant initiated a change request to revise the MAER technical report document to include these references in the aluminum/air and aluminum/atmosphere/weather sections. On the basis of its review, the staff finds the applicant's response acceptable.

The applicant stated, as documented in the staff's MPS audit and review report for the Unit 3 miscellaneous structural commodities, that the information for fire/EQ barrier penetration seals (including ceramic damming material) indicated "Not Applicable" for the evaluation group. During the audit and review, the staff asked the applicant to explain how the ceramic damming material was evaluated for aging effects. The applicant stated that ceramic materials are similar to the glass and porcelain that are described in the MAER as having no aging effects. As documented in the staff's MPS audit and review report, the applicant stated that it does not properly document this conclusion and the MAER does not specifically address ceramics. The applicant stated that the conclusions in the LRA remain valid and unchanged. However, the applicant has initiated a change request to revise the MAER technical report to include ceramic along with glass and porcelain as having no aging effects that require evaluation for any application or environment to which it is exposed. In addition, the applicant initiated change requests to revise the Unit 3 miscellaneous structural commodities to indicate that the MAER indicates no potential aging effects and no aging management required for ceramics; therefore, the AMR does not evaluate aging mechanisms for the ceramic blanket or ceramic board in an air environment. On the basis of its review, the staff finds the applicant's response acceptable.

The polyethylene form used for expansion joint/seismic gap material between adjacent buildings/structures in the atmosphere/weather environment is listed as no aging effect requiring management in Table 3.5.2-37 of Unit 3. In RAI 3.5-8, the applicant was requested to provide technical data to show that the polyethylene form material will not degrade in the atmosphere/weather environment and the plant operating experience to substantiate it.

By letter dated November 9, 2004, the applicant responded that The polyethylene foam material used for seismic gap filler is covered by a flashing and not exposed to rain, wind, or sun. There should not have been an Expansion joint/Seismic gap material line item in LRA Table 3.5.2-37 with an atmosphere/weather environment. As indicated in Table 3.5.2-37, aging effects for the polyethylene foam are managed by the structures monitoring program.

The staff finds the applicant's response acceptable.

Table 3.5.2-37 of Unit 3 lists structures monitoring program as the AMP for neoprene used for flood gate gasket, roof hatch seals, and watertight door gasket, but lists Work

Control Process as the AMP for neoprene used for gaskets in junction, terminal, and pull boxes. In RAI 3.5-9, the applicant was requested to explain the need for using different AMPs for the same material.

By letter dated November 9, 2004, the applicant responded that the structures monitoring program AMP manages the aging effects for flood gates, roof hatches, and watertight doors, which are considered to be structural members, and includes inspection of the associated flood gate gasket, roof hatch seals, and watertight door gaskets. The structures monitoring program AMP does not include inspection of junction, terminal, and pull boxes since these items are not considered to be structural members. Therefore, the work control process AMP is credited for managing aging effects associated with gaskets in junction, terminal and pull boxes.

The staff finds the applicant's response acceptable.

Table 3.5.2-37 listed no aging effect requiring management for carbon steel junction, terminal, and pull boxes in air environment. In RAI 3.5-10, the applicant was requested to provide data to show that the carbon steel will not rust in the air that may contain moisture and the plant operating experience to substantiate it.

By letter dated November 9, 2004, the applicant stated that as described in note 35 for the carbon steel junction, terminal, and pull boxes in LRA Table 3.5.2-37, loss of material is not an applicable aging effect since these components are not exposed to an intermittent wetted environment.

This conclusion is consistent with the North Anna and Surry License Renewal SER concurrence that carbon steel components have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting (North Anna Power Station Units 1 and 2, and Surry Power Station, Units 1 and 2, NUREG-1766, Section 3.8.5.2.1, Page 3-230). Further, this conclusion is supported by a review of Millstone plant-specific operating experience, which identifies no instances of loss of material due to corrosion of the junction, terminal, and pull boxes in an air environment.

The staff finds the applicant's response acceptable.

3.5B.2.3.38 Load Handling Cranes and Devices - Aging Management Evaluation - Table 3.5.2-38

The staff reviewed Table 3.5.2-38 of the LRA, which summarized the results of AMR evaluations for the load handling cranes and devices component groups. The staff interviewed the applicant's technical staff and reviewed the Unit 3 technical report for load handling cranes and devices.

In the LRA, the applicant has identified no aging effects for stainless steel components exposed to air, including fuel transfer system support members (structural base supports, tracks and anchorage) component types. Air is not identified in the GALL Report as an environment for these components and materials.

On the basis of its review of current industry research and operating experience, the staff finds that air on metal will not result in aging that will be of concern during the period of extended

operation. The external environments being referred to are typical of ambient air (e.g., under a shelter, indoor, or air-conditioned enclosure or room). Without the presence of the aggressive environment, stainless steel components will experience insignificant amounts of corrosion, and no aging effects are applicable to this component/commodity group. Therefore, the staff finds that there are no aging effects requiring management for metal in an air environment.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5B.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment, structures and component supports systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the containment, structures and component supports systems, as required by 10 CFR 54.21(d).

3.6 Aging Management of Electrical and Instrumentation and Controls

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and instrumentation and controls components and component groups associated with the following systems:

- cable and connectors
- electrical penetrations
- bus duct

3.6.1 Summary of Technical Information in the Application

In LRA Section 3.6, the applicant provided AMR results for electrical and instrumentation and controls components and component groups. In LRA Table 3.6.1, "Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 for Electrical Components," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the electrical and instrumentation and controls components and component groups.

In LRA Tables 3.6.2-1 through 3.6.2-3, the applicant provided a summary comparison of the Millstone aging management activities with the aging management activities evaluated in NUREG-1801 for the electrical component groups Cables and Connectors, Electrical Penetrations and Bus Duct. In these tables, the applicant also provided a summary of materials of construction, service environments, aging effects requiring management, and credited aging management program for each electrical component group.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and instrumentation and controls system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMPs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluation are documented in the staff's MPS audit and review report and summarized in Section 3.6.2.1 of this SER.

The staff also performed an onsite audit of those AMRs that were consistent with the GALL Report and for which further evaluation is recommended. During the audit, the staff verified that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.6.2.2 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.6.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with or not addressed in the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the staff's MPS audit and review report and summarized in Section 3.6.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.6.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the FSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the electrical and instrumentation and controls system components.

Table 3.6-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.6 that are addressed in the GALL Report.

Table 3.6-1 Staff Evaluation for Electrical and Instrumentation and Controls in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Electrical equipment subject to10 CFR 50.49 EQ requirements (Item Number 3.6.1-01)	Degradation due to various aging mechanisms	Environmental qualification of electrical components	TLAA	This TLAA is evaluated in Section 4.4.
Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements (Item Number 3.6.1-02)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics, radiolysis and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	Electrical cables and connectors not subject to 10 CFR 50.49 environmental qualification requirements (B2.1.8)	Consistent with GALL, which recommends no further evaluation (See Section 3.6.2.1)
Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (Item Number 3.6.1-03)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion	Aging management programs for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements	Electrical cables not subject to 10 CFR 50.49 environmental qualification requirements used in instrumentation circuits (B2.1.9)	Consistent with GALL, which recommends no further evaluation (See Section 3.6.2.1)
Inaccessible medium-voltage (2 kV to 15 kV) cables not subject to 10 CFR 50.49 EQ requirements (Item Number 3.6.1-04)	Formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees	Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	Inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements (B2.1.14)	Consistent with GALL, which recommends no further evaluation (See Section 3.6.2.1)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage (Item Number 3.6.1-05)	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric acid corrosion		Not applicable (See Section 3.6.2.1)

The staff's review of the MPS electrical and instrumentation and controls and associated components followed one of several approaches. One approach, documented in Section 3.6.2.1, involves the staff's review of the AMR results for components in the electrical and instrumentation and controls that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.6.2.2, involves the staff's review of the AMR results for components in the electrical and instrumentation and controls that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.6.2.3, involves the staff's review of the AMR results for components in the electrical and instrumentation and controls that the applicant indicated are not consistent with the GALL Report or are not addressed in the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the electrical and instrumentation and controls components is documented in Section 3.0.3 of this SER.

3.6.2.1 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Not Recommended

Summary of Technical Information in the Application. In Section 3.6.2.1 of the LRA, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage aging effects related to the electrical and instrumentation and control components:

- Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Staff Evaluation. In LRA Tables 3.6.2-1 through 3.6.2-3, the applicant provided a summary of AMRs for the electrical and instrumentation and control components and identified which AMRs it considered to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated the AMR was consistent with the GALL Report.

Note A indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated that the component for the AMR line item is different from, but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in its MPS audit and review report. The staff did not repeat its review of the matters described in the GALL Report. However, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL Report AMRs. The staff evaluation is discussed below.

Conclusion. The staff has evaluated the applicant's claim of consistency with GALL Report. The staff also has reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.6.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for electrical components. The applicant provided information concerning how it will manage the aging effects of electrical equipment subject to environmental qualification.

The applicant stated that environmental qualification is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is addressed separately in LRA Section 4.4, Environmental Qualification of Electric Equipment and LRA Appendix B, Section B3.1, Electrical Equipment Qualification.

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

As stated in the SRP-LR, environmental qualification is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.4 of this SER documents the staff's review of the applicant's evaluation of this TLAA. In performing this review, the staff followed the guidance in Section 4.4 of the SRP-LR.

3.6.2.2.2 Quality Assurance for Aging Management of Non-Safety-Related Components

Section 3.0.4 of this SER provides the staff's evaluation of the applicant's quality assurance program.

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and

(2) the applicant adequately addressed the issues that were further evaluated. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.3 AMR Results That Are Not Consistent With or are Not Addressed in the GALL Report

Summary of Technical Information in the Application. The applicant did not address the AMR results of electrical components which are not addressed in the GALL Report.

Staff Evaluation. For component type, material and environment combination that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation.

The applicant identified three commodities which indicated would cover all electrical components within the scope of licensee renewal. These commodities were identified as:

(1) Cable and Connectors. In its letter dated November 9, 2004, the applicant confirmed that it treats splices as an integral part of the cable. Non-EQ splices are included in commodity groups "Conductors" and "Insulation" in LRA Table 2.5.1-1 and the aging management review results are included in Table 3.6.2-1. This commodity includes non-EQ cables installed in raw water or damp soil. The staff requested clarification of the statement in the LRA that the thermal exposure of elastomers would remain below 95 °F and therefore would not require an AMP. In its response dated January 11, 2005, the applicant confirmed that the referenced temperature was the ambient temperature and when the effects of ohmic heating on the cable insulation is included, sufficient margin exists below the 60 year analyzed temperature limit for the extended period of operation. Therefore no aging management program is required.

(2) Containment Electrical Penetrations. The staff requested clarification on the following two items.

   1. The LRA stated that the pressure boundary of the electrical containment penetrations contain non-metallic components such as Polysulfone and Vitron. Clarify why there is no aging management program required for those materials that maintain containment integrity or identify the AMP that does cover this function.

   2. The LRA stated that the electrical conduction and insulation functions of the electrical containment penetrations contain electrical connectors, insulation and insulators. Clarify why there is no aging management program required for those materials that maintain electrical conductivity and insulation or identify the AMP that does cover these functions.

   In its response dated November 9, 2004, the applicant stated that the non-EQ penetrations were qualified to the same requirements as the EQ penetrations. The applicant stated the life expectancy of the electrical penetrations exceed 60 years and therefore was not a concern for the extended period of operation.

(3) Bus Duct. The staff requested clarification on two items.

1. The LRA did not address an aging management program for the high-voltage cables and connectors from the portions of the 345 kV switchyard to the reserve station service transformer (RSST) and the medium-voltage cables (including any cable bus or bus duct) and connectors from the RSST to the Class 1E switchgear that are used to recover offsite power following a station blackout (SBO).
2. The applicant responded in its response dated December 3, 2004, that the SBO path within the scope of licensee renewal included the 345 kV switchyard and the high-voltage bus from the switchyard to the RSSTs. The applicant also stated that the aluminum conductor steel reinforced (ACSR) high-voltage conductor and the tubular aluminum high-voltage bus were not insulated and experience has demonstrated no corrosion of the conductors that could cause a loss of intended function.

The applicant stated in its response dated December 3, 2004, that the medium-voltage connection from the Unit 2 RSST to the safety-related bus was by cable and the connection from the Unit 3 RSST to the safety-related bus was by cable and bus duct.

The staff review of the SBO path for license renewal is documented below in three parts in the following sections.

- high voltage insulators (Section 3.6.2.3.2)
- non-segregated bus duct (Section 3.6.2.3.3)
- switchyard bus (Section 3.6.2.3.4)

3.6.2.3.1 Electrical Connectors not Subject to 10 CFR 50.49 EQ Requirements That Are Exposed to Borated Water Leakage

Summary of Technical Information in the Application. The applicant identified the following aging effects associated with electrical components subjected to exposure to borated water require management:

- reduced insulation resistance caused by corrosion.
- loss of material caused by corrosion.

In LRA Table 3.6.1, "Summary of Aging Management Evaluations for Electrical Components in Chapter VI of NUREG-1801," the applicant indicated in item 3.6.1-05 that the borated water leakage environment was considered for electrical connectors. However, connectors at Millstone are protected from borated water leakage by their location within protective enclosures and by design features which seal the enclosures along with associated conduit and cable entrances and corrosion of connector contact surfaces caused by intrusion of borated water is not an aging effect requiring management.

In LRA Table 3.6.1, "Summary of Aging Management Evaluations for Electrical Components in Chapter VI of NUREG-1801," the applicant stated that an aging management program was not required.

In LRA Section B2.1.3, "Boric Acid Corrosion," the applicant stated that the Millstone boric acid corrosion program addresses industry experience in response to Nuclear Regulatory Commission (NRC) Generic Letter (GL) 88-05 and Bulletins 2002-01 and 2002-02. The Millstone boric acid corrosion program manages loss of material in areas where there are carbon steel and low-alloy steel structures or components on which borated reactor water might leak.

Staff Evaluation. The staff agreed that LRA correctly identified the aging effects associated with electrical components exposed to boric acid. The staff also agreed that there is no need for an aging management program for electrical connections exposed to borated water because the design at Millstone inhibits the ingress of borated water into electrical connections and the boric acid corrosion program will address any observed borated water leakage.

The staff concluded that the applicant adequately addressed the aging threat to electrical connections from borated water by design of the connection enclosures supplemented by their borated water leakage assessment program and no separate aging management program for connectors exposed to borated water was required.

3.6.2.3.2 High Voltage Insulators

Summary of Technical Information in the Application. Section 2.1.3.7.5, Station Blackout, includes the following components in scope for offsite power restoration following a SBO: 1) the 345 kV bus to the RSST and the associated disconnect switch, 2) the overhead conductors from the Connecticut Light & Power (CL&P) switchyard, 3) the North Bus (Unit 2), the South Bus (Unit 3) and their associated disconnect switches, and 4) the support structures associated with these in-scope components. Section 2.5.3, Bus Ducts, describes the high-voltage bus duct connection between the switchyard and the RSST and identifies the high-voltage insulators non-porous translucent porcelain ceramic covered with an oven-baked glaze. The high-voltage insulators are used to insulate the high-voltage components (cable and bus) from the grounded support structures. No aging effects were discussed.

Table 2.5.3-1, Bus Duct, lists bus support insulator as part of the commodity group with an intended function to insulate and provide structural support. Table 3.6.2-3, Electrical Components - Bus Duct - Aging Management Evaluation, indicates there is no aging effect requiring management for the bus support insulator. In Table 3.6.2-3, Electrical Components - Bus Duct - Aging Management Evaluation, the applicant stated that there was no aging management program for bus support insulators of porcelain material because there was no aging effect that required management.

Staff Evaluation. In Table 3.6.2-3, Electrical Components - Bus Duct - Aging Management Evaluation, the applicant stated that there was no aging effect that required management.

The staff concluded that the applicant adequately addressed the aging management for high-voltage insulators and agreed that no aging management program was required for high-voltage insulators.

3.6.2.3.3 Non-segregated Bus Duct

Summary of Technical Information in the Application. Section 2.1.3.7.5, Station Blackout, includes the bus duct from the RSST to the safety-related buses in-scope for license renewal. Section 2.5.3, Bus Duct, describes the high-voltage bus duct connection between (1) the switchyard and the RSST and (2) the medium-voltage non-segregated bus duct from the RSST to the safety buses. No aging effects were discussed.

Table 2.5.3-1, Bus Duct, fails to include any description for the medium-voltage bus duct components.

Table 3.6.2-3, Electrical Components - Bus Duct - Aging Management Evaluation, identifies the insulation system material for the (medium-voltage non-segregated) bus duct conductors in Unit 3 as Noryl. (Noryl is the General Electric trademark name for a plastic type electrical insulation material.) The table indicates there is no aging effect requiring management for the Noryl insulating material.

In its response to RAI 3.6-2 dated December 3, 2004, the applicant stated that there were no bus ducts between the RSST and the safety-related buses in Unit 2. For Unit 3, round, aluminum bus ducts are located outdoors between the RSST and the service building wall penetration. Inside the service building, the bus ducts are bolted, insulated aluminum bus bar. The applicant's letter indicated the bus ducts were normally loaded to 67 percent of their rating so that thermal cycling would be minimum and splice bolting torque relaxation is not expected to occur.

However, the Millstone-3 FSAR, Section 8.3.1.1.2, Class 1E AC Power, states:

> During normal operation, power is supplied through the normal station service transformer A from the unit generator via the isolated phase bus duct, with the generator breaker closed,. normal station service transformer A supplies power to emergency 4.16 kV buses 34C (Train A) and 34D (Train B), via normal buses 34A and 34B, respectively.
>
> In the event of loss of the normal offsite power source, the alternate offsite power source supplies power through the reserve station service transformer A from the 345 kV switchyard. reserve station service transformer A supplies power to emergency 4.16 kV buses 34C (Train A) and 34D (Train B).

The applicant stated that no AMP is required for the bus ducts in the SBO recovery path because the bus has no aging effects requiring management.

Staff Evaluation. In its response dated December 3, 2004, to RAI 3.6-2, the applicant stated that, for Unit 3, round, aluminum bus ducts are located outdoors between the RSST and the building wall penetration, are welded, non-ventilated with no joints or fasteners. Inside the service building, the bus ducts are bolted, insulated aluminum bus bar and are vented by means of down-turned elbow fittings with screens. The LRA identifies the insulating material used on the Unit 3 medium-voltage, non-segregated bus duct in the service building as Noryl. Industry experience has identified an aging effect for Noryl-insulated, non-segregated bus duct as insulation cracking.

Aging effects for the non-segregated phase bus ducts requiring evaluation are those associated with moisture/debris intrusion and bolt loosening due to thermal cycling.

The bus ducts are located both inside and outside. Bus duct enclosures located outside are non-vented. The vented bus duct does not provide protection for moisture.

Entry of debris into the vented bus duct is restricted by down-turned elbow fittings with screens. Therefore, debris intrusion is not an aging effect requiring management. The metal bus duct enclosures provide protection for the enclosed bus duct against weather and debris.

Industry experience has shown that bus ducts exposed to appreciable ohmic or ambient heating during operation may experience loosening of bolted connections related to the repeated cycling of connected loads or the ambient temperature environment. This phenomenon can occur in heavily loaded circuits (i.e., those exposed to appreciable ohmic heating or ambient heating) that are routinely cycled. The Millstone FSAR indicates that the normal path for power to the safety-related buses is from the NSST. The bus duct from the RSST to the safety-related bus is not normally loaded. Therefore it appears that the bus duct is normally not loaded and may be subject to thermal cycling.

Industry operating experience was reviewed for problems associated with bus ducts. The following items were selected for further review and dispositioned:

In its response the applicant also indicated that the following generic communication were reviewed as part of its aging management review and determined to be not applicable to Millstone Unit 3.

- Information Notice 89-64, "Electrical Bus Bar Failures," was issued to address Noryl-insulated medium-voltage bus bar failures that occurred at several nuclear facilities. The failures identified in Information Notice 89-64 were attributed to cracking of the Noryl bus bar insulation in combination with the accumulation of moisture or debris in the bus duct housings that provided a tracking path to ground.
- Information Notice 98-36, "Inadequate or Poorly Controlled, Non-Safety Related Maintenance Activities Unnecessarily Challenged Safety Systems," notified licensees of various inadequate maintenance activities (e.g., failure to install gaskets or caulking of outdoor components) in the industry which resulted in moisture intrusion and challenges to safety-related systems.
- Information Notice 2000-14, "Non-Vital Bus fault Leads to Fire and Loss of Offsite Power," informed licensees of a transient at Diablo Canyon nuclear plant caused by a failure of a bus bar due to overheating at a splice joint. Potential causes of the failure include inconsistent silver plating of aluminum bus bars, currents approaching bus capacity, undersized splice plates, torque relaxation of connecting bolts, and undetected damage from a 1995 explosion of Auxiliary Transformer 1-1.

Non-segregated phase bus duct is characterized as all three phases contained in a single enclosure. This could be exposed conductors (ie. tube, bar, channel, etc.) insulated from the enclosure or it could be insulated cable. The problems documented in Information Notices 89-64, 98-36, and 2000-14, apply to bus duct with exposed bar conductors. The failure mechanisms identified in Information Notices 89-64 and 98-36 are not applicable to Millstone 2 because Unit 2 does not have bus ducts with exposed conductors.

Some of the potential causes of the bus bar failure addressed in Information Notice 2000-14 could apply to other types of bus duct designs. These mechanisms include currents approaching bus capacity and torque relaxation of connecting bolts. The Millstone non-segregated phase bus ducts are designed to carry the output of the start-up auxiliary transformers. The worst-case loading on any portion of the cable bus duct for either unit is approximately 67 percent. No description of the connections from bus to equipment was provided. Therefore, currents approaching bus capacity and torque relaxation have not been ruled out as an aging mechanisms for the non-segregated phase bus ducts at Millstone.

In its response dated February 8, 2005, the applicant indicated that a review conducted by an independent consultant concluded that the aging of the specific Noryl compound used in at Millstone would not degrade over the period of extended operation. The same response also indicated that the bolted connections were joined using Bellville spring washers that would further reduce the probability of torque relaxation from thermal cycling.

The staff agrees that the LRA, together with the supplement information in the responses dated December 3, 2004, and February 8, 2005, adequately identified the aging effects associated with metal-enclosed (non-segregated) bus ducts.

The staff concluded that the applicant adequately addressed the aging effects for Noryl-insulated, non-segregated bus duct in Unit 3 and adequately documented its conclusion that no separate aging management program for non-segregated bus duct was required.

3.6.2.3.4 Switchyard Bus

Summary of Technical Information in the Application. Section 2.1.3.7.5, Station Blackout, includes the following components within the scope of license renewal for offsite power restoration following a SBO: (1) the 345 kV bus to the RSST and the associated disconnect switch, (2) the overhead conductors from the CL&P switchyard, (3) the Switchyard North Bus (Unit 2), the Switchyard South Bus (Unit 3), and their associated disconnect switches, and (4) the support structures associated with these in-scope components. Section 2.5.3, Bus Ducts, describes the high-voltage switchyard bus as tubular conductors.

Table 2.5.3-1, Bus Duct, includes a description for bus duct and identifies the intended function for the bus duct (conductors) to conduct electricity. The table does not differentiate between the high-voltage switchyard bus duct and medium-voltage bus duct.

Table 3.6.2-3, Electrical Components - Bus Duct - Aging Management Evaluation, identifies the high-voltage bus duct and switchyard bus components as metal conductors with porcelain insulators. The table indicates that there are no components with aging effects that require management and no aging management programs were identified.

Staff Evaluation. The high-voltage switchyard buses are composed of bare aluminum tubes. The staff agrees that there is no aging effect that requires management. Based on the tube materials used in the high-voltage switchyard buses, the staff also agrees that no aging management program for high-voltage switchyard bus was required.

1.7The staff concludes that the applicant adequately addressed the aging effects for high-voltage switchyard bus and concludes that no separate aging management program for high-voltage switchyard bus was required.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated AMR results involving material, environment, aging effect requiring management, and AMP combinations that are not evaluated in the GALL Report or not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review of the AMR results, the staff concludes that actions have been identified and have been or will be taken to manage the effects of aging during the period of extended operation on the functionality of structures and components subject to an AMR such that there is reasonable assurance that the activities authorized by a renewed license will continue to be conducted in accordance with the CLB for the period of extended operation, as required by 10 CFR 54.29(a).

3.6.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the electrical and instrumentation and controls systems components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the electrical and instrumentation and controls systems, as required by 10 CFR 54.21(d).

3.7 Conclusion for Aging Management

The staff has reviewed the information in LRA Section 3, "Aging Management Review Results," and Appendix B, "Aging Management Programs and Activities." On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable FSAR supplement program summaries and concludes that the FSAR supplement adequately describes the AMPs credited for managing aging as required by 10 CFR 54.21(d).

With regard to these matters, the NRC staff has concluded that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis, and that any changes made to the MPS current licensing basis in order to comply with 10 CFR 54.21(a)(3) are in accord with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 <u>Identification of Time-Limited Aging Analyses</u>

This section addresses the identification of time-limited aging analyses (TLAAs). Dominion Nuclear Connecticut, Inc. (Dominion or the applicant) discusses the TLAAs in Sections 4.2 through 4.7 of its license renewal applications (LRAs). Sections 4.2 through 4.8 of this safety evaluation report (SER) document the review of the TLAAs conducted by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff).

The TLAAs are certain plant-specific safety analyses that are based on an explicitly assumed 40-year plant life. Pursuant to Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* [10 CFR 54.21(c)(1)], the applicant for license renewal must provide a list of TLAAs, as defined in 10 CFR 54.3.

In addition, pursuant to 10 CFR 54.21(c)(2), an applicant must provide a list of plant-specific exemptions granted under 10 CFR 50.12 that are based on TLAAs. For any such exemptions, the applicant must provide an evaluation that justifies the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated calculations for the Millstone Power Station (MPS) against the six criteria specified in 10 CFR 54.3. The applicant indicated that it had identified the calculations that met the six criteria by searching the current licensing basis (CLB). The CLB includes the final safety analysis report (FSAR), engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable vendor reports. The applicant listed the following applicable TLAAs in LRA Table 4.1-1, "Time-Limited Aging Analysis Categories:"

- reactor vessel neutron embrittlement
- metal fatigue
- environmental qualification (EQ) of electrical equipment
- concrete containment tendon prestress
- containment liner plate and penetrations
- crane load cycle limit
- reactor coolant pump flywheel
- reactor coolant pump Code Case N–481
- leak before break

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that it did not identify any exemptions granted under 10 CFR 50.12 that were based on a TLAA, as defined in 10 CFR 54.3.

4.1.2 Staff Evaluation

In Section 4.1 of each LRA, the applicant identified the TLAAs applicable to MPS. The staff reviewed the information to determine whether the applicant had provided adequate information to meet the requirements of 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs are analyses that meet the following six criteria:

(1) involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term (40 years)

(4) are determined to be relevant by the applicant in making a safety determination

(5) involve conclusions, or provide the basis for conclusions, related to the capability of the system, structure, and component to perform its intended functions, as delineated in 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the current licensing basis

The applicant provided a list of common TLAAs from NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plant," dated July 2001. The applicant listed those TLAAs that are applicable to MPS in each Table 4.1-2 of the LRAs, which provided a comparison to TLAAs from NUREG-1800.

As required by 10 CFR 54.21(c)(2), an applicant must provide a list of all exemptions granted under 10 CFR 50.12 that are based on a TLAA and evaluated and justified for continuation through the period of extended operation. In its LRA, the applicant stated that each active exemption was reviewed to determine whether the exemption was based on a TLAA. The applicant did not identify any TLAA-based exemptions. On the basis of the information provided by the applicant with regard to the process used to identify TLAA-based exemptions, as well as the results of the applicant's search, the staff finds that the applicant identified no TLAA-based exemptions that are justified for continuation through the period of extended operation, in accordance with 10 CFR 54.21(c)(2).

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1), and has confirmed that no exemptions to 10 CFR 50.12 have been granted on the basis of a TLAA, as required by 10 CFR 54.21(c)(2).

4.2 <u>Reactor Vessel Neutron Embrittlement</u>

The NRC uses two parameters as a measure of the fracture toughness of ferritic steels (i.e., either carbon steel or low-alloy steel) used to fabricate the reactor vessels (RVs) in light-water reactors:

- a reference temperature for nil-ductility transition (RT_{NDT}), which is a measure of the material's ability to resist cleavage failure, and
- the upper-shelf energy (USE) value for the material, which is a measure of the material's ability to resist ductile failure.

During plant service, neutron radiation reduces the fracture toughness of the RV materials by causing the RT_{NDT} to increase and the USE to decrease. The base metal materials and weld materials in the region of the vessel immediately adjacent to the reactor core (i.e., in the beltline region of the RV) are most susceptible to these effects because they are exposed to neutron fluences in excess of 1.0×10^{17} neutrons/cm^2 (1.0×10^{17} n/cm^2)(E>1.0 MeV).

The staff performs the following three reviews to ensure that the beltline materials in PWR RVs have adequate fracture toughness during normal and off-normal operating conditions:

(1) assessments for pressurized thermal shock (PTS), as required by 10 CFR 50.61

(2) assessments for calculating the pressure-temperature (P-T) limit curves for heatups, cooldowns, and pressure tests of the RVs, as required by 10 CFR Part 50, Appendix G, Section IV.A.2

(3) assessments for USE, as required by 10 CFR Part 50, Appendix G, Section IV.A.1.

Since these assessments are related to the amount of neutron radiation absorbed over time, they must be treated as TLAAs for the materials in the beltline of the RV. The staff evaluates these TLAAs in the following subsections to SER Chapter 4.2:

- SER Section 4.2.2 - TLAA for USE (the analogous LRA section is LRA Section 4.2.2)
- SER Section 4.2.3 - TLAA for PTS (the analogous LRA section is LRA Section 4.2.3)
- SER Section 4.2.4 - TLAA for calculation of the P-T limit curves (the analogous LRA section is LRA Section 4.2.4)

Section 4.2.1 of the LRA for Millstone Units 2 and 3 describes the neutron fluence calculations to support the above TLAAs for USE, PTS, and P-T limit curves. Therefore, the neutron fluence calculations will be evaluated in Section 4.2.1 of this SER in order to support the evaluation of the above TLAAs.

4.2.1 Neutron Fluence

4.2.1.1 Summary of Technical Information in the Application

In Section 4.2.1 of the LRA for Millstone Unit 2, the applicant summarizes the analytical evaluation of the neutron fluence calculations for the period of extended operation. In this section of the LRA, the applicant provided the following assessment for the neutron fluence calculations and the fluence values (Table 4.2-1 and 4.2-2 of the LRA) through the period of extended operation:

> The analytical calculation of the space and energy dependent neutron flux in the reactor vessel is performed with the two-dimensional discrete ordinates transport code DOTIV, (Reference 4.8-42). The calculations employ an angular quadrature of 48 sectors (S8), a third-order LeGendre [Legendre] polynomial scattering approximation (P3), the BUGLE cross section set (Reference 4.8-43) with 47 neutron energy groups, and a fixed distribution source corresponding to the time weighted average power distribution for the applicable irradiation period.
>
> The transition temperature shift for the base metal employing the neutron flux calculated using this methodology is in good agreement with the predicted value employing Regulatory Guide 1.99, Revision 2 guidance. The transition temperature shift for the weld metal employing the 4 neutron flux calculated using this methodology is conservative compared with the predicted shift using Regulatory Guide 1.99, Revision 2 guidance (Reference 4.8-44).

For Millstone Unit 3, the description of the neutron fluence evaluation in the LRA is limited to the statement that the neutron fluence is calculated using a discrete-ordinates transport method consistent with draft NRC Regulatory Guide (DG)-1053. The neutron fluence values were provided in Tables 4.2-1 and 4.2-2 of the Millstone Unit 3 LRA.

In LRA Section 4.2.1 for Unit 2, the applicant stated that the analytical calculation of the space and energy-dependent neutron flux in the reactor vessel is performed with the two-dimensional discrete ordinates transport code DOT-IV. The calculations employ an angular quadrature of 48 sectors (S8), a third-order LeGendre polynomial scattering approximation (P3), the BUGLE cross-section set with 47 neutron energy groups, and a fixed distribution source corresponding to the time-weighted average power distribution for the applicable irradiation period.

4.2.1.2 Staff Evaluation

The staff issued RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," in March 2001. The RG provides guidance regarding acceptable methods for the benchmarking of RV fluence methodologies based on the requirements of General Design Criterion (GDC) 31 and, in part, on GDC 14 and 30. Therefore, the staff based its review of the RV fluence evaluation for Millstone Units 2 and 3 on the adherence of the calculational method to the guidance in RG 1.190.

To evaluate the fluence values for Millstone Unit 2, the staff requested the applicant to specify whether the fluence calculations met the guidance in RG 1.190. In addition, several other requests for additional information were asked, such as the derivation of the neutron sources, what assumption were made for core loading, and the consideration of the effect of plutonium in the calculations. These requests were identified by the staff as RAI 4.2.1-1(a) through (e).

In response to RAI 4.2.1-1(a) through (e), the applicant stated that the methodology used for the calculation of the vessel neutron fluence to the end of the renewed license (54 effective full-power years (EFPYs) of operation) does not fully conform to the guidance in RG 1.190. In addition, the transport cross sections are derived from the ENDF/B-IV file, which is not allowed in RG 1.190. Although the methodology does not meet the guidance of RG 1.190, the applicant stated that the fluence calculation is sufficiently documented to determine the impact of neutron fluence on radiation embrittlement.

In Table 4.2-2 of the submittal, the applicant indicated that for RT_{PTS} the critical element is the Lower Shell Plate C-506-1 with an estimated RT_{PTS} equal to 190.5 °F at 54 EFPYs and a peak inside surface fluence of 4.05×10^{19} n/cm^2 (E > 1.0 MeV). The staff has concluded from experience that fluence values calculated using methods not in compliance with the guidance in RG 1.190 could differ by as much as 40 percent from fluence values calculated by methods that adhere to RG 1.190 guidance. Assuming that the above fluence value is underestimated by 40 percent, the value would be 5.67×10^{19} n/cm^2. Using equation 2 in RG 1.99 with the chemistry factor (CF) of 110 °F and an initial RT_{NDT} value of 7.0 °F from Table 4.2-2, the RT_{PTS} is equal to 197.9 °F. This value is well within the screening criterion of 270 °F of 10 CFR 50.61. Therefore, the staff concludes that the material properties are well within the safety limits. Similar results are obtained with the USE and are discussed in Section 4.2.2.2 of this SER.

However, the applicant is planning to submit pressure-temperature (P-T) limit curves for 54 EFPYs at least two years prior to the period of extended operation. In response to RAI 4.2.1-3, the applicant stated that the FSAR supplement will be modified to reflect revised vessel fluence methodologies that follow the guidance in RG 1.190. (See Section 4.2.1.3 of this SER.) This resolves RAI 4.2.1-1(a) through (e).

In addition, the staff requested the applicant to confirm that the neutron fluence methodology used for Millstone Unit 3 adheres to the guidance of RG 1.190. Several other requests for additional information were made by the staff to evaluate the fluence calculations, such as what approximations were used, what assumptions regarding fuel loading were made, and what consideration of plutonium was made in the fluence calculations. These requests were identified by the staff as RAI 4.2.1-2(a) through (e).

In its response to RAI 4.2.1-2(a) through (e), the applicant stated that the vessel fluence for Unit 3 was calculated using a discrete ordinates method using DOORS 3.1, "RSICC Computer Code Collection CCC-650, "DOORS 3.1, Two- and Three-Dimensional Discrete Ordinates Neutron/Photon Transport Code System," dated August, 1996, which followed the guidance in RG 1.190. Specifically, the transport cross sections were derived from BUGLE-96, RSICC Data Library Collection DLC-185 "BUGLE-96 Coupled 47 Neutron, 20 Gamma-Ray Group Cross Section Library Derived from ENDF/B-VI for LWR Shielding and Pressure Vessel Dosimetry Applications," dated March, 1996, which is based on the ENDF/B-VI file recommended in RG 1.190. Similarly, the anisotropic scattering was approximated with a P_3 LeGendre expansion polynomial and the angular discretization with a S_8 order of angular quadrature. Energy- and space-dependent power distributions were derived from cycle-specific calculations. Projections to 54 EFPYs were based on the low leakage loadings for cycles four to six. The burnup dependent effects of the neutron source account for the spatial variation of the neutron source as well as the spectral effects introduced by the derivative fissioning isotopes of Pu-239 and Pu-241. In summary, the staff finds that the proposed value of the vessel fluence in Table 4.2-1 for 54 EFPYs for E > 1.0 MeV is acceptable because the methodology follows the guidance in RG 1.190. This resolves RAI 4.2.1-2(a) through (e).

4.2.1.3 FSAR Supplement

The staff recognizes that the applicant calculated fluence values to 54 EFPYs (i.e., the end of the period of extended operation) in each LRA Section 4.2.1, which contains the evaluations of TLAAs. However, the applicant did not specifically state that the calculations for neutron fluence values are TLAAs. The staff considers that the calculations for neutron fluence values meet the requirements of 10 CFR 54.3, in that they use time-limiting assumptions. Also, the operating assumptions in these calculations could change, as for example, with the introduction of new fuel, new material properties, etc. In such an instance, 10 CFR 50.61 and other regulations require recalculation of the fluence and reevaluation of the material properties. Pursuant to 10 CFR Part 54.21(d), the Millstone FSAR supplement for a facility LRA must contain a summary description for each AMP and TLAA proposed for management of the effects of aging. The staff determined that Appendix A of the LRAs (the FSAR supplement) did not include a corresponding FSAR supplement summary description for the TLAA in Section 4.2.1, "Neutron Fluence," of the LRAs. Therefore it is necessary to capture this information in the FSAR supplements. Pursuant to 10 CFR 54.21(d), the staff requested that a corresponding FSAR supplement summary description for each LRA Section 4.2.1 be included in the FSAR supplements. This request was identified by the staff as RAI 4.2.1-3.

In response to RAI 4.2.1-3, in a letter dated December 3, 2004, the applicant updated Section A3.1.3 of the Millstone Units 2 and 3, FSAR supplements to incorporate a summary description on the current methodology of calculating neutron fluence and the use of RG 1.190 in developing fluence values for the period of extended operation. This includes a statement in the proposed FSAR supplements that when developing the Millstone Units 2 and 3 P-T limit curves for the period of extended operation, fluence values will be developed in accordance with RG 1.190 requirements. Millstone Unit 3 uses a fluence methodology in accordance with DG-1053, and the specific methodology applied to the calculation followed the guidance of RG 1.190. DG-1053 is the draft version of RG 1.190 and provides similar conservatism when calculating the reactor vessel fluence values. Therefore for Millstone Unit 3, the fluence values meet the guidelines of RG 1.190 and are acceptable to the staff.

However, Millstone Unit 2 does not use a fluence methodology in accordance with RG 1.190, and therefore the methodology may be less conservative. The staff has concluded from experience that fluence values calculated using methods not in compliance with the guidance in RG 1.190 could differ by as much as 40 percent from fluence values calculated by methods that adhere to RG 1.190 guidance. Since the applicant will be providing new P-T limit curves for 54 EFPY, the staff requested that the applicant commit to submit the reactor vessel fluence calculations using a methodology in accordance with RG 1.190, which will also support the P-T limit curve submittal, to the NRC along with the 54 EFPY P-T limit curves in 2005. The applicant needed to add to its list of commitments the submittal of a re-evaluation of the USE and RT_{PTS} to update the licensing basis to be consistent with the fluence values used in the P-T limit curves.

In response to supplemental RAI 4.2.1-3 in a letter dated February 8, 2005, the applicant committed to update the USE, RT_{PTS} and P-T limit curves based on fluence values developed in accordance with RG 1.190 requirements, through the period of extended operation. The applicant will provide these updated evaluations at least two years prior to the period of extended operation and is documented as Commitment Item 37 in the Millstone Unit 2 FSAR supplement, Appendix A, Table A6.0-1. This resolves RAI 4.2.1-3.

4.2.1.4 Conclusion

The staff has reviewed the applicant's evaluation on neutron fluence, as summarized in Section 4.2.1 of the LRAs, and has determined that the applicant's calculation of the neutron fluence values, as projected through the expiration of the periods of extended operation for the Millstone units, is acceptable to use in the evaluation of the TLAAs for the USE, PTS, and P-T limit curves. The neutron fluence values are acceptable because Millstone Unit 3 meets the guidelines of RG 1.190, and because the staff added a conservative factor to the Millstone Unit 2 methodology based on past evaluations. The staff also concludes that the Millstone FSAR supplements contain appropriate summary descriptions of the TLAA on neutron fluence for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.2 Upper-Shelf Energy

4.2.2.1 Summary of Technical Information in the Application

In each LRA Section 4.2.2, the applicant summarizes the requirements of 10 CFR Part 50, Appendix G, for end-of-license USE values and identifies that the calculation of the USE values is a TLAA for the applications. In this section of the LRAs, the applicant provided the following assessment for the USE values through the expiration of the periods of extended operation for the units:

> Upper shelf energy values have been calculated per 10 CFR 50.61 using the most recent reactor pressure vessel material property information, including the best estimate copper and nickel values for each of the beltline plates and welds, unirradiated drop weight and Charpy data, and reactor vessel surveillance capsule examination results. This information, developed for 32 effective full power years (EFPY), was used in part to respond to NRC Generic Letter 92-01 Revision 1, Supplement 1 which requested that addressees identify, collect and report any new information pertaining to the analysis of reactor vessel structural integrity. Thirty-two EFPY would be reached at the end of the currently licensed 40-year period of operation assuming a capacity factor of 80%. Similarly, 54 EFPY would be reached at the end of the period of extended operation (60 years) assuming a capacity factor of 90%. The calculated upper shelf energy values were then used in conjunction with NRC RG 1.99, Revision 2 requirements to predict those material changes due to irradiation.
>
> The 54 EFPY upper shelf energy values for the reactor pressure vessel beltline materials were calculated using Figure 2 in RG 1.99, Revision 2, Position 1. Capsule data has been considered and determined to result in values less conservative than obtained from using RG 1.99, Revision 2, Position 1. As shown in Table 4.2-1, acceptable upper shelf energy values have been demonstrated for reactor pressure vessel beltline plate and weld materials through the 54 EFPY period of extended operation. Since all reactor pressure vessel beltline plate and weld materials have upper shelf energy values greater than 50 ft-lbs, no equivalent margins analysis was performed.

Acceptable upper shelf energy values have been calculated in accordance with Regulatory Guide 1.99, Revision 2 to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii). Calculated upper shelf energy values for the most limiting reactor pressure vessel beltline plate and weld materials remain greater than 50 ft-lbs.

In each LRA Section 4.2.2, the applicant described the screening criteria that establish limits on how far the USE values for a reactor pressure vessel (RPV) material may be allowed to drop due to neutron radiation exposure. The applicant stated that regulation 10 CFR Part 50, Appendix G, Section IV.A.1 requires the initial USE value to be greater than 75 ft-lb in the unirradiated condition and for the value to be greater than 50 ft-lb in the fully irradiated condition as determined by Charpy V-notch specimen testing throughout the licensed life of the plant. USE values of less than 50 ft-lb may be acceptable to the NRC if it can be demonstrated that these lower values will provide margins of safety against brittle fracture equivalent to those required by ASME Section XI, Appendix G.

USE values have been calculated per 10 CFR 50.61 using the most recent RPV material property information, including the best estimate copper and nickel values for each of the beltline plates and welds, unirradiated drop weight and Charpy data, and reactor vessel surveillance capsule examination results.

This information, developed for 32 effective full power years (EFPY), was used in part to respond to NRC Generic Letter (GL) 92-01 Revision 1, Supplement 1, which requested that addressees identify, collect, and report any new information pertaining to the analysis of reactor vessel structural integrity. Thirty-two EFPY would be reached at the end of the currently licensed 40-year period of operation, assuming a capacity factor of 80 percent. Similarly, 54 EFPY would be reached at the end of the period of extended operation (60 years) assuming a capacity factor of 90 percent. The calculated USE values were then used in conjunction with NRC RG 1.99, Revision 2 requirements to predict those material changes due to irradiation.

The 54 EFPY USE values for the RPV beltline materials were calculated using Figure 2 in RG 1.99, Revision 2, Position 1. Capsule data have been considered and determined to result in values less conservative than obtained from using RG 1.99, Revision 2, Position 1. As shown in Table 4.2-1, acceptable USE values have been demonstrated for RPV beltline plate and weld materials through the 54 EFPY period of extended operation. Since all RPV beltline plate and weld materials have USE values greater than 50 ft-lb, no equivalent margins analysis was performed.

A comparison of copper content and initial upper-shelf energy for Millstone Unit 2 beltline materials listed in Table 4.2-1 to the values listed in NRC reactor vessel integrity database (RVID2 version 2.0.5 updated June 9, 1999) indicates slight differences for selected materials. The most significant discrepancies are relative to initial USE for weld seam 9-203, fabricated with weld wire heats 90136 and 10137, and Linde 0091 flux. The value of USE documented in Table 4.2-1 is 2.2 ft-lb greater than the value provided by the RVID2. The Table 4.2-1 value is derived from surveillance weld material representative of this weld (same consumables) and constitutes a mean of all data at 100 percent shear. Similarly, the weld seams 2-203A/B/C and 3-203A/B/C fabricated with weld wire heat A8746 and Linde flux 124 have a USE 10.5 ft-lb greater than the RVID2 value. The Table 4.2-1 value is based on a generic value for Linde 124 welds provided in Combustion Engineering Owners Group report CEN-622-A. This report has been reviewed and approved by the NRC.

A comparison of copper content, nickel content, and initial USE for Millstone Unit 2 beltline materials listed in Table 4.2-1 to the values submitted to the NRC in response to GL 92-01 indicate only differences for weld 9-203, heat 90136. Initial USE for weld 9-203, heat 90136 listed in Table 4.2-1 is 21.2 ft-lb greater than the GL 92-01 value. These updated values are based on surveillance data that were identified subsequent to the issuance of the Millstone licensee response to GL 92-01.

The applicant states that acceptable USE values have been calculated in accordance with RG 1.99, Revision 2 to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii). Calculated USE values for the most limiting RPV beltline plate and weld materials remain greater than 50 ft-lb.

4.2.2.2 Staff Evaluation

Section IV.A.1 to 10 CFR Part 50, Appendix G, provides requirements for demonstrating that reactor vessels (RV) in U.S. pressurized water reactor (PWR) light-water reactor facilities will have ductility throughout their service lives. The Rule requires RV beltline materials to have USE values equal to or above 75 ft-lb initially, and equal to or above 50 ft-lb throughout the life of the vessel. RG 1.99, Revision 2 provides an expanded discussion regarding the calculations of USE values and describes two methods for determining USE values for RV beltline materials, depending on whether or not a given RV beltline material is represented in the plant's Reactor Vessel Material Surveillance Program.

The applicant provided its USE assessments for the RV beltline materials of Millstone Units 2 and 3 in Table 4.2-1 of the applications. However, for Millstone Unit 2, one weld (upper/intermediate shell circumferential weld 8-203, heats 10137 and 33A277) was not included in the USE evaluation. This weld is in the NRC staff's RVID. In RAI 4.2.2-1, the staff requested the applicant to provide a USE evaluation for this weld, or provide justification for not including it in the evaluation.

In response to RAI 4.2.2-1, in a letter dated December 3, 2004, the applicant provided a USE evaluation for the Millstone Unit 2 RPV upper/intermediate shell circumferential weld 8-203. The evaluation provided a USE value for weld 8-203 of 72.2 ft-lb for heat 33A277 and 77.3 ft-lb for heat 10137. The staff confirmed these values and determined that they are conservative and that a USE value of 72.2 ft-lb for weld 8-203 is acceptable. However, the applicant stated in its response that this weld does not meet the definition of beltline region in Appendix G to 10 CFR Part 50, because it is above the active core. However, 10 CFR Part 50 Appendix G, paragraph II.F also defines the beltline region to include adjacent regions of the RV that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limited material with regard to radiation damage. In addition, 10 CFR Part 50, Appendix H specifies that material exposed to peak neutron fluence that exceeds 10^{17} n/cm^2 must be monitored by a surveillance program complying with ASTM E 185. Also, RG 1.99, Revision 2, sets forth criteria for evaluating the USE and PTS for material exceeding this fluence value. The applicant determined the inner surface fluence value for this weld to be 2.43×10^{18} n/cm^2. Therefore, the applicant was requested to update the FSAR supplement for Millstone Unit 2 by adding weld 8-203 and the corresponding USE value to Table 1 of the Millstone Unit 2 FSAR supplement.

In response to supplemental RAI 4.2.2-1 in a letter dated February 8, 2005, the applicant provided the USE evaluation for the Millstone Unit 2 reactor pressure vessel upper/intermediate circumferential weld (weld No. 8-203) manufactured from which used weld wire heats 33A277 and 10137. The evaluation is documented in Table 3.1.1-3-1 to Dominion's supplemental response to RAI 3.1.1-3. The applicant calculated the USE values for these materials in accordance with 10 CFR Part 50, Appendix G through the extended period of operation. The results of the USE evaluations on these expanded beltline regions had no effect on the limiting material. The staff confirmed that the limiting material previously identified in the LRA is still bounding. Therefore, since the applicant evaluated all materials that were determined to exceed the 1.0×10^{17} n/cm^2 (E>1.0 MeV) boundary and identified that the limiting material specified in the LRA is still bounding, the staff finds this response acceptable. In addition, the level of detail described in the FSAR supplement follows the recommendations of NUREG-1800, Table 4.2-1. This resolves RAI 4.2.2-1.

The USE assessments were based on the 1/4t neutron fluence values listed in LRAs Table 4.2-1. These neutron fluence values are based on the projected values at the end of the periods of extended operation (i.e., 54 EFPY). Section 4.2.3.1 of this SER sets forth the staff's evaluation of the fluence methodologies.

The staff performed independent calculations of the USE values for the RV beltline materials through the period of extended operation for Millstone Units 2 and 3. The staff applied the 1/4t neutron fluence values listed in LRA Table 4.2-1 for the Millstone Unit 3 RV as its basis for its independent calculations since the fluence methodologies were consistent with RG 1.190. For Millstone Unit 2, the staff used both the 1/4t neutron fluence values listed in the LRA Table 4.2-1 and fluence values that were increased by a factor of 40 percent to estimate the variance in the fluence methodologies providing a conservative estimate of the fluence values that would bound the values expected if a RG 1.190-compliant analysis was performed. The staff applied the calculational methods in RG 1.99, Revision 2, as its methodology for performing the independent USE calculations. RG 1.99, Revision 2 requires that all available plant-specific surveillance data be used in determining the USE. The staff's calculations included the use of the surveillance capsule values provide in the RVID. RVID is a database maintained by the staff. It contains a summary of all of the relevant materials data submitted by all applicants in their evaluations of reactor vessel integrity. While performing the independent USE calculations, the staff calculated a USE value for the lower shell plate C-506-1 that differed from the value specified in Table 4.2-1 of the application for 54 EFPY. This difference can be attributed to the applicant performing the evaluation consistent with Position 1.1 of RG 1.99, Revision 2, for material that has no surveillance data available. In RAI 4.2.2-2, the staff requested the applicant to provide the calculated USE value for the lower shell plate C-506-1, heat C5667-1 using all available surveillance data as required by RG 1.99, Revision 2.

In response to RAI 4.2.2-2, in a letter dated December 3, 2004, the applicant provided a USE evaluation for the Millstone Unit 2 RPV lower shell plate C-506-1, heat C5667-1, using all available surveillance data as recommended by RG 1.99, Revision 2. The evaluation provided a USE value for shell plate C-506-1, heat C5667-1, of 54.5 ft-lb, using surveillance capsule W-97. The staff confirmed this value and determined that it is conservative and acceptable. However, the applicant did not include this revised USE value of 54.5 ft-lb in the Millstone Unit 2 FSAR supplement. Therefore, the applicant was requested to update the FSAR supplement for Millstone Unit 2 by revising the USE value from 76.1 ft-lb to 54.5 ft-lb for shell plate C-506-1, heat C5667-1, in Table 1 of Section A3.1.1 to the Millstone Unit 2 FSAR supplement.

In response to supplemental RAI 4.2.2-2 in a letter dated February 8, 2005, the applicant stated that the calculated USE value for Millstone Unit 2 lower shell plate C-506-1, heat number C5667-1 is 65.3 ft-lbs, not the 54.5 ft-lbs originally identified in Table 1 of Dominion's December 3, 2004, response to RAI 4.2.2-2. The 65.3 ft-lbs value represents the reactor pressure vessel lower shell plate C-506-1, heat number C5667-1 USE value developed using all available surveillance data. The USE value of 54.5 ft-lbs previously presented in the RAI response is more conservative than the actual USE value of 65.3 ft-lbs. The staff notes that the value of 54.5 ft-lbs was deemed conservative based on the staff's calculated value of 61 ft-lbs. In either case, the USE value is above the 50 ft-lbs required by 10 CFR Part 50, Appendix G. This also confirms that this subcomponent of the reactor pressure vessel is not the limiting material. The limiting material is discussed below. In addition, the level of detail described in the FSAR supplement follows the recommendations of NUREG-1800, Table 4.2-1. This resolves RAI 4.2.2-2.

In Section 4.2.2 of the Millstone Unit 2 LRA, the applicant stated that there is a difference between the unirradiated USE value presented in Table 4.2-1 of the application and RVID values for the mid-circumferential weld (weld 9-203) fabricated with weld wire heats 90136 and 10137 with Linde 0091 flux. The value of the unirradiated (initial) USE documented in Table 4.2-1 is 2.2 ft-lb greater than the value provided in RVID. The applicant stated that the value in the LRA was based on the mean of all surveillance weld material representative of this weld (same consumables) at 100 percent shear. In RAI 4.2.2-3, the staff requested the applicant to provide all relevant surveillance weld data for each of the weld wire heats (90136 and 10137) which were used to calculate the mean unirradiated USE values for each weld wire heat.

In response to RAI 4.2.2-3, in a letter dated December 3, 2004, the applicant provided all relevant surveillance weld data for each of the weld wire heats (90136 and 10137) which were used to calculate the mean unirradiated USE values for each weld wire heat. Based on the surveillance data results submitted by the applicant, the staff confirmed that the mean unirradiated (initial) USE value for weld 9-203 is 132.2 ft-lb and is acceptable in determining the 54 EFPY USE value for this weld. This resolves RAI 4.2.2-3.

Table 4.2-1 of the Millstone Unit 2 application also stated that the unirradiated USE values for the lower and intermediate axial welds 2-203A, B, and C; and weld 3-203A (heat A8746) using Linde 124 flux was based on the generic value provided in Combustion Engineering Owners Group report CEN-622-A. This report was approved by the NRC in a letter dated September 25, 1996. Previously, the unirradiated USE value was 73 ft-lb, based on Charpy impact data tested at 10°F. The staff considers this value of 73 ft-lb to be in the transition range of the material, not the upper-shelf range; therefore, the actual unirradiated USE value would be much higher, and the use of the generic value of 83.5 ft-lb based on data in the upper-shelf region is appropriate for the unirradiated USE value for these welds using Linde 124 flux.

The staff determined that at Millstone Unit 2 the lower and intermediate shell axial welds 2-203A, B, and C; and weld 3-203A (heat A8746) are the limiting beltline materials for USE. The staff calculated a USE value of 55.2 ft-lb for these welds at 54 EFPY using the LRAs fluence value. This USE value is in agreement with the 54 EFPY USE value calculated by the applicant for these welds (54.3 ft-lb). In addition, the staff applied a 40 percent increase in fluence to estimate values that would bound fluence values performed in accordance with the guidelines of RG 1.190, yielding an estimated fluence of 4.606×10^{19} n/cm^2 for the limiting lower shell axial welds 2-203A, B, and C; and weld 3-203A. Using this estimated fluence value, the staff calculated a limiting USE value of 52.9 ft-lb. Both of these values meet the acceptance criterion in 10 CFR Part 50, Appendix G, for maintaining the USE values of the RV beltline materials above 50 ft-lb throughout the period of extended operation. The staff confirmed that the updates to the surveillance data (copper content and unirradiated USE values) for Millstone Unit 2, as reported in Section 4.2.2 of the application, did not change the limiting USE material for Millstone Unit 2. The updates include the unirradiated USE values for welds 9-203; 2-203A, B, C; and 3-203A, discussed in the previous paragraphs, which were found acceptable. In addition, the chemistry values for weld 9-203 had different copper contents than what was previously submitted in response to GL 92-01. However, these best-estimate chemistry values were previously approved by SER dated August 30, 1999, and incorporated into RVID; and are therefore acceptable.

The staff determined that, at Millstone Unit 3, lower shell plate B9820-2 (heat D1242-2) is the limiting beltline material for USE. The staff calculated a USE value of 59.0 ft-lb for this plate at 54 EFPY. This value is in agreement with the 54 EFPY USE value calculated by the applicant for this material (58.8 ft-lb). Both of these values meet the acceptance criterion in 10 CFR Part 50, Appendix G, for maintaining the USE values of the RV beltline materials above 50 ft-lb throughout the period of extended operation.

Based on these assessments, the staff has determined that the RVs at Millstone Units 2 and 3 will maintain an acceptable level of USE throughout the units' periods of extended operation. The staff therefore concludes that the applicant's TLAA for USE, as given in Section 4.2.2 of the LRAs, is in compliance with requirements of 10 CFR Part 50, Appendix G.

4.2.2.3 FSAR Supplement

Section A.3.1.1 of each LRA includes the following FSAR supplement summary description for the TLAA on USE:

> 10 CFR 50, Appendix G contains screening criteria that establish limits on how far the upper shelf energy values for a reactor pressure vessel material may be allowed to drop due to neutron irradiation exposure. The regulation requires the initial upper shelf energy value to be greater than 75 ft-lbs in the unirradiated condition and for the value to be greater than 50 ft-lbs in the fully irradiated condition as determined by Charpy V-notch specimen testing throughout the licensed life of the plant. Upper shelf energy values of less than 50 ft-lbs may be acceptable to the NRC if it can be demonstrated that these lower values will provide margins of safety against brittle fracture equivalent to those required by ASME Section XI, Appendix G.
>
> Acceptable upper shelf energy values have been calculated in accordance with Regulatory Guide 1.99, Revision 2 to the end of the period of extended operation. Calculated upper shelf energy values for the most limiting reactor pressure vessel beltline plate and weld materials remain greater than 50 ft-lbs.

The applicant's FSAR supplement summary description does not specify how the RV beltline materials at Millstone Units 2 and 3 will be in compliance with the applicable requirements in 10 CFR Part 50, Appendix G, as projected through the period of extended operation. Specifically, the applicant has not stated which materials are limiting; nor has it stated the materials' USE values. In RAI 4.2.2-4, the staff requested the applicant to provide this information in the FSAR supplements.

In its response to RAI 4.2.2-4, dated December 3, 2004, the applicant provided information, including the beltline USE values, that will be incorporated into Section A3.1.1 of the Millstone Units 2 and 3 FSAR supplements concerning the limiting beltline material and stated that they are in compliance with the applicable requirements in 10 CFR Part 50, Appendix G. The staff has reviewed this information and requests the following supplemental information. The applicant stated that the USE values for the limiting beltline materials have been calculated in accordance with 10 CFR 50.61 and demonstrate acceptable USE values through the period of extended operation. The staff requested that the applicant confirm that the USE analysis was performed in accordance with 10 CFR Part 50, Appendix G, and not 10 CFR 50.61 (which is used for PTS evaluation). The confirmed information should be incorporated into the FSAR supplements accordingly.

In its response to supplemental RAI 4.2.2-4, dated February 8, 2005, the applicant confirmed that the Millstone Units 2 and 3 USE evaluations were performed using 10 CFR Part 50, Appendix G, and not 10 CFR 50.61. The applicant had erroneously cited 10 CFR 50.61 in its response to RAI 4.2.2-4. The applicant also stated that the applicable FSAR supplements reference 10 CFR Part 50, Appendix G. This resolves RAI 4.2.2-4.

The applicant's Millstone FSAR supplements summary descriptions are consistent with the staff analysis for the TLAA on USE in Section 4.2.2.2 of this SER. The FSAR supplements summary descriptions summarize the applicable USE requirements that must be met to ensure continued compliance with 10 CFR Part 50, Appendix G, and demonstrates why the RV beltline materials at Millstone Units 2 and 3 will be in compliance with the applicable requirements in 10 CFR Part 50, Appendix G, as projected through the extended periods of operation for the units. The staff therefore concludes that FSAR supplements summary description for the TLAA on USE is acceptable.

4.2.2.4 Conclusion

The staff has reviewed the applicant's TLAA on USE, as summarized in each LRA Section 4.2.2, and has determined that the RV beltline materials at Millstone Units 2 and 3 will continue to comply with the staff's USE requirements of 10 CFR Part 50, Appendix G, throughout the extended periods of operation for the Millstone units. The staff therefore concludes that the applicant's TLAA for USE is in compliance with the staff's acceptance criterion for TLAAs in 10 CFR 54.21(c)(1)(ii) and that the safety margins established and maintained during the current operating term will be maintained during the periods of extended operation as required by 10 CFR 54.21(c)(1). The staff also concludes that the FSAR supplements contain an appropriate summary description of the TLAA on USE for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.3 Pressurized Thermal Shock

4.2.3.1 Summary of Technical Information in the Application

In each LRA Section 4.2.3, the applicant summarizes the PTS requirements of 10 CFR 50.61 and identifies that the calculation of the adjusted reference temperature values for PTS (i.e., RT_{PTS} values) is a TLAA for the applications. In this section of the LRAs, the applicant provided the following assessment for the RT_{PTS} values for the RV beltline materials at Millstone through the period of extended operation for the units:

> Reactor pressure vessel beltline fluence is one of the factors used in determining the margin of acceptability of the reactor pressure vessel to pressurized thermal shock as a result of radiation embrittlement. The margin is the difference between the maximum nil ductility reference temperature in the limiting beltline material (RT_{PTS}) and the screening criteria established in accordance with 10 CFR 50.61(b)(2). The screening criteria for the limiting reactor vessel materials are 270 °F for beltline plates, forging and axial weld materials, and 300 °F for beltline circumferential weld materials. The 54 EFPY RT_{PTS} values for the reactor pressure vessel beltline materials are summarized within Table 4.2-2. The RT_{PTS} screening criteria have been met in all cases.
>
> Acceptable RT_{PTS} values have been calculated in accordance with Regulatory Guide 1.99, Revision 2 requirements to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

RPV beltline fluence is one of the factors used in determining the margin of acceptability of the RPV to pressurized thermal shock as a result of radiation embrittlement. The margin is the difference between the maximum nil ductility reference temperature in the limiting beltline material (RT_{PTS}) and the screening criteria established in accordance with 10 CFR 50.61(b)(2). The screening criteria for the limiting reactor vessel materials are 270 °F for beltline plates, forgings, and axial weld materials; and 300 °F for beltline circumferential weld materials.

The LRAs contain the applicant's description of the methodology it utilized in calculating RT_{PTS} values. The applicant stated that the methodology is also consistent with RG 1.99, Revision 2 requirements. The 54 EFPY RT_{PTS} values for the RPV beltline materials are summarized within LRAs Table 4.2-2. The RT_{PTS} screening criteria have been met in all cases.

A comparison of copper content, nickel content, and initial RT_{NDT} Millstone Unit 2 beltline materials listed in LRA Table 4.2-2 to the values listed in NRC reactor vessel integrity database (RVID2 version 2.0.5, updated June 9, 1999) identified no differences.

A comparison of copper content, nickel content, initial RT_{NDT} for Millstone Unit 2 beltline materials listed in LRA Table 4.2-2 to the values submitted to the NRC in response to GL 92-01 indicate slight differences for selected materials. The applicant stated that the most significant discrepancies are relative to initial RT_{NDT} for shell plate C-506-2 and shell plate C-506-3. For shell plate C-506-2 the initial RT_{NDT} listed in Table 4.2-2 is 15.4 °F lower than the GL 92-01 value. Similarly, for shell plate C-506-3 the initial RT_{NDT} listed in Table 4.2-2 is 32.0 °F lower than the GL 92-01 value. These updated values are based on original qualification data that were identified subsequent to the issuance of the Millstone response to GL 92-01.

Acceptable RT_{PTS} values have been calculated in accordance with RG 1.99, Revision 2 requirements to the end of the period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii).

4.2.3.2 Staff Evaluation

The staff's requirements for ensuring that the RV beltline materials of pressurized light-water reactors will have adequate protection against the consequences of PTS events are set forth in 10 CFR 50.61. The Rule requires applicants to calculate an adjusted reference temperature value for PTS (i.e., RT_{PTS} values) for each base metal and weld material located in the beltline region of their RVs. The Rule sets a screening limit of 270 °F for RT_{PTS} values that are calculated for plates, forging, and axial weld materials; and a screening limit of 300 °F for RT_{PTS} values that are calculated for circumferential weld materials. The Rule also provides an expanded discussion regarding how the calculations of RT_{PTS} values should be performed and describes two methods for determining RT_{PTS} values for RV beltline materials, depending on whether or not a given RV beltline material is represented in the plant's reactor vessel material surveillance program.

For the RV beltline materials of Millstone Units 2 and 3, the applicant provided its RT_{PTS} value assessments in Table 4.2-2 of the applications. However, for Millstone Unit 2, one weld (upper/intermediate shell circumferential weld 8-203, heats 10137 and 33A277) was not included in the RT_{PTS} evaluation. In RAI 4.2.2-1, the staff requested the applicant to provide a RT_{PTS} evaluation for this weld, or provide justification for not including it in the evaluation. The applicant's RT_{PTS} value assessments for the Millstone units are based on fluence values listed in LRAs Table 4.2-2 for the inner surface location of the RVs, as projected to the end of the extended periods of operation (i.e., 54 EFPY).

In response to RAI 4.2.2-1, in a letter dated December 3, 2004, the applicant provided an RT_{PTS} evaluation for the Millstone Unit 2 reactor pressure vessel upper/intermediate circumferential weld 8-203 which used weld wire heats 33A277 and 10137. The evaluation provided a RT_{PTS} value for weld 8-203 of 97.9 °F for heat 33A277 and 73.9 °F for heat 10137. The staff confirmed these values and determined that they are conservative and therefore acceptable. However, the applicant also stated in its response, that this weld does not meet the 10 CFR Part 50, Appendix G definition of beltline region, since it is above the active core. However, 10 CFR Part 50, Appendix G, paragraph II.F, also defines the beltline region to include adjacent regions of the reactor vessel that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limited material with regards to radiation damage. In addition, 10 CFR Part 50, Appendix H specifies that material exposed to peak neutron fluence that exceed 10^{17} n/cm^2 must be monitored by a surveillance program complying with ASTM E185. RG 1.99, Revision 2 sets forth criteria for evaluating the USE and RT_{PTS} for material exceeding this fluence value. The applicant determined that the inner surface fluence value for this weld to be 2.43 x10^{18} n/cm^2. Therefore, the applicant was requested to update the FSAR supplement for Millstone Unit 2 by adding weld 8-203 and the corresponding RT_{PTS} value to Table 1 of the FSAR supplement for Millstone Unit 2.

In response to supplemental RAI 4.2.2-1 in a letter dated February 8, 2005, the applicant provided the PTS evaluation for the Millstone Unit 2 reactor pressure vessel upper/intermediate shell circumferential weld (weld No. 8-203) manufactured from weld wire heats 33A277 and 10137. The evaluation is documented in Table 3.1.1-3-2 to Dominion's supplemental response to RAI 3.1.1-3. The applicant calculated the PTS values for these materials in accordance with 10 CFR 50.61 through the extended period of operation. The results of the PTS evaluations on these expanded beltline regions had no effect on the limiting material. The staff confirmed that the limiting material previously identified in the LRA is still bounding. Therefore, since the applicant performed the evaluations of all materials that were determined to exceed the 1.0×10^{17} n/cm^2 (E>1.0 MeV) boundary and identified that the limiting material specified in the LRA is still bounding, the staff finds this response acceptable. In addition, the level of detail described in the FSAR supplement follows the recommendations of NUREG-1800, Table 4.2-1. This resolves RAI 4.2.2-1.

To confirm the validity of the applicant's limiting 54 EFPY RT_{PTS} value for the Millstone Unit 2 RV, the staff performed independent calculations of the RT_{PTS} values through the period of extended operation. For Millstone Unit 2, the staff used both the inside diameter neutron fluence values listed in LRA Table 4.2-1 and fluence values that were increased by a factor of 40 percent to estimate the variance in the fluence methodologies providing a conservative estimate of the fluence values that would bound the values expected if a RG 1.190-compliant analysis was performed. The staff determined that for Millstone Unit 2, lower shell plate C-506-1 (heat C5667-1) is the limiting RV beltline material for PTS. The staff calculated an RT_{PTS} value of 190.5 °F for this material at 54 EFPY (using the LRA fluence value), which is in agreement with the applicant's calculation. Applying the 40 percent increase in fluence to estimate values that would bound fluence values performed with the guidelines of RG 1.190 yields an estimated fluence of 5.67×10^{19} n/cm^2 for the limiting lower shell plate C-506-1 (heat C5667-1). Using this estimated fluence value, the staff calculated a limiting RT_{PTS} value of 197.9 °F. Both of these values meet the screening criteria of 270 °F. The staff also notes that the copper content, nickel content, and the initial RT_{NDT} values listed in Table 4.2-2 of the LRA are consistent with the values in RVID. Therefore, the staff concludes that the Millstone Unit 2 RV can meet the requirements of 10 CFR 50.61 through the period of extended operation for the unit.

To confirm the validity of the applicant's limiting 54 EFPY RT_{PTS} value for the Millstone Unit 3 RV, the staff performed independent calculations of the RT_{PTS} values through the period of extended operation. The staff determined that at Millstone Unit 3, intermediate shell plate B9805-1 (heat C4039-2) is the limiting beltline material for PTS. The staff calculated an RT_{PTS} value of 134.7 °F for this plate material at 54 EFPY. This value is in agreement with the limiting material and RT_{PTS} value reported by the applicant. The staff also notes that the copper content, nickel content, and the initial RT_{NDT} values listed in Table 4.2-2 of the LRA are consistent with the values in RVID. Therefore, the staff concludes that the Millstone Unit 3 RV can meet the requirements of 10 CFR 50.61 through the period of extended operation for the unit.

4.2.3.3 FSAR Supplement

Each LRA Section A.3.1.2 includes the following FSAR supplement summary description for the TLAA on PTS:

> Reactor pressure vessel beltline fluence is one of the factors used to determine the margin to reactor pressure vessel pressurized thermal shock as a result of radiation embrittlement. The margin is the difference between the maximum nil ductility reference temperature in the limiting beltline material (RT_{PTS}) and the screening criteria established in accordance with 10 CFR 50.61(b)(2). The

screening criteria for the limiting reactor vessel materials are 270 °F for beltline plates, forging and axial weld materials, and 300 °F for beltline circumferential weld materials.

Acceptable RT_{PTS} values have been calculated in accordance with Regulatory Guide 1.99, Revision 2, requirements to the end of the period of extended operation.

The applicant's FSAR supplement summary description does not specify how the RV beltline materials at Millstone Units 2 and 3 will be in compliance with the applicable requirements in 10 CFR 50.61, as projected through the periods of extended operation. Specifically, the applicant has not stated which materials are limiting, and their corresponding RT_{PTS} values to demonstrate that the applicable requirements were met. In RAI 4.2.3-1, the staff requested that the applicant provide this information in the FSAR supplements.

In its response to RAI 4.2.3-1, dated December 3, 2004, the applicant provided information that will be incorporated into Section A3.1.2 of the Millstone Units 2 and 3 FSAR supplements concerning the limiting beltline material and further stated that they are in compliance with the applicable requirements of 10 CFR Part 50.61. The staff reviewed this information and requested additional supplemental information. The applicant stated that the RT_{PTS} values for the limiting beltline materials have been calculated in accordance with RG 1.99, Revision 2 through the period of extended operation and demonstrate acceptable RT_{PTS} values through the period of extended operation. The applicant needed to confirm that the RT_{PTS} analysis was performed in accordance with 10 CFR 50.61. The confirmed information needed to be incorporated into the FSAR supplements accordingly.

In its response to supplemental RAI 4.2.3-1. dated February 8, 2005, the applicant confirmed that the Millstone Units 2 and 3 PTS evaluations were developed in accordance with 10 CFR 50.61, and not RG 1.99, Revision 2. The applicant had erroneously cited RG 1.99, Revision 2 in its response to RAI 4.2.3-1. The applicant also stated that the applicable FSAR supplements reference 10 CFR 50.61. This resolves RAI 4.2.3-1.

The applicant's FSAR supplements summary description is consistent with the staff analysis for the TLAA on PTS in Section 4.2.3.2 of this SER. The FSAR supplements summary descriptions summarize the applicable PTS requirements that must be met to ensure continued compliance with 10 CFR 50.61 and discuss why the RV beltline materials at Millstone Units 2 and 3 are in compliance with the applicable requirements of 10 CFR 50.61, as projected through the periods of extended operation for the units. The staff therefore concludes that FSAR supplement summary description for the TLAA on PTS is acceptable.

4.2.3.4 Conclusion

The staff has reviewed the applicant's TLAA on PTS, as summarized in Section 4.2.3 of the LRA and has determined that the RV beltline materials at Millstone Units 2 and 3 will continue to comply with the staff's requirements for PTS in 10 CFR 50.61 throughout the periods of extended periods of operation for the Millstone units. The staff therefore concludes that the applicant's TLAA for PTS is in compliance with the staff's acceptance criterion for TLAAs in 10 CFR 54.21(c)(1)(ii) and that the safety margins established and maintained during the current operating term can be maintained during the periods of extended operation as required by

10 CFR 54.21(c)(1). The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA on PTS for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.4 Pressure-Temperature (P-T) Limits

4.2.4.1 Summary of Technical Information in the Application

In Section 4.2.4 of the LRAs, the applicant concluded that the P-T limits for Millstone Units 2 and 3 met the definition in 10 CFR 54.4 for TLAAs. The applicant concluded that the P-T limits for the Millstone units were TLAAs that needed to be assessed against the acceptance criteria of 10 CFR 54.21(c)(1). The applicant provided the following assessment for the TLAA on the P-T limits:

> 10 CFR Part 50, Appendix G requires that heatup and cooldown of the reactor pressure vessel be accomplished within established pressure-temperature limits. These limits identify the maximum allowable pressure as a function of reactor coolant temperature. As the pressure vessel becomes irradiated and its fracture toughness is reduced, the allowable pressure at low temperatures is reduced. Therefore, in order to heatup and cooldown, the reactor coolant temperature and pressure must be maintained within the limits of Appendix G as defined by the reactor pressure vessel fluence.
>
> In accordance with 10 CFR 50, Appendix G, updated pressure-temperature limits for the period of extended operation will be developed and implemented prior to the period of extended operation.
>
> Consistent with 10 CFR 54.21(c)(1)(iii), acceptable pressure-temperature limits will be developed and implemented in accordance with 10 CFR 50, Appendix G prior to the period of extended operation.

The 10 CFR Part 50, Appendix G requires that heatup and cooldown of the reactor pressure vessel be accomplished within established P-T limits. These limits identify the maximum allowable pressure as a function of reactor coolant temperature.

As the pressure vessel becomes irradiated and its fracture toughness is reduced, the allowable pressure at low temperatures is reduced. Therefore, in order to heat up and cool down, the reactor coolant temperature and pressure must be maintained within the limits of 10 CFR Part 50, Appendix G as defined by the reactor pressure vessel fluence.

Heat up and cool down limit curves have been calculated using the adjusted RT_{NDT} corresponding to the limiting beltline material of the reactor pressure vessel for the current period of licensed operation. Current low temperature overpressure protection (LTOP) system heat up and cool down limit curves were approved in license amendment 218. Current cold overpressure protection system (COPS) heat up and cool down limit curves were approved for Millstone Unit 3 in license amendment 197.

The applicant stated that, consistent with 10 CFR 54.21(c)(1)(iii), acceptable P-T limits will be developed and implemented in accordance with 10 CFR 50, Appendix G prior to the period of extended operation.

4.2.4.2 Staff Evaluation

Paragraph IV.A.2 of 10 CFR Part 50, Appendix G, provides the requirements and criteria for generating the P-T limits that are required for commercial U.S. light-water reactors. The applicant plans to calculate vessel P-T limit curves for 60 years (54 EFPYs) and submit them to the NRC for approval before the start of the period of extended operation. The LRA did not state whether the fluence methodology would be in accordance with RG 1.190 when managing the P-T limits, or where these P-T limit requirements will be documented. Therefore, in RAI 4.2.4-1, the staff asked if the applicant will manage the P-T limits using approved fluence calculations in conjunction with surveillance capsule results from the surveillance program. Also, the applicant was requested to state if the technical specification would be updated upon calculating the P-T limits for the period of extended operation. The applicant was asked to include this information in the Millstone FSAR supplements to describe the management of the P-T limits.

In response to RAI 4.2.4-1, in a letter dated December 3, 2004, the applicant updated Section A3.1.3 of the Millstone Units 2 and 3 FSAR supplements to incorporate a summary description on the current methodology of calculating neutron fluence and the use of RG 1.190 in developing fluence values for the P-T limit curves in the period of extended operation. This includes a statement in the proposed Millstone FSAR supplements that when developing the Millstone Units 2 and 3 P-T limit curves for the period of extended operation, fluence values will be calculated in accordance with RG 1.190 recommendations. Millstone Unit 3 uses a fluence methodology in accordance with DG-1053. This is the draft version of RG 1.190 and provides similar conservatism when calculating the reactor vessel fluence values. However, Millstone Unit 2 does not use a fluence methodology in accordance with RG 1.190. In addition, the applicant is planning to submit P-T limit curves for 54 EFPY to the NRC in 2005. Therefore, since the applicant will be providing new P-T limit curves for 54 EFPY, the staff requests that the applicant commit to submit the reactor vessel fluence calculations using a methodology in accordance with RG 1.190, which will also support the P-T limit curve submittal, to the NRC along with the 54 EFPY P-T limit curves in 2005. The resolution of this issue is addressed in Section 4.2.1.3.

The staff finds the applicant's plan to manage the P-T limits acceptable because the change in the P-T limits will be submitted to the NRC for approval before the start of the period of extended operation and implemented via the license amendment process (i.e., modifications of technical specifications), thereby meeting the requirements of 10 CFR 50.60 and Appendix G to 10 CFR 50.

4.2.4.3 FSAR Supplement

Each Section A3.1.3 of the LRAs includes the following FSAR supplement summary description for the TLAA on the Millstone P-T limits:

> <u>Millstone Unit 2</u>
> Heatup and cooldown limit curves have been calculated using the adjusted RT_{NDT} corresponding to the limiting beltline material of the reactor pressure vessel for

the current period of licensed operation. Current low temperature overpressure protection (LTOP) system heatup and cooldown limit curves were approved in license amendment 218.

In accordance with 10 CFR 50, Appendix G, updated pressure-temperature limits for the period of extended operation will be developed and implemented prior to the period of extended operation. Low temperature overpressure protection system enable temperature requirements will be updated to ensure that the pressure-temperature limits will not be exceeded for postulated plant transients during the period of extended operation.

Millstone Unit 3
Heatup and cooldown limit curves have been calculated using the adjusted RT_{NDT} corresponding to the limiting beltline material of the reactor pressure vessel for the current period of licensed operation. Current cold overpressure protection system (COPS) heatup and cooldown limit curves were approved in license amendment 197.

In accordance with 10 CFR 50, Appendix G, updated pressure-temperature limits for the period of extended operation will be developed and implemented prior to the period of extended operation. Cold overpressure protection system enable temperature requirements will be updated to ensure that the pressure-temperature limits will not be exceeded for postulated plant transients during the period of extended operation.

On the basis of the staff's evaluation described above, the summary description for the reactor coolant system TLAA for reactor vessel P-T limits described in the FSAR supplements provides an adequate description of this TLAA, as required by 10 CFR 54.21.

4.2.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii) and 10 CFR 54.21(c)(1)(iii), that the applicant can generate the P-T limits for the periods of extended operation for Millstone Units 2 and 3 in accordance with the technical specifications process. The staff will evaluate the end-of-extended-operating-term P-T limit curves for Millstone upon submittal by the applicant. The staff's review of the period-of-extended-operation P-T limit curves, when submitted, will ensure that the reactor coolant system for Millstone Units 2 and 3 will be operated in a manner that ensures the integrity of the reactor coolant system during the period of extended operation and that the curves, when submitted, will satisfy the requirements of 10 CFR 54.21(c)(1)(ii) for the period of extended operation. Because evaluation of P-T limit curves is performed when the limits are updated through the technical specification process, they need not be evaluated now. The technical specification process provides a process for managing P-T limits, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3 Metal Fatigue

A metal component subjected to cyclic loading at loads less than the static design load may fail due to fatigue. Metal fatigue of components may have been evaluated based on an assumed number of transients or cycles for the current operating term. The validity of such metal fatigue analysis is reviewed for the period of extended operation.

4.3A Unit 2 Metal Fatigue

4.3A.1 Summary of Technical Information in the Application

The applicant discussed the design of reactor coolant pressure boundary (RCPB) components in Section 4.3.1 of the LRA. Components of the RCPB were designed to the ASME Boiler and Pressure Vessel Code, Section III requirements for Class 1 components and the requirements for ANSI B31.7 Class 1 piping components. Table 4.3.2 lists the transients and number of transient cycles used in the design of ASME Class 1 components. Table 4.3.2 also lists the estimated number of transient cycles for 60 years of plant operation. The applicant's estimate indicates that the number of design cycles will remain bounding for the period of extended operation. The applicant indicated that the significant design transients are tracked by a fatigue monitoring program (FMP).

In addition to the design of Class 1 components using transient cycles listed in Table 4.3.2 of the LRA, the applicant identified evaluations that were performed to address other specific issues. These evaluations were performed for the surge line to address NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," and to address the potential for temperature stratification and oscillations in unisolable sections of pipe in response to NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems." The applicant indicated that the evaluations remain valid for the period of extended operation.

The applicant discussed the evaluation of ASME Class 2 and 3, ANSI B31.7 Class 2 and 3, and ANSI B31.1 components in Section 4.3.2 of the LRA. The codes and standards for ASME Class 2 and 3, ANSI B31.7 Class 2 and 3, and ANSI B31.1 components require that a stress-reduction factor be applied to the allowable thermal bending stress range if the number of full-range cycles exceeds 7,000. The applicant identified three piping systems within the scope of license renewal that have been projected to exceed 7,000 full-temperature cycles during the period of extended operation. The applicant evaluated these piping systems for the number of expected cycles and found them acceptable for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant discussed the evaluation of environmentally-assisted fatigue of RCPB components in Section 4.3.3 of the LRA. The applicant provided the results of an evaluation of the environmental effects on the components listed in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components." The applicant indicated that the environmental fatigue correlations in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," were used in the evaluations. The applicant's evaluation indicated that all components had acceptable fatigue usage for the period of extended operation.

4.3A.2 Staff Evaluation

As discussed previously, RCPB components were designed to the Class 1 requirements of the ASME Code and the Class 1 requirements of ANSI B31.7. These requirements contain explicit criteria for the fatigue analysis of components. Consequently, the applicant identified the fatigue analysis of these components as TLAAs. The staff reviewed the applicant's evaluation of the RCPB components for compliance with the provisions of 10 CFR 54.21(c)(1).

The specific design criterion for fatigue analysis of RCPB components involves calculating the cumulative usage factor (CUF). The fatigue damage in the component caused by each thermal or pressure transient depends on the magnitude of the stresses caused by the transient. The CUF sums the fatigue damage resulting from each transient. The design criterion requires that the CUF not exceed 1.0.

Table 4.3-2 of the LRA provides the current cycle counts and estimated cycle counts at 60 years of plant operation for transients used in the design of ASME Class 1 components. The staff compared the list of monitored transients with those listed in Millstone FSAR Section 4.2.1. The applicant monitors all of the normal, upset, and test transients listed in FSAR Section 4.2.1 with the exception of loading/unloading and step-load change cycles. The applicant indicated that these cycles are not counted because the transients produce insignificant fatigue usage contributions to any Class 1 component. In RAI 4.3.1-2, the staff requested that the applicant indicate whether these transients contributed to the cumulative usage factors for the vessel inlet/outlet nozzles reported in Table 4.3-3 of the LRA. The staff also requested that the applicant provide a summary of the load pairs that contribute to the fatigue usage of the vessel inlet/outlet nozzles and the corresponding fatigue usage for each load pair.

The applicant's December 3, 2004, response indicated that the loading/unloading and step-change transients are significant contributors to the design fatigue usage factors for the reactor vessel inlet/outlet nozzles. Even though these transients are significant contributors to the design CUF for these nozzles, the design CUFs are well below the allowable limit of 1.0. In addition, the applicant indicated that the number of design cycles assumed for plant loading/unloading and step-change transients is considered conservative based on plant operation. As a consequence, these transients are not expected to cause significant fatigue usage in the inlet/outlet nozzles for the period of extended operation. The staff agrees with the applicant that it is not necessary to track these transients. On the basis of the information provided by the applicant, the staff finds that the FMP tracks the significant design transients listed in FSAR Section 4.2.1.

The applicant stated in the LRA that an FMP monitors the significant design transients at Millstone Unit 2. The applicant also indicated that FatiguePro software is used to monitor significant transient cycles, and that stress-based fatigue monitoring is used at locations of high-fatigue usage. In RAI 4.3.1-1, the staff requested that the applicant list the locations where stress-based fatigue monitoring is used. The staff also requested that the applicant indicate the length of time the FatiguePro software has been used and describe how the number of transient cycles and fatigue usage was determined prior to installation of the FatiguePro software.

The applicant's December 3, 2004, response indicated that stress-based fatigue monitoring is used at the pressurizer surge nozzle and the reactor coolant system (RCS) hot-leg surge nozzle.

The applicant indicated that the FatiguePro software was used to analyze process computer data from 1996 to the present to obtain the fatigue usage for each transient. The applicant also indicated that operator logs were used to identify transient occurrences prior to 1996. The fatigue usage associated with the transient occurrences prior to 1996 was estimated using the fatigue usage calculated from the FatiguePro software for the transients that occurred after 1996. The staff finds that the applicant's method of estimating the fatigue usage prior to 1996 reasonable and acceptable.

As discussed in Section 4.3A.1 of this SER, the applicant performed additional evaluations in response to NRC Bulletins 88-08 and 88-11. The applicant's evaluation for NRC Bulletin 88-08 is summarized in a September 20, 1988, letter to the NRC. The applicant indicated that no piping sections susceptible to the concerns identified in NRC Bulletin 88-08 were discovered at Millstone Unit 2. Therefore, no additional evaluation was required by the applicant for the period of extended operation.

The applicant indicated that an additional evaluation of the pressurizer surge line was performed in response to NRC Bulletin 88-11. The applicant referenced the generic analysis in Combustion Engineering Owners Group Report CEN-387-P as bounding for Millstone Unit 2. The staff found that CEN-387-P provided an acceptable evaluation of the pressurizer surge line thermal concern in its safety evaluation dated July 6, 1993. As discussed previously, the applicant monitors critical surge line locations using FatiguePro stress-based software. Therefore, the applicant's FMP will assure that the pressurizer surge line evaluation remains valid for the period of extended operation.

Section 4.3.2 of the LRA describes the evaluation of non-Class 1 components. The LRA indicates that three piping systems may exceed 7,000 full-temperature thermal cycles during the period of extended operation. The LRA also indicates that these systems were evaluated using appropriate stress-range reduction factors and found acceptable for the period of extended operation. In RAI 4.3.2-1 the staff requested that the applicant describe the criteria used to obtain the stress-range reduction factors.

The applicant's November 9, 2004, response indicated that ASME Section III, Subsection NC-3600 was used for the re-analysis of the hot-leg sample line, the pressurizer steam space sample line and the common hot-leg/pressurizer steam space sample line. The applicant provided the results of the analysis in Table 1 of the response. Table 1 shows the calculated stresses are well within the allowable stresses for the number of thermal expansion cycles expected for the period of extended operation. On the basis of the information provided by the applicant, the staff finds that the applicant has performed an acceptable evaluation of the sample lines for the period of extended operation in accordance with the requirements of 10 CFR 54.21(c)(1)(ii).

The applicant indicates that the FMP will continue during the period of extended operation and will assure that design cycle limits are not exceeded. The applicant's FMP tracks transients and cycles of RCS components that have explicit design transient cycles to assure that these components remain within their design basis. Generic Safety Issue 166 (GSI-166), "Adequacy of the Fatigue Life of Metal Components," raised concerns regarding the conservatism of the fatigue curves used in the design of the RCS components. Although GSI-166 was resolved for the current 40-year design life of operating components, the staff identified GSI-190, "Fatigue

Evaluation of Metal Components for 60-year Plant Life," to address license renewal. The NRC closed GSI-190 in December 26, 1999 (see Appendix D, Reference 17), concluding:

> The results of the probabilistic analyses, along with the sensitivity studies performed, the iterations with industry (NEI and EPRI), and the different approaches available to the applicants to mange the effects of aging, lead to the conclusion that no generic regulatory action is required, and that GSI-190 is closed. This conclusion is based primarily on the negligible calculated increases in core damage frequency in going from 40- to 60-year lives. However, the calculations supporting resolution of this issue, which included consideration of environmental effects, and the nature of age-related degradation indicate the potential for an increase in the frequency of pipe leaks as plants continue to operate. Thus, the staff concludes that, consistent with existing requirements in 10 CFR 54.21, applicants should address the effects of coolant environment on component fatigue life as aging management programs are formulated in support of license renewal.

The applicant indicated that it evaluated six component locations equivalent to those identified in NUREG/CR-6260 for a newer vintage Combustion Engineering plant. The staff finds these acceptable locations for evaluating environmental fatigue. The applicant provided the design and environmental usage factors in Table 4.3-3 of the LRA. All of the design and environmental usage factors are less than the allowable limit of 1.0.

The staff compared the applicant's calculated fatigue usage factors with those listed in NUREG/CR-6260. The applicant's calculated fatigue usage factors were less than those listed in NUREG/CR-6260 for a newer vintage Combustion Engineering plant. However, the applicant's reported usage factors are more in line with the values listed in NUREG/CR-6260 for an older vintage Combustion Engineering plant. The staff notes that the NUREG/CR-6260 evaluation for the newer vintage Combustion Engineering plant was for San Onofre Unit 2 and 3 components. The San Onofre units have a greater thermal power level than Millstone Unit 2, which may account, in part, for the difference in calculated usage factor. As an additional check, the staff compared the usage factors with the usage factors provided by the applicant during the license renewal review of St. Lucie Units 1 and 2. St. Lucie Units 1 and 2 are Combustion Engineering plants that have thermal power levels comparable to Millstone Unit 2. The Millstone Unit 2 usage factors are comparable to the St. Lucie Units 1 and 2 usage factors, with the exception of the surge line. As indicated previously, the applicant uses stress-based fatigue monitoring for the surge line and, as a consequence, the staff expects lower usage factors for the surge line components. On the basis of the comparison of the reported usage factors with previous Combustion Engineering plants of comparable power level, the staff concludes the usage factors provided by the applicant in Table 4.3-3 are reasonable.

The staff noted that the applicant provided usage factors for the low-alloy charging and safety injection nozzles, whereas NUREG/CR-6260 indicates the highest environmental usage factors for the newer vintage Combustion Engineering plant occurred in the nozzle safe-ends. In a December 3, 2004, response, the applicant indicated that the highest design CUFs for the safety injection and charging nozzles occurred in the low-alloy nozzles. However, the applicant also indicated that, using worst case environmental factors for stainless steel, the calculated CUF for the charging nozzle safe-end is greater than the low-alloy nozzle. The applicant indicated that the environmental usage factor for the safe-end is less than 1.0 using the projected number of cycles for 60 years of plant operation. Since the applicant used projected cycles instead of design cycles to evaluate the charging nozzle safe-end, the applicant's FMP should incorporate these cycles in the program. This was identified as Confirmatory Item 4.3-1.

In response to Confirmatory Item 4.3-1, in a letter dated April 1, 2005, the applicant stated that cycle counting has been incorporated in the Millstone FMP and the projected cycles versus design cycles are now used in the evaluation of the charging nozzle safe-ends, with acceptable results through the period of extended operation. Based on this response, Confirmatory Item 4.3-1 is closed.

The applicant evaluated the effects of the reactor water environment on the fatigue-sensitive locations and concluded that the resulting fatigue usage will be acceptable for the period of extended operation. The staff finds that the applicant has performed an acceptable evaluation of the environmental fatigue usage of the fatigue-sensitive locations identified in NUREG/CR-6260. The staff also finds that the applicant's FMP provides additional assurance that the fatigue usage at these locations will not exceed the allowable limit of 1.0 during the period of extended operation.

4.3A.3 FSAR Supplement

The applicant provided a Millstone FSAR supplement description of the FMP in Section A4.2 of the LRA and a description of its TLAA evaluation for metal fatigue analysis in Section A3.2 of the LRA. On the basis of its review of the FSAR supplement, the staff concludes the summary description of the applicant's actions to address metal fatigue of components is adequate.

4.3A.4 Conclusion

The staff has reviewed the applicant's metal fatigue TLAA and concludes the applicant's actions and commitments satisfy the requirements of 10 CFR 54.21(c)(1).

The staff has also reviewed the Millstone FSAR supplement for the TLAA and finds that the FSAR supplement contains an adequate description of the metal fatigue of components to satisfy 10 CFR 54.21(d).

4.3B Unit 3 Metal Fatigue

4.3B.1 Summary of Technical Information in the Application

The applicant discussed the design of reactor coolant pressure boundary (RCPB) components in Section 4.3.1 of the Unit 3 LRA. Components of the RCPB were designed to the ASME Boiler and Pressure Vessel Code, Section III, requirements for Class 1 components. Table 4.3.2 lists the transients and number of transient cycles used in the design of ASME Class 1 components. Table 4.3.2 also lists the estimated number of transient cycles for 60 years of plant operation. The applicant's estimate indicates that the number of design cycles will remain bounding for the period of extended operation. The applicant indicated that the significant design transients are tracked by an FMP.

In addition to the design of Class 1 components using transient cycles listed in Table 4.3.2 of the LRA, the applicant identified evaluations that were performed to address other specific issues.

These evaluations were performed for the surge line to address NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," and to address the potential for temperature stratification and oscillations in unisolable sections of pipe in response to NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems." The applicant indicated that the evaluations remain valid for the period of extended operation.

The applicant discussed the evaluation of ASME Class 2 and 3, ANSI B31.7 Class 2 and 3, and ANSI B31.1 components in Section 4.3.2 of the LRA. The codes and standards for ASME Class 2 and 3, ANSI 31.7 Class 2 and 3, and ANSI B31.1 components require that a stress-reduction factor be applied to the allowable thermal bending stress range if the number of full-range cycles exceeds 7,000. The applicant indicated that piping systems within the scope of license renewal are bounded by the 7,000 cycles. Therefore, the applicant concluded that the existing pipe stress calculations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant discussed the evaluation of environmentally-assisted fatigue of RCPB components in Section 4.3.3 of the LRA. The applicant provided the results of an evaluation of the environmental effects on the components listed in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components." The applicant indicated that the environmental fatigue correlations in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," were used in the evaluations. The applicant's evaluation indicated that four of the six components are projected to exceed a usage factor of 1.0 during the period of extended operation when environmental effects are considered. The applicant proposed to manage these four components in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

4.3B.2 Staff Evaluation

As discussed previously, components of the RCPB were designed to the Class 1 requirements of the ASME Code. These requirements contain explicit criteria for the fatigue analysis of components. Consequently, the applicant identified the fatigue analysis of these components as TLAAs. The staff reviewed the applicant's evaluation of the RCPB components for compliance with the provisions of 10 CFR 54.21(c)(1).

The specific design criterion for fatigue analysis of RCPB components involves calculating the cumulative usage factor (CUF). The fatigue damage in the component caused by each thermal or pressure transient depends on the magnitude of the stresses caused by the transient. The CUF sums the fatigue damage resulting from each transient. The design criterion requires that the CUF not exceed 1.0. The applicant indicated that the FMP monitors the design transients at Millstone Unit 3. Table 4.3.2 of the LRA provides the current cycle counts and estimated cycle counts at 60 years of plant operation for transients used in the design of ASME Class 1 components. The LRA indicates that FatiguePro software is used to monitor the number of significant transient cycles and that stress-based fatigue monitoring is used at locations of high fatigue usage. In RAI 4.3.1-1, the staff requested that the applicant list the locations where stress-based fatigue monitoring is used. The staff also requested that the applicant indicate the length of time the FatiguePro software has been used and describe how the number of transient cycles and fatigue usage was determined prior to installation of the FatiguePro software.

The applicant's December 3, 2004, response indicated that stress-based fatigue monitoring is used at the pressurizer surge nozzle, pressurizer heater penetration, RCS hot-leg surge line nozzle, charging nozzle, safety injection nozzle, and RHR tee. The applicant indicated that the FatiguePro software was used to analyze process computer data from 1996 to the present to obtain the fatigue usage for each transient. The applicant also indicated that operator logs were used to identify transient occurrences prior to 1996. The fatigue usage associated with the transient occurrences prior to 1996 was estimated using the fatigue usage calculated from the FatiguePro software for the transients that occurred after 1996. The staff finds that the applicant's method of estimating the fatigue usage prior to 1996 reasonable and acceptable.

The applicant also provided a list of the transients monitored by the FMP. The staff compared the list of monitored transients with those listed in Millstone FSAR Table 3.9N-1. The applicant indicated that a number of the normal and upset transients listed in FSAR Table 3.9N-1 are not monitored because they produce insignificant fatigue usage. These transients include steady-state fluctuations, step-load decrease with steam dump, feedwater cycling, loop-out-of-service startup and shutdown, loading and unloading between 0 and 15 percent full power, boron concentration equalization, refueling, reduced-temperature return to power, turbine roll test, inadvertent reactor coolant depressurization, and inadvertent startup of inactive loop. The staff reviewed the transients listed in NUREG/CR-6260 for the fatigue evaluation of components in a newer-vintage Westinghouse PWR. The staff notes that the transients listed above did not contribute significantly to the fatigue usage of the components evaluated in NUREG/CR-6260. Therefore, the staff agrees with the applicant that it is not necessary to track these transients. On the basis of the information provided by the applicant, the staff finds that the FMP tracks the significant design transients listed in FSAR Table 3.9N-1.

The Westinghouse Owners Group issued topical report WCAP-14577, Revision 1-A, "Aging Management for Reactor Internals," to address the aging management of the reactor vessel internals (RVIs). The staff's review of WCAP-14577, Revision 1-A identified a number of issues that should be addressed on a plant-specific basis. Renewal Applicant Action Item 11 specified in WCAP-14577, Revision 1-A indicates that the fatigue TLAA of the RVI should be addressed on a plant-specific basis. In RAI 4.3.1-3, the staff requested that the applicant discuss the design basis for the components listed in Table 3-3 of WCAP-14577, Revision 1-A and indicate how fatigue of these components is managed.

The applicant's November 9, 2004, response indicated that the RPV stress report does not address fatigue of the RVI. Therefore, the applicant concluded that there is no fatigue TLAA associated with the RVI. Section 3.9N.5.2 of the FSAR discusses the design-loading conditions for the RVI. The FSAR indicates that the RVI were evaluated using the thermal transients listed in FSAR Table 3.9N.1. Since these are the same transients used in the fatigue evaluation of RCS components, the staff requested that the applicant confirm that there is no TLAA associated with the RVI. In a followup response (e-mail dated December 20, 2004, from W. Watson (MPS) to J. Eads (NRC)), the applicant confirmed that its internal searches and external searches by Westinghouse did not identify a TLAA associated with the RVI. As discussed previously, the applicant estimates that number of significant design transient cycles listed in FSAR Table 3.9N-1 remain bounding for the period of extended operation. The staff concludes that, even if a TLAA associated with the RVI exists, it would remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The Westinghouse Owners Group issued Topical Report WCAP-14575-A, "Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components," to address aging management of the RCS piping. Tables 3-2 through 3-16 of WCAP-14575-A list RCS components where fatigue is considered significant. The staff review of WCAP-14575-A identified a number of issues that should be addressed on a plant-specific basis. Renewal Applicant Action Item 8 indicates that the applicant should address components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575-A. The applicant's FMP monitors the significant plant design transients listed in FSAR Table 3.9N-1 that were used in the design of RCPB components. The staff finds that the applicant's FMP, which monitors the significant plant design transients, adequately addresses Renewal Applicant Action Item 8.

The Westinghouse Owners Group has issued the generic Topical Report WCAP-14574-A to address aging management of pressurizers. The staff's review of WCAP-14574-A identified a number of issues that should be addressed on a plant-specific basis. Renewal Applicant Action Item 1 requests the applicant to demonstrate that the pressurizer subcomponent CUFs remain below 1.0 for the period of extended operation. Table 2-10 of WCAP-14574-A indicates that the ASME Section III Class 1 fatigue CUF criterion could be exceeded at several pressurizer subcomponent locations during the period of extended operation. WCAP-14574-A also identified recent unanticipated transients that were not considered in the original ASME Section III Class 1 fatigue analyses, including inflow/outflow thermal transients. In RAI 4.3.1-4, the staff requested the applicant to provide the following information:

- Confirm that the additional transients discussed in WCAP-14574-A, not considered in the original design, have been addressed at Millstone Unit 3.
- Show the ASME Section III Class 1 CLB CUFs for the applicable subcomponents of the Millstone pressurizers specified in Table 2-10 of WCAP-14574-A and the corresponding CUFs for the period of extended operation.
- Discuss the impact of the environmental fatigue correlations provided in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," on the above results.

The applicant's December 3, 2004, response indicated that the pressurizer lower head and surge-line nozzle were evaluated for the additional transients discussed in WCAP-14574-A. The applicant provided the CUFs for the period of extended operation for the subcomponents listed in Table 2-10 of WCAP-14574-A. All CUFs are less than 1.0 for the period of extended operation.

The applicant also discussed the impact of the environmental fatigue correlations on the pressurizer subcomponents. The applicant committed to use the pressurizer surge-line nozzle as a leading indicator to address environmental fatigue of the pressurizer subcomponents during the period of extended operation. The staff finds that the pressurizer surge-line nozzle is an acceptable sample component location for assessing the impact of environmental fatigue on the pressurizer components. The staff accepted this position during its review of other license renewal applications for Westinghouse plants.

As discussed in Section 4.3B.1 of this SER, the applicant performed an additional evaluation of the pressurizer surge line in response to NRC Bulletin 88-11. The applicant's evaluation indicated that the usage factor, including environmental effects, will remain less than 1.0 for 60 years of plant operation for the surge line and pressurizer lower head. The applicant further indicated that stress-based fatigue monitoring of the surge line and lower pressurizer will be used to ensure that the fatigue usage of these components remains less than 1.0. The staff finds that the applicant has adequately addressed Renewal Applicant Action Item 1 of WCAP 14574-A, by evaluating the fatigue-sensitive subcomponents for insurge/outsurge transients, considering the effects of the reactor water environment, and assuring that the thermal transients that are significant contributors to the design fatigue usage of RCS components will be monitored by the FMP.

The applicant indicated that components other than the RCBP were designed to ASME Class 2 and 3, ANSI B31.7 Class 2 and 3, and ANSI B31.1. The codes and standards for ASME Class 2 and 3, ANSI B31.7 Class 2 and 3, and ANSI B31.1 components require that a stress-reduction factor be applied to the allowable thermal bending stress range if the number of full-range cycles exceeds 7,000. The applicant indicated that piping systems within the scope of license renewal are bounded by the 7,000 cycles for 60 years of plant operation. On the basis of the information provided by the applicant, the staff finds that these analyses remain valid for the period of extended operation in accordance with 54.21(c)(1)(i).

The applicant indicates that the FMP will continue during the period of extended operation and will assure that the design cycle limits are not exceeded. The applicant's FMP tracks design transients and cycles that are significant contributors to the fatigue usage of RCS components to assure that these components remain within their design basis. GSI-166, "Adequacy of the Fatigue Life of Metal Components," raised concerns regarding the conservatism of the fatigue curves used in the design of the RCS components. Although GSI-166 was resolved for the current 40-year design life of operating components, the staff identified GSI-190, "Fatigue Evaluation of Metal Components for 60-year Plant Life," to address license renewal. The NRC closed GSI-190 in December 25, 1999 (see Appendix D, Reference 17), concluding:

> The results of the probabilistic analyses, along with the sensitivity studies performed, the iterations with industry (NEI and EPRI), and the different approaches available to the applicants to mange the effects of aging, lead to the conclusion that no generic regulatory action is required, and that GSI-190 is closed. This conclusion is based primarily on the negligible calculated increases in core damage frequency in going from 40- to 60-year lives. However, the calculations supporting resolution of this issue, which included consideration of environmental effects, and the nature of age-related degradation indicate the potential for an increase in the frequency of pipe leaks as plants continue to operate. Thus, the staff concludes that, consistent with existing requirements in 10 CFR 54.21, applicants should address the effects of coolant environment on component fatigue life as aging management programs are formulated in support of license renewal.

The applicant indicated that it evaluated the effects of the reactor water environment on the fatigue life of six component locations. These six component locations are equivalent to the component locations identified in NUREG/CR-6260 for a newer vintage Westinghouse plant. The staff finds these acceptable locations for evaluating the effects of the reactor water environment on the fatigue life of components.

The results of the applicant's evaluation are presented in Table 4.3-3 of the LRA. The staff compared the applicant's calculated fatigue usage factors with those listed in NUREG/CR-6260 for a newer vintage Westinghouse reactor. The applicant's calculated fatigue usage factors were comparable to those listed in NUREG/CR-6260 with the exception of the surge line. The applicant's design usage factor is much lower than the usage factor reported in NUREG/CR-6260.

The applicant submitted the results of an evaluation of the surge line to the NRC in response to NRC Bulletin 88-11 (reference 4.8-36 of the LRA). The submittal indicated that the maximum calculated fatigue usage for the surge line at the RCS hot-leg nozzle was 0.434. This usage factor is more in line with the design value listed in NUREG/CR-6260. However, Table 4.3-3 of the LRA indicates that the maximum design fatigue usage for the surge line is 0.0796. In RAI 4.3.1-2, the staff requested the applicant provide the basis for the usage factor report in Table 4.3-3 of the LRA.

The applicant's December 3, 2004, response indicated that the original CUF for the hot-leg nozzle, based on the number of design cycles, was 0.434. The applicant indicated that the value listed in LRA Table 4.3-3 is the projected 60-year fatigue usage based on an evaluation using the data obtained from stress-based fatigue monitoring at Millstone Unit 3. The staff finds that the applicant's response adequately clarifies the basis for the CUF reported in Table 4.3-3 of the LRA.

The applicant's evaluation indicated that the calculated usage factors may exceed 1.0 for four components: the surge line, the charging nozzle, the safety injection nozzle, and the RHR piping. The applicant committed to manage the fatigue of these components with the FMP for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

The applicant's FMP is discussed in the LRA. The applicant indicated that the program is consistent with the aging management program (AMP) provided in NUREG-1801, Section X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary." The AMP requires that the usage factor, including environmental effects, be maintained below 1.0 during the period of extended operation. The program requires that corrective actions be taken to prevent the usage factor from exceeding 1.0 during the period of extended operation. Acceptable corrective actions include the following:

- further refinement of the fatigue analysis
- repair of the affected locations
- replacement of the affected locations

The program also requires that additional component locations be reviewed if the usage factor is projected to exceed 1.0. The staff finds that the applicant's FMP, which is consistent with NUREG-1801, provides an acceptable approach to address environmental fatigue of the surge line, the charging nozzle, the safety injection nozzle, and the RHR line for the period of extended operation in accordance with 10 CFR 54.21(c)(1).

4.3B.3 FSAR Supplement

The applicant provided an FSAR supplement description of the FMP in Section A4.2 of the LRA and a description of its TLAA evaluation for metal fatigue analysis in Section A3.2 of the LRA. On the basis of its review of the FSAR supplement, the staff concludes the summary description of the applicant's actions to address metal fatigue of components is adequate.

4.3B.4 Conclusion

The staff has reviewed the applicant's metal fatigue TLAA and concludes that the applicant's actions and commitments satisfy the requirements of 10 CFR 54.21(c)(1).

The staff has also reviewed the Millstone FSAR supplement for the TLAA and finds that the FSAR supplement contains an adequate description of the metal fatigue of components to satisfy 10 CFR 54.21(d).

4.4 <u>Environmental Qualification</u>

The 10 CFR 50.49 environmental qualification (EQ) program has been identified as a TLAA for the purposes of license renewal. The TLAA of EQ electrical components includes all long-lived, passive and active electrical components and instrumentation and controls (I&C) components that are important to safety and located in a harsh environment. The harsh environments of the plant are those areas that are subjected to environmental effects by a loss-of-coolant accident (LOCA) or a high-energy line break (HELB). The EQ equipment comprises safety-related and Q-list equipment; non-safety-related (NSR) equipment, the failure of which could prevent satisfactory accomplishment of any safety-related function; and necessary post-accident monitoring equipment.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs in the LRA. The applicant shall demonstrate that one of the following is true for each type of EQ equipment (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effect of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.4.1 Summary of Technical Information in the Application

The applicant provided in LRA Section 4.4, "Environmental Qualification of Electric Equipment," the following information:

The electrical equipment qualification (EEQ) program is an integral part of the design, construction, and operation of nuclear power generating stations. A description of this program and a comparison of the program to the guidance of NUREG-1801 is provided in each LRA Appendix B, Section B3.1, Electrical Equipment Qualification.

Part 50 of 10 CFR requires that certain categories of systems, structures and components (SSCs) be designed to accommodate the effects of both normal and accident environmental conditions, and that design control measures be employed to ensure the adequacy of these designs. Specific requirements pertaining to the environmental qualification (EQ) of these categories of electrical equipment are embodied in 10 CFR 50.49. The categories include safety-related (Class 1E) electrical equipment, non-safety-related electrical equipment whose failure could prevent the satisfactory accomplishment of a safety function by safety-related equipment, and certain post-accident monitoring equipment. As required by 10 CFR 50.49, electrical equipment not qualified for the current license term is to be refurbished, replaced, or have its qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for electrical equipment that specify a qualification of 40 years or greater are considered to represent a TLAA. Unit modifications, such as the installation or removal of equipment, systems, or non-identical replacement of existing components, are evaluated to ensure compliance with 10 CFR 50.49. Changes to system geometry (e.g., a piping addition or rerouting), system and equipment operational changes, environmental changes (e.g., baseline changes in temperature or radiation levels), and setpoint changes can affect the continued acceptability of existing aging evaluations. These changes are evaluated through the design control process. Electrical equipment aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpectedly adverse or harsh conditions are identified (e.g., during normal operation or maintenance activities) that could affect the qualification of a component, the affected component is evaluated and appropriate corrective actions taken (e.g., addition of shielding, equipment qualification zone changes, or changes to the qualification bases). Plant modification and events that impacted temperature and radiation values that were used in the underlying assumptions in the equipment qualification calculations have been reviewed in the Operating Experience section of each LRA Appendix B, Section B3.1, Electrical Equipment Qualification.

4.4.2 Staff Evaluation

The staff reviewed the information in Section 4.4 and Appendix B, Section B3.1 of each LRA to determine whether the applicant has demonstrated that the effects of aging on the intended function(s) of electrical components will be adequately managed through the MPS EQ program, together with other plant programs/processes, during the period of extended operation as required by 10 CFR 54.21(c)(1)(iii). Based on the applicant's statement that the EQ program is consistent with Section X.E1 of the GALL report, the staff concludes that the MPS EQ program will adequately manage the effects of aging on the intended function(s) of electrical components for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Millstone uses the value of greater than 10^4 rads to define a harsh radiological environment for equipment qualification purposes. The fact that certain areas of the B train auxiliary feedwater pump room could exceed 10^5 rads means that this room must be considered to be a harsh radiological environment for the purpose of equipment qualification, unless certain areas can be expected to experience local doses of less than or equal to 10^4 rads. In that case, the room can be considered to be a generally harsh environment, with locally mild environments. Whatever the radiation field is at any location within the room, the equipment in that room must be designed to withstand the environment that it is expected to experience, such that it will perform its intended function during and following a design-basis accident (as specified in the FSAR).

In the case of the Target Rock valve controllers, it was demonstrated, through analysis, that the area in which they are located is not expected to exceed the 4.2×10^3 rads assumed for their qualification. Therefore, even though the room is deemed to be a generally harsh environment, since the Target Rock valve controllers are expected to be in a locally mild environment of ≤4.2

X 10^3 rads, they are expected to be able to perform their intended function during and following a design-basis accident.

Sections A3.3 and A4.1 of Appendix A to the LRA contain the applicant's FSAR supplement for the EQ program as an AMP and TLAA for license renewal. The staff reviewed this section and finds that the program description is consistent with the material contained in Sections 4.4 and B3.1 of the LRA. The staff finds that the FSAR supplement provides an adequate summary of the program activities as required by 10 CFR 54.21(d).

4.4.3 Conclusion

The staff has reviewed the information in each Section 4.4 and Appendix B, Section B3.1 of the LRAs. On the basis of this review, the staff concludes that the applicant has demonstrated that it can adequately manage the effects of aging on the intended function(s) of electrical components that meet the definition for TLAA, as defined in 10 CFR 54.3, during the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). In addition, the staff concluded that the FSAR supplement contains an adequate summary description of the programs and activities for the evaluation of TLAAs for the period of extended operation, as required by 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Information in the Application

The Millstone Unit 2 containment consists of a pre-stressed, reinforced concrete cylinder and dome, and a flat, reinforced concrete mat foundation supported on unweathered bedrock. The cylindrical portion of the containment is prestressed by a post-tensioning system composed of horizontal and vertical tendons, with the horizontal tendons placed in three 240-degree systems that use three buttresses as support for the anchorages. The dome has a three-way post tensioning system. Prestress on the containment tendons is expected to decrease over the life of the unit as a result of such factors as elastic deformation, creep and shrinkage of concrete, anchorage seating losses, tendon wire friction, stress relaxation, and corrosion.

The applicant stated that the evaluation of containment tendon examination and surveillance test results involved the use of time-limited assumptions such as corrosion rates, losses of tendon prestress, and changes in material properties. Regression analysis incorporating the most recent 25-year containment tendon surveillance results are provided in Tables 4.5-1, 4.5-2, and 4.5-3. These results and projections beyond 25 years are compared to design minimum requirements and the bounding 60-year, 95-percent confidence value in Figure 4.5-1. Confidence values were developed using a standard deviation that had been derived from the appropriate dome, horizontal, and vertical tendon data set. The applicant indicated that the containment tendon examinations are performed in accordance with Millstone Unit 2 technical specification requirements, and that its evaluation meets the requirements of 10 CFR 54.3. As such, the applicant concludes that the evaluation represents a TLAA.

Based on the above discussion, the applicant concluded that consistent with 10 CFR 54.21(c)(1)(ii), acceptable losses in containment tendon prestress have been projected to the end of the period of extended operation.

The Unit 3 LRA states that the Millstone Unit 3 containment is a subatmospheric cylindrical reinforced concrete structure designed without the use of prestressed tendons. Therefore, loss of prestress is not applicable to this containment.

4.5.2 Staff Evaluation

The design of the Unit 3 containment does not use prestressed tendons so this TLAA section is not applicable to Unit 3. The applicant provided the results of its regression analysis from the measured data and smooth projected curves for each group of tendons in Unit 2. However, the methodology used to arrive at the trends appears to be quite different from the method used by other applicants. To obtain clarification on the various steps involved in arriving at the projected trend lines, the staff requested the following information:

In RAI 4.5-1, the staff noted that the TLAA description included a number of time-limited assumptions, such as corrosion rates, losses of tendon prestress, and changes in material properties that have been utilized in performing the analysis. The applicant was requested to provide a quantitative summary of the corrosion rates, factors contributing to tendon prestress loss (e.g., creep, shrinkage, and relaxation of prestressing steel) and a factor related to change in material properties used in performing the analysis.

In response to RAI 4.5-1, in its letter of November 9, 2004, the applicant provided the following information:

> The evaluation of containment tendon examination and surveillance test results involves the use of time-limited assumptions. The Millstone Unit 2 tendon surveillance program consists of periodically inspecting the physical condition of a randomly selected group of tendons identified in accordance with Regulatory Guide 1.35. Visual and quantitative examinations are performed of the tendon sheathing filler material, anchorages, measurements of tendon liftoff forces (plus a visual assessment of stressing washers, shims, bearing plates), tensile testing of wire samples and corrosion assessments. Comparison of liftoff forces from the most recent tendon examinations to original installation lock-off forces provides direct evidence of potential system degradation.
>
> Containment tendon examination and surveillance test results can be found in the responses to RAI 4.5-5 (Figures 1, 2 and 3), RAI 4.5-6 (Tables 1, 2 and 3) and in RAI 4.5-7 (Table 1). These figures and tables include such quantitative tendon examination results as the actual and projected decreases in tendon group lock-off force, the presence or absence of free water, corrosion assessments, tensile testing results, and sheathing filler chemical analysis results. These inspection results reveal that the Millstone Unit 2 containment post tensioning system has experienced no abnormal degradation. Tendon lock off-force values were found to remain constant with projected lock-off forces (Millstone Unit 2 LRA, Section 4 – Figure 4.5-1) remaining above minimum requirements over the period of extended operation.

The applicant provided a description of examinations it performed and the factors it considered in performing the TLAA. As this response is associated with the responses to RAIs 4.5-5, 4.5-6, and 4.5-7, the staff position regarding the TLAA adequacy is discussed in the staff's evaluation of these RAIs.

In RAI 4.5-2, the staff requested a clarification of the prestressing force values provided in the second column of Tables 4.5-1, 4.5-2, and 4.5-3. The staff noted that the lowest required prestressing force for each group of tendons was established based on the computations of the minimum requirement to counteract the tension produced due to specified internal pressure. The tendon spacing is typically based on the tendon lock-off forces minus the estimates of losses due to anchorage take-up, elastic shortening, time dependent losses, and losses due to friction. The staff questioned whether it is feasible to account for all these factors and end up with the same minimum required tendon force (1308 kips) at tendon anchorages for hoop, vertical, and dome tendons. The applicant was requested to provide the basis for establishing the minimum required forces along with a comparison against the measured prestressing forces.

In its letter dated December 3, 2004, the applicant provided the following information in response to RAI 4.5-2:

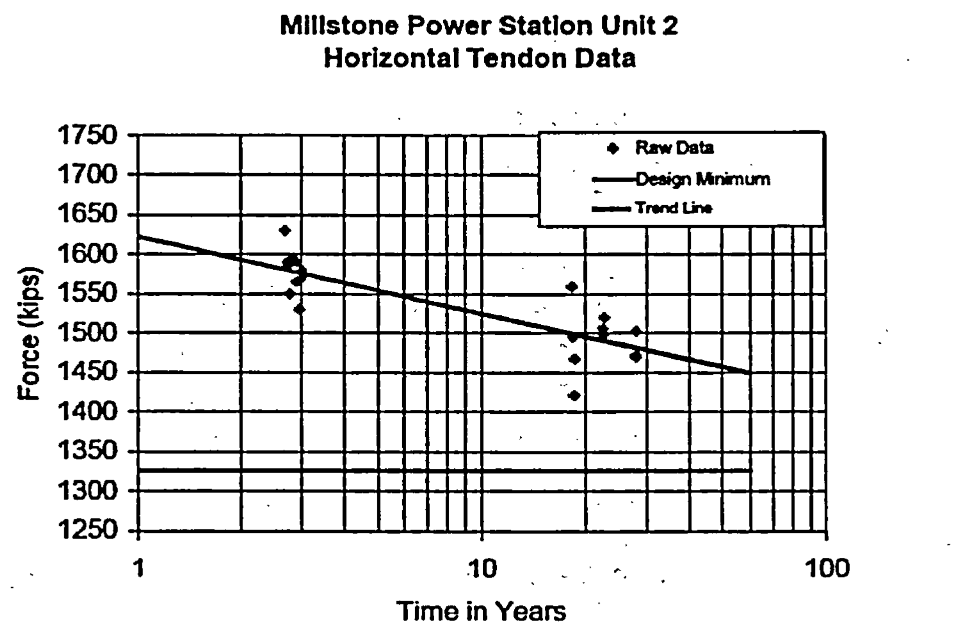
> The Millstone Unit 2 containment is pre-stressed by a post-tensioning system composed of dome, vertical and horizontal (hoop) tendon groups.
>
> Each tendon consists of approximately 186 stabilized, low relaxation 0.250-inch diameter wires, each having a tensile strength of 240,000 psi. The design of the post tensioning system takes into consideration a number of factors including tendon spacing, steel relaxation, stress losses due to concrete creep, steel elasticity, number of tendon wires and variability in same tendon load readings. Taking these variables into consideration, Dominion originally used a value of 1308 kips for the minimum pre-stress forces (Millstone Unit 2 LRA, Section 4 – Tables 4.5-1, -2 and -3, and Figure 4.5-1) as a nominal value considered to represent a bounding pre-stress force for all three tendon groups. However, based on a conversation with the reviewer, Dominion decided to determine the actual values for the Millstone Unit 2 containment dome, vertical and horizontal (hoop) tendon groups, which are 1343 kips, 1339 kips and 1325 kips respectively.
>
> As presented in the responses to RAI 4.5-4 (Figures 1, 2 and 3) and RAI 4.5-5 (Figures 1, 2 and 3), projected lockoff forces (Millstone Unit 2 LRA, Section 4 – Figure 4.5-1) remain above minimum requirements over the period of extended operation.

In view of the magnitudes of tendon forces in dome, vertical, and hoop directions, the staff considers the revised values provided for the minimum required prestress forces acceptable.

In RAI 4.5-4, the staff noted that the number of tendons sampled (i.e., 4 percent and 2 percent of the population of the group of tendons) during each tendon inspection is small, and that the sample size is not amenable to statistical analysis for establishing confidence levels (column 3 of Tables 4.5-1, 4.5-2, and 4.5-3) during each inspection based on the measured results. The staff also pointed out that, as the sample size of each tendon inspection is small, Attachment 3 of NRC Information Notice 99-10, Revision 1, recommended regression analysis of the measured tendon forces without averaging or any statistical calculation. The applicant was requested to provide more information about the values in column three of the identified tables and an explanation of measured tendon force values used in the regression analysis.

In its January 11, 2005 response, the applicant removed the tables provided in the LRA, and substituted new tables showing measured prestressing forces during tendon inspections for each group of tendons. In response to the staff's follow-up question as to why 3-, 5-, and 10-year data are missing from the tables, the applicant stated that as these tendons went through repeated tensioning and detensioning, the data were not reliable. The measurements taken during the 1-, 15-, 20-, and 25-year inspections were used for developing the trend lines. In Figures 1, 2, and 3 of the revised response (dated January, 11 2005), the applicant provided the trend lines and the measured tendon force data. Figure A, showing the trend line related to horizontal tendons, is reproduced below:

Figure A: Trend Line Relationship with Horizontal Tendons



In RAI 4.5-5, the staff noted that the process used by license renewal applicants with respect to prestressed concrete containments is to assume that the tendon force varies with the logarithm of time (as discussed in RG 1.35.1). The staff indicated that it was not apparent in Figure 4.5-1 what functional relationship had been assumed between the two variables. The applicant was requested to provide additional information regarding the process used in arriving at the trending curves shown in Figure 4.5-1.

In its response, in a letter dated January 11, 2005, the applicant confirmed that it is using procedures for monitoring and trending prestressing force consistent with the recommendations in RG 1.35.1 and NRC Information Notice 99-10. Therefore, the staff finds the process acceptable, as the use of RG 1.35.1 for estimating the target prestressing forces, and Information Notice 99-10 for projecting the actual measured prestressing forces (as illustrated in the figure above), provides the elements needed for an adequate TLAA.

In RAI 4.5-6, the staff noted that Section 5.9.3.3.4 of the Millstone Unit 2 FSAR indicates that 16 (below grade) horizontal tendons were identified to have ground water intrusion. The FSAR also indicates that the corrosion protection medium is continuously supplied to these tendons at a pressure slightly above the hydrostatic pressure to prevent intrusion of ground water. The staff also noted that Appendix 5F of the FSAR indicates that the below-grade portions of about 70 vertical tendons have been subjected to ground water intrusion. Appendix 5F also describes the attempts made to reduce the potential of corrosion of the components of these tendons.

The staff indicated that, due to the unusual maintenance conditions of these tendons, they are likely to experience greater age-related degradation (corrosion of wires, corrosion of anchorage components, etc.) than other tendons. The applicant was requested to provide the following information related to these tendons:

- During periodic inspections, are the samples from these tendons selected for special inspection and lift-off testing?
- Which tendons are included in the samples used in Tables 4.5-2 and 4.5-3?
- For the affected tendons, please provide a summary of the results of inspections performed in accordance with IWL-2523.

In its November 9, 2004, response, the applicant stated that it was using Section XI Inservice Inspection Program (Subsection IWL), and that it had not selected special tendons from the tendons subjected to ground water intrusion in the inspection samples. The applicant provided tables of tendons selected for examinations during various inspections, and conditions of the tendon hardware, sampled wires, chemical properties of corrosion protection medium (e.g., chlorides, nitrates, sulfides), and amount of free water in the grease samples tested. Three hoop tendons and one vertical tendon which had experienced water intrusion were included for examinations. The anchor heads and bearing plates of these tendons indicated visible oxide during 15, 20, and 25 years of inspections. The amount of free water increased from 15 to 20 years. However, during the 25-year inspection, the free water content decreased from 62 oz to 22 oz. The wire samples tested from these tendons indicated no difference in their strengths and percentage elongation compared to other tendons.

The staff finds that though the applicant is not including specific tendons that are subjected to ground water intrusion in its inspection samples, its random sample process incorporates these tendons, and it is monitoring the condition of suspect tendons during subsequent examinations. The TLAA is based on the force measurements taken on the randomly selected tendons. Therefore, the staff finds the applicant's approach in monitoring the conditions of the affected tendons acceptable.

In RAI 4.5-7, the staff noted that Section A3.4 of the Millstone 2 FSAR supplement provides only a general summary of the TLAA. Table 4.5-1 of NUREG-1800 recommends a discussion of trend lines and predicted lower limit (PLL) in the FSAR supplement. In order for the summary to be meaningful, the applicant was requested to provide a table showing the minimum required prestressing forces and the projected (to 60 years) prestressing forces for each group of tendons. The staff indicated that the tabulated values will confirm the validity of the analysis results based on the inspections conducted during the period of extended operation. The applicant was requested to supplement this information in Section A3.4 of the FSAR supplement.

In its response dated January 11, 2005, the applicant proposed to incorporate Table 1 (as reproduced below), in Millstone Unit 2 FSAR supplement.

Table 1 Millstone Power Station Unit 2 Containment Tendon Prestress

Inspection Year	Dome Tendon Projected (kips)	Dome Minimum Value (kips)	Vertical Tendon Projected (kips)	Vertical Minimum Value (kips)	Horizontal Tendon Projected (kips)	Horizontal Minimum Value (kips)
40	1453	1343	1521	1339	1467	1325
60	1435	1343	1509	1339	1449	1325

With the inclusion of this table, the staff finds the information in Section A3.4 of the FSAR supplement acceptable, as the table provides the necessary information for comparing the results of the inspections that will be performed during the period of extended operation.

4.5.3 Conclusion

On the basis of the review of this section of the LRAs and RAI responses, the staff concludes that the TLAA performed in accordance with 10 CFR 54.21(c)(1)(ii) is acceptable, and there is a reasonable assurance that in conjunction with the aging management of the containment structure to be performed in accordance with the aging management program described in LRA Appendix B, Section B2.1.16, the Millstone 2 containment will be able to perform its intended function during the period of extended operation.

4.6 Containment Liner Plate and Penetration Fatigue Analyses

4.6A Unit 2 Containment Liner Plate and Penetration Fatigue Analyses

The interior surface of the concrete containment structure is lined with thin metallic plates to provide a leak-tight barrier against the uncontrolled release of radioactivity to the environment, as required by 10 CFR Part 50. The thickness of the liner plates is generally between 1/4 inch (6.2 mm) and 3/8 inch (9.5 mm). The liner plates are attached to the concrete containment wall by stud anchors or structural rolled shapes, or both. The design process assumes that the liner plates do not carry loads. However, normal loads, such as from concrete shrinkage, creep, and thermal changes, imposed on the concrete containment structure, are transferred to the liner plates through the anchorage system. Internal pressure and temperature loads are directly applied to the liner plates. Thus, under design-basis conditions, the liner plates could experience significant strains.

Fatigue of the liner plates may be considered in the design based on an assumed number of loading cycles for the current operating term. The cyclic loads include reactor building interior temperature variation during the heatup and cooldown of the reactor coolant system, a loss-of-coolant accident (LOCA), annual outdoor temperature variations, thermal loads due to high-energy containment penetration piping lines (such as steam and feedwater lines), seismic loads, and pressurization due to periodic Type-A integrated leak rate tests.

The containment liner plates, penetration sleeves (including dissimilar metal welds), and penetration bellows may be designed in accordance with the requirements of Section III of the ASME Boiler and Pressure Vessel Code. If a plant's code of record requires a fatigue analysis, then this analysis may be a TLAA and must be evaluated in accordance with 10 CFR 54.21(c)(1) to ensure that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The adequacy of the fatigue analyses of the containment liner plates (including welded joints), penetration sleeves, dissimilar metal welds, and penetration bellows is reviewed for the period of extended operation. The fatigue analyses of the pressure boundary of process piping are reviewed in Section 4.3A of this SER, following the guidance in Section 4.3 of the SRP-LR.

4.6A.1 Summary of Technical Information in the Application

The applicant discussed the evaluation of the containment liner in Section 4.6.1 of the LRA. The applicant indicated that the following loads were considered in the design of the liner plate:

- 40 cycles of outdoor temperature variation
- 500 cycles of temperature variation due to startups and shutdowns
- 1 design-basis accident thermal cycle

The applicant discussed the evaluation of the containment penetrations in Section 4.6.2 of the LRA. The applicant indicated that the containment penetrations were fabricated, installed, inspected, and tested in accordance with Section III of the ASME Code and ANSI B31.7. The applicant indicated that the number of cycles used for the design of the containment liner plate penetrations was evaluated and found to be acceptable for the period of extended operation.

The applicant concluded that the fatigue analysis of the containment liner plate and penetrations have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.6A.2 Staff Evaluation

The design of the liner plate is discussed in Section 5.2.4 of the FSAR. The FSAR indicates that the analysis of the liner plate was performed in accordance with the criteria specified in Section III of the ASME Code, 1968 edition. The staff confirmed that the design cycles identified by the applicant in Section 4.6.1 of the LRA are the same as those specified in FSAR Section 5.2.4 for the fatigue analysis of the liner plate. In a followup response (e-mail dated December 20, 2004; from W. Watson (MPS) to J. Eads (NRC)), the applicant indicated that the number of design cycles was multiplied by 1.5 to demonstrate that the fatigue design of the liner is acceptable for 60 years of operation. Table 4.3-2 of the LRA indicates that the 500 heatup and cooldown cycles assumed for the fatigue design of RCS components should be bounding for the period of extended operation; therefore, the applicant used a conservative estimate for the number of startup and shutdown cycles. The staff concludes that the applicant's use of the 1.5 factor to extrapolate the number of design load cycles from 40 to 60 years of plant operation is acceptable. The staff finds the applicant has performed an acceptable assessment regarding the fatigue life of the liner plate for the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(ii).

The design of the containment penetrations is discussed in Section 5.2.7 of the FSAR. The FSAR indicates that the penetrations were fabricated, installed, inspected, and tested in accordance with Section III of the ASME Code and ANSI B31.7 as indicated by the applicant. The applicant indicated that the number of cycles used in the design of the containment penetrations was found acceptable for the period of extended operation. The staff finds the applicant has performed an acceptable assessment regarding the fatigue life of the containment penetrations for the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(i).

4.6A.3 FSAR Supplement

The applicant provided an FSAR supplement description of its TLAA evaluation for containment liner plate and penetration fatigue analyses in Section A3.5 of the LRA. On the basis of its review of the FSAR supplement, the staff concludes the summary description of the applicant's actions to address metal fatigue of components is adequate.

4.6A.4 Conclusion

The staff has reviewed the applicant's TLAA of the containment liner and penetrations and concludes the applicant's actions satisfy the requirements of 10 CFR 54.21(c)(1).

The staff has also reviewed the FSAR supplement for the TLAA and finds that the FSAR supplement contains an adequate description of the applicant's actions to address fatigue of the containment liner plate and penetrations to satisfy 10 CFR 54.21(d).

4.6B Unit 3 Containment Liner Plate and Penetration Fatigue Analyses

The interior surface of the concrete containment structure is lined with thin metallic plates to provide a leak-tight barrier against the uncontrolled release of radioactivity to the environment, as required by 10 CFR Part 50. The thickness of the liner plates is generally between 1/2 inch (12.7 mm) and 3/8 inch (9.5 mm). The liner plates are attached to the concrete containment wall by stud anchors or structural rolled shapes, or both. The design process assumes that the liner plates do not carry loads. However, normal loads, such as from concrete shrinkage, creep, and thermal changes, imposed on the concrete containment structure, are transferred to the liner plates through the anchorage system. Internal pressure and temperature loads are directly applied to the liner plates. Thus, under design-basis conditions, the liner plates could experience significant strains.

Fatigue of the liner plates may be considered in the design based on an assumed number of loading cycles for the current operating term. The cyclic loads include reactor building interior temperature variation during the heatup and cooldown of the reactor coolant system, a LOCA, annual outdoor temperature variations, thermal loads due to high-energy containment penetration piping lines (such as steam and feedwater lines), seismic loads, and pressurization due to periodic Type-A integrated leak-rate tests.

The containment liner plates, penetration sleeves (including dissimilar metal welds), and penetration bellows may be designed in accordance with the requirements of Section III of the ASME Boiler and Pressure Vessel Code. If a plant's code of record requires a fatigue analysis, then this analysis may be a TLAA and must be evaluated in accordance with 10 CFR 54.21(c)(1) to ensure that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The adequacy of the fatigue analyses of the containment liner plates (including welded joints), penetration sleeves, dissimilar metal welds, and penetration bellows is reviewed for the period of extended operation. The fatigue analyses of the pressure boundary of process piping are reviewed in Section 4.3B of this SER, following the guidance in Section 4.3 of the SRP-LR.

4.6B.1 Summary of Technical Information in the Application

The applicant discussed the evaluation of the containment liner in Section 4.6.1 of the LRA. The applicant indicated that ASME Section III and Section VIII, 1971 Edition were used in the design of the Millstone Unit 3 containment liner. The applicant indicated that the analysis of the containment liner plate has been projected to the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant discussed the evaluation of the containment penetrations in Section 4.6.2 of the LRA. The applicant indicated that Millstone Unit 3 penetrations consist of both sleeved and unsleeved piping penetrations, electrical penetrations, a fuel transfer tube, a personnel air lock, and the equipment hatch. The applicant stated there were no applicable codes for the design of concrete containment liners at the beginning of construction of Millstone Unit 3. The applicant indicated that ASME Section III, Division 1 and 2, and ASME Section VIII were used as guides. The applicant indicated that the containment liner plate and access openings, including the fuel transfer tube assembly, were designed for the following loads:

- 400 cycles of thermal expansions
- 100 cycles of differential pressure
- 100 cycles of 1/2-safe shutdown earthquake

The applicant stated that the analysis of the containment liner plate penetrations has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.6B.2 Staff Evaluation

The design of the liner plate is discussed in Section 3.8.1 of the Millstone Unit 3 FSAR. The FSAR indicates that the analysis of the liner plate conforms with the criteria specified in Section III of the ASME Code, 1971 edition through the 1973 summer addendum. The staff confirmed that the design cycles identified by the applicant in Section 4.6.1 of the LRA are the same as those specified in FSAR Table 3.8 for the fatigue analysis of the liner plate. In response (e-mail dated November 10, 2004, from W. Watson (MPS) to J. Eads (NRC)) to a staff question during an October 12, 2004, teleconference, the applicant indicated that the number of design cycles was multiplied by 1.5 to demonstrate that the fatigue design of the liner is acceptable for 60 years of operation. Table 4.3-2 of the LRA indicates that the 400 thermal cycles (heatup and cooldown cycles) should be bounding for the period of extended operation. The staff also finds the applicant's estimate of the number of cycles for differential pressure conservative based on the projected number of startup and shutdown cycles. Therefore, the staff concludes that the applicant used a conservative estimate of the number of load cycles for the period of extended operation. The staff finds the applicant has performed an acceptable assessment regarding the fatigue life of the liner plate for the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(ii).

The design of the containment penetrations is also discussed in Section 3.8.1 of the Millstone Unit 3 FSAR. Table 3.8-2 of the FSAR indicates that the penetrations were evaluated using Section III, Class-1 or Class-2 criteria. The applicant indicated that the number of cycles used in the design of the containment penetrations was found acceptable for the period of extended operation. As discussed previously, the number of thermal and pressure cycles used in the evaluation of the containment penetrations should be bounding for the period of extended operation based on the information provided in LRA Table 4.3-2. Therefore, the staff finds the applicant has performed an acceptable assessment regarding the fatigue life of the containment penetrations for the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(i).

4.6B.3 FSAR Supplement

The applicant provided an FSAR supplement description of its TLAA evaluation for containment liner plate and penetration fatigue analyses in Section A3.4 of the LRA.

4.6B.4 Conclusion

The staff has reviewed the applicant's TLAA of the containment liner and penetrations and concludes the applicant's actions and commitments satisfy the requirements of 10 CFR 54.21(c)(1).

The staff has also reviewed the FSAR supplement for the TLAA and finds that the FSAR supplement contains an adequate description of the applicant's actions to address fatigue of the containment liner plate and penetrations to satisfy 10 CFR 54.21(d).

4.7 Other Plant-Specific Time-Limited Aging Analyses

4.7A Unit 2 Other Plant-Specific Time-Limited Aging Analyses

4.7A.1 Crane Load Cycle Limit

4.7A.1.1 Summary of Technical Information in the Application

In LRA Section 4.7.1, the applicant identified the following examples of the types of cranes determined to be within the scope of license renewal. These cranes were designed in accordance with, or reconciled to, the guidance contained in NUREG-0612, "Control of Heavy Loads in Nuclear Power Plants."

- containment polar crane
- spent fuel crane
- monorails

NUREG-0612 requires that the design of heavy-load, overhead handling systems meets the intent of Crane Manufacturers Association of America, Inc., Specification No. 70 (CMAA-70).

Overhead cranes designed to CMAA-70 have an implicit fatigue design basis, equivalent to a limiting number of 100,000 load cycles. The Millstone Unit 2 polar crane was originally designed to the requirements of the Electric Overhead Crane (EOC) Institute Specification No. 61. This design was subsequently reconciled to the guidance contained in NUREG-0612.

As noted by the applicant, the most frequently used crane is the spent fuel crane. The spent fuel crane is expected to experience approximately 17,500 load cycles over a 60-year period for the movement of spent fuel from the reactor to the spent fuel pool. In addition, the crane is used in support of other activities including fuel shuffles and inspections. In supporting these uses, the spent fuel crane is expected to conservatively experience a total of 35,000 load cycles over a 60-year period. This number is well below the 100,000 load cycles allowed in CMAA-70.

4.7A.1.2 Staff Evaluation

The containment polar crane in Unit 2 was originally designed to the requirements of Electric Overhead Crane Institute Specification No. 61. Since this specification does not contain guidelines for fatigue evaluation, the applicant was requested in RAI 4.7.1-1 to explain how the crane was reconciled to the fatigue design basis of 100,000 load cycles as required by the CMAA-70.

In its response dated November 9, 2004, the applicant stated:

> In accordance with NUREG-0612, the load carrying parts of the polar crane, except for structural members and hoisting ropes, were designed such that the calculated static stress in the material, based on rated load, will not exceed 20% of the assumed average ultimate strength of the material. The Millstone Unit 2 polar crane was designed for a load of 578 tons (NRC to Northeast Nuclear Energy Company, Summary of Meeting of March 20, 1991, With Representatives of Northeast Utilities Concerning the Construction Aspects of the Millstone Unit 2 Steam Generator Replacement Project, Letter A09459 dated April 4, 1991), but the largest typical load, the pressure vessel head (including the associated weight of the lifting rig, CEDMs and CEDM coolers), is nominally 140 tons.
>
> The Millstone Unit 2 polar crane is used primarily during refueling outages. Assuming four load cycles per year (pressure vessel head removal and replacement plus other miscellaneous uses such as RCP motor movement) for a 60-year period of time, the polar crane would only experience a nominal 240 load cycles through the current and extended periods of operation. This number is significantly less than the 100,000 design load cycles (Millstone Unit 2 LRA Section 4.7.1).

The staff finds the applicant's response reasonable and acceptable because the applicant has provided a satisfactory explanation for reconciling the design of the polar crane to the requirements of CMAA-70.

As noted by the applicant, the most frequently used crane is the spent fuel crane. This crane is projected to lift 35,000 load cycles over a 60-year period for Unit 2. The staff requested the applicant to provide the basis for arriving at this projected figure of 35,000 load cycles.

In its supplemental response to RAI 4.7.1-1 dated January 11, 2005, the applicant stated:

> The Millstone Unit 2 spent fuel pool crane is the most frequently used crane of those cranes within the scope of license renewal. As such, the spent fuel pool crane would experience the highest number of load cycles over the period of extended operation. The capacity of the Unit 2 spent fuel crane is 2,000 pounds. A fuel assembly with its associated rigging weighs approximately 1,500 pounds.
>
> Assuming full-core off-loads and subsequent reloading of the 217 fuel assemblies every 1.5 years, the spent fuel pool crane is expected to experience 17,360 lifts (or load cycles) over a 60-year period.
>
> 217 X 2 lifts/cycle X 1 cycle/1.5 years X 60 years = 17,360 lifts
>
> The crane is also used to support other activities including fuel shuffles and inspections. Considering all of these uses, the spent fuel pool crane is expected to conservatively experience a total of 35,000 lifts (i.e., 17,360 lifts X 2) over a 60-year period. This number is well below the allowable number of 100,000."

The staff finds the applicant's response reasonable and acceptable because the applicant has provided a satisfactory basis for determining the projected number of lifts.

Considering all the uses, the spent fuel crane is likely to experience a total of 35,000 load cycles over a 60-year period. This number is well below the design load cycles of 100,000, and therefore acceptable. A similar conclusion based on projected load cycles being well below the number of design load cycles is applicable for the other cranes within the scope of license renewal.

4.7A.1.3 FSAR Supplement

In Appendix A, Section A3.6.1 of the application, the applicant provided a summary description of the evaluation of the crane load cycle limit. The applicant stated that the load cycles for these cranes were evaluated for the period of extended operation. For each crane, the projected load cycles through the period of extended operation will be less than the design load cycles and, therefore, all cranes in the scope of license renewal will continue to perform their intended function throughout the period of extended operation. On the basis of staff's review, the staff concludes that the applicant's description is sufficient to satisfy the requirements of 54.21(d).

4.7A.1.4 Conclusion

The staff has reviewed the information in LRA Section 4.7.1 and Appendix A, Section A3.6.1, as well as the additional information provided in the applicant's responses to staff's request for additional information. On the basis of the review discussed above, the staff concludes that the applicant has provided adequate information to meet the requirements of 10 CFR 54.21(c)(1), option (ii) related to the TLAA for the crane load cycle limits.

4.7A.2 Reactor Coolant Pump Flywheel

4.7A.2.1 Summary of Technical Information in the Application

In Section 4.7.2 of the Millstone Unit 2 LRA, the applicant addresses its analysis of fatigue-crack initiation and growth for the reactor coolant pump (RCP) flywheel.

The RCP motors are provided with flywheels to increase rotational inertia, thus prolonging pump coast-down and assuring a more gradual loss of primary coolant flow to the core in the event that pump power is lost. During normal operation, the RCP flywheels develop sufficient kinetic energy to produce high-energy missiles in the event of failure. Conditions that may result in overspeed of the pump increase both the potential for failure and the kinetic energy of the flywheel. These concerns led the NRC to issue RG 1.14, "Reactor Coolant Flywheel Integrity," Revision 1, August 1975. One of the recommendations of RG 1.14 is to volumetrically inspect the flywheels at 3- and 10-year intervals.

The applicant stated that an evaluation was performed of the likelihood of flywheel failure over a 60-year period of operation, and a justification was developed for the relaxation of RG 1.14, Revision 1, Regulatory Position C.4.b(2). The NRC has reviewed and accepted the topical report SIR-94-080-A developed by Structural Integrity Associates, Inc., subject to certain conditions, for referencing in license applications. Using this evaluation, the NRC issued Amendment Number 264 for the Millstone Unit 2 RCP flywheel inspection frequency. The amendment allows Millstone Unit 2 to examine each reactor coolant pump flywheel at least once every 10 years, coinciding with the ASME Section XI inservice inspection program.

The applicant concluded that the evaluation of the reactor coolant pump flywheels represents a time-limited aging analysis per 10 CFR 54.3 since it involves the use of time limited assumptions such as thermal cycles and crack growth rates. Consistent with 10 CFR 54.21(c)(1)(iii), the applicant concluded that the RCP flywheel fatigue will be adequately managed by the Inservice Inspection Program: Systems, Components and Supports for the period of extended operation.

4.7A.2.2 Staff Evaluation

In Section 4.7.2 of the Millstone Unit 2 LRA, the applicant describes an analysis of fatigue-crack initiation and growth for the RCP flywheel. The staff reviewed this section to determine whether the applicant provided adequate information to meet the requirements of 10 CFR 54.21(c)(1), as the information relates to the TLAA for the RCP flywheel.

To reduce the RCP flywheel inspection frequency, Millstone Unit 2 submitted an amendment to its TS in a letter dated April 26, 2001. The amendment justification referenced the topical report SIR-94-080A, "Relaxation of Reactor Coolant Pump Flywheel Inspection Requirements," which was approved by the NRC with certain conditions. The conditions are specified in the NRC's SER dated May 21, 1997. The crack growth calculations were based on an assumed 4,000 cycles of RCP startups and shutdowns rather than a specific time period of operation. The LRA states that the number of cycles from actual plant operating conditions through the end of the period of extended operation is expected to be much less that the assumed 4,000 cycles.

In RAI 4.7.2-1, the staff requested that the applicant discuss how crack growth rates and the number of start/stop cycles used in SIR-94-080A are applicable to the period of extended operation. In the applicant's response to RAI 4.7.2-1, dated December 3, 2004, the applicant states that a flaw tolerance evaluation using linear elastic fracture mechanics principles was performed using lower bound fracture toughness values at the most highly stressed locations. A crack growth evaluation was performed using the ASME Section XI crack growth law for ferritic steel in an air environment with an assumed initial flaw size of 0.25 inches (ultrasonic testing detection uncertainty). The crack growth after 4000 startup/shutdown cycles (this value is significantly more than expected for the period of extended operation) was found to be minimal (0.0035 inches) resulting in a final flaw size of 0.2535 inches. This final flaw size is significantly below the calculated ASME Section XI, paragraph IWB-3610 allowable flaw size of 1.64 inches for normal operating speed and 2.0 inches for accident speed conditions. Millstone Unit 2 is expected to experience a total of 300 RCP startup/shutdown cycles, including the period of extended operation.

The applicant's fatigue-crack growth analysis for the RCP flywheels demonstrates that the postulated flaw is not expected to grow in excess of the critical crack-size, even when the flywheels have been subjected to the change in the stress-intensity factor for the flywheels associated with 4,000 RCP startup/shutdown cycles. Since this bounds the number of RCP startups/shutdown cycles assumed for both the current operating period and the proposed period of extended operation, the staff concludes that the fatigue-crack growth analysis for the RCP flywheels meets the acceptance criterion for TLAAs in 10 CFR 54.21(c)(1)(ii), in that the analysis remains bounding for the period of extended operation.

4.7A.2.3 FSAR Supplement

Section A3.6.2 of Appendix A to the LRA provides the applicant's FSAR supplement regarding RCP flywheel consistent with the staff's evaluation discussed in Section 4.7.2.2 of this SER. The FSAR supplement summary description for the TLAA on the RCP Flywheel is therefore acceptable to the staff, and satisfies the criterion for FSAR supplement summary descriptions in 10 CFR 54.21(d).

4.7A.2.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration pursuant to 10 CFR 54.21(c)(1)(ii) that, for the TLAA on the RCP flywheel, the analysis remains valid for the period of extended operation.

The staff also concludes that the FSAR supplement contains an adequate summary description of this TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.7A.3 Reactor Coolant Pump Code Case N–481

4.7A.3.1 Summary of Technical Information in the Application

In Section 4.7.3 of the Millstone LRA, the applicant concluded that the use of ASME Code Case N–481 for Millstone Units 2 and 3 for evaluating the reactor coolant pump (RCP) casing met the definition in 10 CFR 54.3 for a TLAA, since it involves the use of time-limiting assumptions such as thermal cycles and crack growth rates. The applicant concluded that the use of ASME Code Case N–481 for the RCP casing welds at the Millstone units were TLAAs that needed to be assessed against the acceptance criteria of 10 CFR 54.21(c)(1). The applicant provided the following assessment for the TLAA on the ASME Code Case N–481:

> Millstone, Unit 2
> ASME Boiler and Pressure Vessel Code, Section XI, specifies that a volumetric inspection of the reactor coolant pump casing welds and a visual inspection of pump casing internal surfaces be performed on a reactor coolant pump within each 10-year inspection period. These 10-year volumetric inspections are significant because the reactor coolant pumps have already been welded to the piping and the pumps must be disassembled in order to gain access to the inside surface of the cast stainless steel casings. In recognition of these difficulties, ASME Code Case N–481, Alternative Examination Requirements for Cast Austenitic Pump Casings, was developed to allow for the replacement of volumetric examinations with [a] fracture mechanics, based evaluation and supplemented by specific visual inspections. The NRC, with no supplemental requirements or conditions, has approved Code Case N–481 for use at Millstone Unit 2.
>
> The evaluation of reactor coolant pump casings represents a time-limited aging analysis per 10 CFR 54.3 since it involves the use of time limited assumptions such as thermal cycles, and crack growth rates. Consistent with 10 CFR 54.21(c)(1)(iii), acceptable reactor coolant pump casing will be managed by the Inservice Inspection Program: Systems, Components and Supports for the period of extended operation.
>
> Millstone, Unit 3
> The Millstone Unit 3 Mode 93A-1 reactor coolant pump casings are single castings, which contain no welds. Therefore, Code Case N–481, Alternative Examination Requirements for Cast Austenitic Pump Casings, is not applicable.

4.7A.3.2 Staff Evaluation

Cast austenitic stainless steel (CASS) RCP casings are subject to thermal aging. Thermal aging refers to the gradual change in the microstructure and properties of a susceptible material due to its exposure to elevated temperatures for an extended period of time. Thermal aging may result in a reduction of the fracture toughness of a susceptible material such as CASS, since the thermal aging embrittlement effect (loss of fracture toughness) is a time-dependent phenomena. The associated aging effect requires a TLAA to ensure that it will be adequately managed through the period of extended operation.

ASME Code Case N–481 was approved by the NRC staff in RG 1.147, Revision 13, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," to allow the use of visual inspections and a postulated flaw evaluation in lieu of the volumetric examinations of the cast austenitic RCP casings welds as required by Table IWB-2500-1, Examination Category B-L-1, Item B12.10 of the ASME Code, Section XI. The purpose of the flaw analysis is to support the application of ASME Code Case N–481 for the inservice inspection (ISI) examination of the RCP casing welds. The requirements of Table IWB-2500-1, Examination Category B-L-2, Item B12.20 of the ASME Code, Section XI to perform internal visual inspections of the internals of the pump casing still apply.

Since the Millstone Unit 3 RCP casings are single castings, which contain no welds, ASME Code Case N–481 does not apply. Therefore, this is not a TLAA for Millstone Unit 3, and no further evaluation for Millstone Unit 3 is necessary.

For Millstone Unit 2, the RCP casings have welds, and therefore the use of ASME Code Case N–481 applies and is required to be evaluated as a TLAA since it uses time limiting assumptions such as thermal cycles and crack growth rates. However, the applicant did not provide the postulated flaw analysis required by the code case for the period of extended operation. In RAI 4.7.3-1(a), the staff requested the applicant to submit this fracture mechanics evaluation for the period of extended operation. In addition, the applicant was requested to compare the crack growth for the extended period to that originally predicted for the current operating period, and provide the basis for concluding that this additional crack growth still allows the continued application of ASME Code Case N–481.

In response to RAI 4.7.3-1(a), in a letter dated December 3, 2004, the applicant stated that a fracture mechanics evaluation, performed as a part of a Combustion Engineering Owners Group CEN-412, Revision 2, Supplement 2 activity, has been performed for the Millstone Unit 2 reactor coolant pumps. The applicant also stated that for Millstone Unit 2, the limiting end-point crack size is 0.39t, significantly greater than the 1/4t flaw postulated in ASME Code Case N–481. The time for the Millstone Unit 2 reactor coolant pump casing to reach the limiting end-point crack size is 103 years. To confirm the methodology and fracture mechanics results, the staff requested that the applicant provide the fracture mechanics evaluation for staff review. This was identified as Open Item 4.7.3-1(a).

In response to RAI 4.7.3-1(a), dated February 8, 2005, the applicant provided CEN-412, Revision 2, Supplement 2. The staff reviewed the report and found the evaluation used a non-conservative fracture toughness value of 150.4 ksi √in. Using the methodology in the report, along with the staff established fracture toughness value of 82 ksi √in, based on the staff's letter to NEI, dated May 19, 2000, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Components," the staff determined that the time required to reach the limiting end-point crack size is 87 years, instead of 103 years. Since this bounds the extended period of operation, the staff finds that the Millstone, Unit 2 reactor coolant pump casing to have adequate toughness for the extended period of operation based on CEN-412, Revision 2, Supplement 2 and the staff's letter dated May 19, 2000. The applicant also submitted an additional supplemental response in a letter dated June 2, 2005, to clarify how it intends to manage the aging of its RCP casings through the period of extended operation. In the June 2, 2005, letter, the applicant stated that the RCP casings will be managed through inspections performed under the aging management program, "Inservice Inspection Program: Systems, Components and Supports," in accordance with 10 CFR 54.21(c)(1)(iii). The staff finds the applicant's management of thermal aging embrittlement using the ASME Code Case N-481 inspection requirements, which consist of a visual inspection, acceptable. This resolves Open Item 4.7.3-1(a).

ASME Code Case N–481 requires an inspection and a fracture mechanics evaluation. The LRA states that the RCP casing will be managed by the inservice inspection program for the period of extended operation consistent with 10 CFR 54.21(c)(1)(iii). In RAI 4.7.3-1(b) the applicant was requested to determine which option of 10 CFR 54.21(c)(1), (Options (i) or (ii)), applies for the fracture mechanics evaluation required by the code case, in addition to Option (iii) for the management by inspection.

In response to RAI 4.7.3-1(b), in a letter dated December 3, 2004, the applicant confirmed that the acceptable reactor coolant pump casing flaw sizes have been projected through the period of extended operation, consistent with 10 CFR 54.21(c)(1)(ii). This is acceptable to the staff since the RCP casing will be managed by the inservice inspection program and justified the use of a postulated flaw evaluation in lieu of the volumetric examinations of the cast austenitic RCP casings welds. This resolves RAI 4.7.3-1(b).

4.7A.3.3 FSAR Supplement

LRA Section A3.6.3 for Millstone Unit 2 provides a FSAR supplement summary description for the TLAA on the use of ASME Code Case N–481. In RAI 4.7.3-1(c), the staff requested the applicant to confirm that Section A3.6.3 of the LRA applies to the pump casing welds, not the pump casing as a whole, to be consistent with the code case. In response to RAI 4.7.3-1(c), in a letter dated December 3, 2004, the applicant confirmed that the use of ASME Code Case N–481 applies to the RCP casing welds and that the requirements of Table IWB-2500-1, Examination Category B-L-2, Item B12.20 of the ASME Code, Section XI apply. This resolves RAI 4.7.3-1(c).

On the basis of the staff's evaluation, the summary description for the reactor coolant system TLAA for the use of ASME Code Case N–481 described in the FSAR supplement (LRA, Appendix A) provides an adequate description of this TLAA, as required by 10 CFR 54.21(d).

4.7A.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii) and 10 CFR 54.21(c)(1)(iii), that for the TLAA on the use of ASME Code Case N–481 on the CASS RCP pump casing welds, the analysis remains valid through the period of extended operation for Millstone Unit 2. The staff also concludes that the Millstone Unit 2 FSAR supplement contains an adequate summary description of the TLAA on the use of ASME Code Case N–481 for the period of extended operation, as required by 10 CFR 54.21(d). The staff also concludes that the use of ASME Code Case N–481 is not a TLAA for Millstone Unit 3 since there are no welds in the pump casings. Therefore, the staff has reasonable assurance that the safety margins established and maintained during the current operating term for the cast austenitic RCP casings will be maintained through the period of extended operation for the Millstone units.

4.7A.4 Leak-Before-Break

4.7A.4.1 Summary of Technical Information in the Application

The applicant stated that a leak-before-break (LBB) analysis has been performed for the Millstone 2 reactor coolant system (RCS) primary loop. The analyses considered the thermal aging of cast austenitic stainless steel piping and the fatigue transients that drive the flaw growth over the operating life of the plant.

The fundamental premise of LBB is that the materials used in nuclear power plant piping are sufficiently tough that even a large through-wall crack would remain stable and not result in a double-ended pipe rupture.

The NRC modified 10 CFR Part 50 General Design Criterion (GDC) 4, "Environmental and Missile Design Bases," in 1987. This change allows applicants to eliminate the dynamic effects of postulated ruptures in primary coolant loop piping in the design of PWRs if LBB criteria are met. In 1990, an LBB analysis was performed for CE-designed nuclear steam supply systems and documented in topical report CEN-367. This analysis demonstrated that plant monitoring systems can detect potential leaks in the RCS primary loop piping before a postulated crack causing the leak would grow to unstable proportions during the 40-year plant life. The NRC approved this analysis in its safety evaluation (SE) dated October 30, 1990. The original design basis for the Millstone Unit 2 RCS considered postulated breaks for the purposes of evaluating protection from the dynamic and environmental effects of the main coolant line (MCL) breaks.

The changes to GDC 4 allowed the application of LBB criteria for the selection of MCL breaks. The NRC approved the criteria for use at Millstone Unit 2 through its SE dated September 1, 1992. This application of LBB has eliminated the requirement to consider postulated breaks on the MCL in evaluating the dynamic effects on the RCS. The applicant's original LBB analysis was updated by letter dated June 25, 1998 due to the replacement of the steam generators. The re-analysis was needed to demonstrate that the conclusions of the original analysis remain valid or have been effectively addressed by the revised evaluations. The staff reviewed and approved the updated analysis in a letter dated November 11, 1998.

4.7A.4.2 Staff Evaluation

The applicant describes its LBB analysis in Section 4.7.4 of the LRA for RCS piping. The staff reviewed this section to determine whether the applicant provided adequate information to meet the requirements contained in 10 CFR 54.21(c) related to the TLAA for LBB for Millstone Unit 2.

The staff confirmed that the NRC generically approved the LBB applications for the primary loop piping for Combustion Engineering Owners Group (CEOG) plants on October 30, 1990, and specifically for Millstone 2 on November 9, 1998. The CEOG provides this generic LBB evaluation in CEN-367-A. There are two time-limited considerations for LBB analysis, crack growth and thermal aging. The material properties of cast austenitic stainless steel (CASS) can change over time. Thermal aging causes an elevation in the yield strength of the material and a degradation of the fracture toughness, with the degree of degradation being a function of the level of ferrite in the material. Thermal aging in CASS will continue until a saturated or fully aged point is reached.

The assessment in CEN-367-A uses the fracture toughness values of the SA-515 Grade 70 carbon steel weld in the LBB analysis, which are the lowest among all base and weld materials in the primary loop piping system. The staff has compared the fracture toughness values in CEN-367-A with the more recent information in NUREG-6177, "Assessment of Thermal Embrittlement of Cast Stainless Steels," and found that the fracture toughness data in CEN-367-A are more conservative than the NUREG-6177 lower-bound fracture toughness curve. Therefore, because the original analysis supporting LBB bounds fully aged CASS, the analysis does not have a material property time dependency that requires further evaluation for license renewal.

In response to RAI 4.7.4-1, the applicant stated that the LBB fatigue-crack growth analysis reported in CEN-367-A is based on 40-year design limits for RCS fatigue transient cycles. In CEN-367-A, the applicant performed a fatigue-crack growth analysis to show that fatigue will not cause degradation of the pressure boundary integrity. In the fatigue-crack growth analysis, the normal and upset cyclical loadings cause postulated flaws to grow. These cyclical loadings are based on reactor coolant design transient cycles. As described in Section 4.3.1 of the LRA, the number of transient cycles assumed in the original design for 40 years was found acceptable for 60 years of operation. Therefore, the postulated flaw growth in CEN-367-A (based on the RCS original design transient cycles) is unchanged for 60 years of operation. The staff finds the response acceptable and considers this issue closed.

In addition, the applicant has the "Metal Fatigue of the Reactor Coolant Pressure Boundary Program" to ensure that the accumulation of the applicable fatigue transient cycles over time will not invalidate the fatigue flaw growth analysis that it performed as part of the approved Millstone Unit 2 LBB analyses. With this program in place, which calls for constant review of the accumulation of applicable fatigue transient cycles, the applicant concluded that the continued implementation of the "Metal Fatigue of the Reactor Coolant Pressure Boundary Program" will provide reasonable assurance that the RCS components within the scope of license renewal will continue to perform their intended function(s) consistent with the CLB for the period of extended operation. The staff reviewed the "Metal Fatigue of Reactor Coolant Pressure Boundary Program" and determined that the program is adequate to monitor the applicable set of transients and their limits, and to count the actual thermal cycle transients to ensure that it is within the allowable limits of the defined transients. In the event that design cycle limits are approached, the applicant will review the analysis and determine appropriate actions.

Based on the above evaluation, the staff finds that the continued implementation of the "Metal Fatigue of the Reactor Coolant Pressure Boundary Program" provides reasonable assurance that thermal fatigue for the primary loop piping and components will be adequately managed, and therefore the analyses for this TLAA remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant reviewed and found the number and characteristics of cycles identified in CEN-367-A to be acceptable for the period of extended operation for the RCS piping at Millstone Unit 2. The applicant needed to identify all other systems or sections of piping that are covered by LBB analyses and if the analyses are applicable for the period of extended operation. The applicant needed to provide documented justification that the LBB analyses for systems covered by LBB analyses remain valid for the period of extended operation. The applicant needed to also provide justification that the analyses have been projected to the end of the period of extended operation, or that the effects of aging on the intended functions of the systems covered by LBB analyses will be adequately managed for the period of extended operation. The applicant needed to also update the FSAR supplement as appropriate. This was identified as Open Item 4.7.4-1.

By letter dated February 8, 2005, the applicant provided additional information to address Open Item 4.7.4-1. For Millstone Unit 2, the systems and components that have been analyzed for LBB include the reactor coolant loop piping (hot leg, cold leg, and crossover piping), the pressurizer surge line, and portions of the safety injection and shutdown cooling systems. The applicant stated that each of the LBB analyses associated with these systems and components were evaluated for the period of extended operation. The discussion for the reactor coolant loop piping is intended to envelope all of the current design basis LBB analyses. The materials evaluated for the subject components include carbon and low alloy steels, stainless steel (including cast austenitic stainless steel (CASS)) and nickel-based alloys. For each LBB analysis, the inputs to the evaluation were reviewed to identify time-limited assumptions. Thermal aging of CASS materials and fatigue crack growth calculations were determined to be time-based inputs as defined in 10 CFR 54.3 and required evaluation for the period of extended operation. The TLAA evaluations of metal fatigue are discussed in LRA Section 4.3.1 and the staff's evaluation is provided in Section 4.3 of this report. The metal fatigue TLAA evaluations conclude that design basis limits are not exceeded for ASME Class 1 components (which envelopes the components evaluated for LBB) through the period of extended operation. Thermal aging of CASS materials for components that have been evaluated for LBB has been evaluated for its effect on fracture toughness. The applicant's review concluded that the analysis used fully aged values for fracture toughness. Corrosion of nickel-based alloys was also considered. Cracking due to PWSCC of nickel-based alloys is managed by the Inservice Inspection Program: Systems, Components, and Supports AMP described in LRA Section B2.1.18. Millstone Unit 2 has committed to follow the industry recommendations related to nickel-based alloys. This commitment is identified in Appendix A, Table A6.0-1, License Renewal commitments, Item 14. The staff finds that the applicant has provided an adequate demonstration that the TLAA for LBB evaluations for the subject components remain valid or have been projected to the end of the period of extended operation. Therefore, the staff concludes that Open Item 4.7.4.1 is closed.

Since the V.C. Summer Nuclear Station main coolant loop weld cracking event involving Alloy 82/182 weld material, the staff has considered the effect of primary water stress-corrosion cracking on Alloy 82/182 piping welds as an operating plant issue affecting all piping with or without approved LBB applications. To resolve this issue, the industry has taken the initiative to (1) develop overall inspection and evaluation guidance, (2) assess the current inspection technology, and (3) assess the current repair and mitigation technology. An interim industry report, "PWR Materials Reliability Project Interim Alloy 600 Safety Assessment for US PWR Plants (MRP-44), Part 1: Alloy 82/182 Pipe Butt Welds," was published in April 2001 to justify the continued operation of PWRs while the industry completes the development of the final report. The staff accepted this interim report in an SE dated June 14, 2001, stating that, "Should the industry not be timely in resolving inspection capabilities to identify PWSCC in Alloy 600 welds, regulatory action may result."

4.7A.4.3 FSAR Supplement

Section A3.6.4 of Appendix A to the LRA provides the applicant's FSAR supplement regarding LBB for RCS piping. The plant design cycles in the applicant's LBB analysis are consistent with those used in the fatigue-crack growth analysis, and they bound the period of extended operation. In addition, the applicant's appropriate consideration of thermal aging of the CASS material constitutes the basis for the staff's acceptance of the applicant's evaluation of the LBB TLAA for the period of extended operation. On the basis of its review of the FSAR supplements, the staff concludes that the summary description of the applicant's TLAA evaluation to address LBB for the period of extended operation is adequate and satisfies 10 CFR 54.21(d).

4.7A.4.4 Conclusion

The staff concludes that, pursuant to 10 CFR 54.21(c)(1)(ii), the applicant has provided an acceptable demonstration that, for the TLAA on LBB of the RCS main-loop piping, the analysis will remain valid for the period of extended operation, and the applicant can adequately manage the effects of aging on the pressure boundary function for the period of extended operation. The staff also concludes that the FSAR supplements contain an adequate summary description of the evaluation of the TLAA for LBB, as required by 10 CFR 54.21(d). The applicant reviewed and found the number and characteristics of cycles identified in CEN-367-A to be acceptable for the period of extended operation for the RCS piping at Millstone Unit 2.

4.7B Unit 3 Other Plant-Specific Time-Limited Aging Analyses

4.7B.1 Crane Load Cycle Limit

4.7B.1.1 Summary of Technical Information in the Application

In LRA Section 4.7.1, the applicant identified the following examples of the types of cranes determined to be within the scope of license renewal. These cranes were designed in accordance with the guidance contained in NUREG-0612 "Control of Heavy Loads in Nuclear Power Plants."

- containment polar crane
- spent fuel crane
- monorails
- jib cranes

NUREG-0612 requires that the design of heavy-load, overhead handling systems meets the intent of CMAA-70. Overhead cranes designed to CMAA-70 have an implicit fatigue design basis, equivalent to a limiting number of 100,000 load cycles.

The most frequently used crane is the spent fuel crane. The spent fuel crane is expected to experience approximately 15,500 load cycles over a 60-year period for the movement of spent fuel from the reactor to the spent fuel pool. In addition, the crane is used in support of other activities including fuel shuffles, and inspections. In supporting these uses, the spent fuel crane is expected to conservatively experience a total of 31,000 load cycles over a 60-year period. This number is well below the 100,000 load cycles allowed in CMAA-70.

4.7B.1.2 Staff Evaluation

The most frequently used crane is the spent fuel crane. This crane is projected to lift 31,000 load cycles over a 60-year period for Unit 3. In RAI 4.7.1-1 the staff requested the applicant to provide the basis for arriving at this projected figure of 31,000 cycles.

In its supplemental response dated January 11, 2005, the applicant stated:

> "The Millstone Unit 3 spent fuel pool crane is the most frequently used crane of those cranes within the scope of license renewal. As such, the spent fuel pool crane would

experience the highest number of load cycles over the period of extended operation. The capacity of the Unit 3 spent fuel pool crane is 6,000 pounds. A fuel assembly with its associated rigging weighs approximately 2,000 pounds.

Assuming full-core off-loads and subsequent reloading of the 193 fuel assemblies every 1.5 years, the spent fuel pool crane will experience 15,440 lifts (or load cycles) over a 60-year period.

193 X 2 lifts/cycle X 1 cycle/1.5 years X 60 years = 15,440 lifts

The spent fuel pool crane is also used to support other activities including fuel shuffles and inspections. Considering all of these uses, the spent fuel pool crane is expected to conservatively experience a total of 31,000 lifts (i.e., 15,440 lifts X 2) over a 60-year period. This number is well below the allowable number of 100,000."

The staff finds the applicant's response reasonable and acceptable because the applicant has provided a satisfactory basis for determining the projected number of lifts.

Considering all the uses, the spent fuel crane is likely to experience a total of 31,000 load cycles over a 60-year period. This number is well below the design load cycles of 100,000, and therefore acceptable. A similar conclusion based on projected load cycles being well below the number of design load cycles is applicable for the other cranes within the scope of license renewal.

4.7B.1.3 FSAR Supplement

In Appendix A, Section A3.5.1 of the application, the applicant provided a summary description of the evaluation of the crane load cycle limit. The applicant stated that the load cycles for these cranes were evaluated for the period of extended operation. For each crane, the projected load cycles through the period of extended operation will be less than the design load cycles and, therefore, all cranes in the scope of license renewal will continue to perform their intended function throughout the period of extended operation. On the basis of staff's review, the staff concludes that the applicant's description is sufficient to satisfy the requirements of 54.21(d).

4.7B.1.4 Conclusion

The staff has reviewed the information in Section 4.7.1 and Appendix A, Section A3.5.1 of the LRA, as well as the additional information discussed by the applicant in its response to staff's request for additional information. On the basis of the review discussed above, the staff concludes that the applicant has provided adequate information to meet the requirements of 10 CFR 54.21(c)(1), option (ii) related to the TLAA for the crane load cycle limits.

4.7B.2 Reactor Coolant Pump Flywheel

4.7B.2.1 Summary of Technical Information in the Application

In Section 4.7.2 of the Millstone Unit 3 LRA, the applicant addresses its analysis of fatigue-crack initiation and growth for the reactor coolant pump (RCP) flywheel.

The RCP motors are provided with flywheels to increase rotational inertia, thus prolonging pump coast-down and assuring a more gradual loss of primary coolant flow to the core in the event that pump power is lost. During normal operation, the RCP flywheels develop sufficient kinetic energy to produce high-energy missiles in the event of failure. Conditions that may result in overspeed of the pump increase both the potential for failure and the kinetic energy of the flywheel. These concerns led the NRC to issue RG 1.14, "Reactor Coolant Flywheel Integrity," Revision 1, August 1975. One of the recommendations of RG 1.14 is to volumetrically inspect the flywheels at 3- and 10-year intervals.

An evaluation was performed of the likelihood of flywheel failure over a 60-year period of operation and a justification was developed for the relaxation of RG 1.14, Revision 1, Regulatory Position C.4.b(2). The NRC has reviewed and accepted the topical report WCAP-14535-A, subject to certain conditions, for referencing in license applications. Using this evaluation, the NRC issued Amendment Number 169 for the Millstone Unit 3 RCP flywheel inspection frequency. The amendment allows Millstone Unit 3 to examine each of the RCP flywheels at least once every 10 years, coinciding with the ASME Section XI inservice inspection program.

The applicant concluded that the evaluation of the RCP flywheels represents a TLAA per 10 CFR 54.3 since it involves the use of time limited assumptions such as thermal cycles and crack growth rates. Consistent with 10 CFR 54.21(c)(1)(iii), the applicant concluded that the RCP flywheel fatigue will be adequately managed by the Inservice Inspection Program: Systems, Components and Supports for the period of extended operation.

4.7B.2.2 Staff Evaluation

In Section 4.7.2 of the Millstone Unit 3 LRA, the applicant describes an analysis of fatigue-crack initiation and growth for the RCP flywheel. The staff reviewed this section to determine whether the applicant provided adequate information to meet the requirements of 10 CFR 54.21(c)(1), as the information relates to the TLAA for the RCP flywheel.

To reduce the RCP flywheel inspection frequency, Millstone Unit 3 submitted an amendment to its TS in a letter dated February 10, 1999. The amendment justification referenced the Westinghouse Topical Report WCAP-14535-A, "Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination," which was approved by the NRC with certain conditions. The conditions are specified in the NRC's SER dated September 12, 1996. The crack growth calculations were based on an assumed 6,000 cycles of RCP startups and shutdowns for a 60-year plant life. The LRA states that the number of cycles from actual plant operating conditions through the end of the period of extended operation is expected to be much less that the assumed 6,000 cycles.

In the applicant's response to RAI 4.7.2, dated December 3, 2004, the applicant stated that the RCP is expected to experience a total of 272 startup/shutdown cycles including the period of extended operation. The 6,000 cycles are considered to represent a conservative number of RCP startups/shutdowns for a 60-year period of operation. Assuming the presence of a large initial crack, additional crack growth after 6,000 startup/shutdown cycles of 0.08 inches is considered small.

The applicant's fatigue-crack growth analysis for the RCP flywheels demonstrates that the postulated flaw in the analysis is not expected to grow in excess of the critical crack size, even when the flywheels have been subjected to the change in the stress-intensity factor for the flywheels associated with 6,000 RCP startup/shutdown cycles. Since this bounds the number of RCP startups/shutdown cycles assumed for both the current operating period and the proposed period of extended operation, the staff concludes that the fatigue-crack growth analysis for the RCP flywheels meets the acceptance criterion for TLAAs in 10 CFR 54.21(c)(1)(ii), in that the analysis remains bounding for the period of extended operation.

4.7B.2.3 FSAR Supplement

Section A3.5.2 of Appendix A to the LRA provides the applicant's FSAR supplement regarding RCP flywheel provides a summary description consistent with the staff's evaluation discussed in Section 4.7.2.2 of this SER. The FSAR supplement summary description for the TLAA on the RCP flywheel is therefore acceptable to the staff, and satisfies the criterion for FSAR supplement summary descriptions in 10 CFR 54.21(d).

4.7B.2.4 Conclusion

The staff concludes that the applicant has provided an acceptable demonstration pursuant to 10 CFR 54.21(c)(1)(ii) that, for the TLAA on the RCP flywheel, the analysis remains valid for the period of extended operation and consistent with 10 CFR 54.21(c)(1)(iii), RCP flywheel fatigue cracking can be adequately managed by the Inservice Inspection Program: Systems, Components and Supports for the period of extended operation.

The staff also concludes that the FSAR supplement contains an adequate summary description of this TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

4.7B.3 Leak-Before-Break

4.7B.3.1 Summary of Technical Information In the Application

The applicant stated that a LBB analysis has been performed for Millstone Unit 3 RCS primary loop. The analyses for Millstone Unit 3 is documented within topical report WCAP-10587, June 1984.

The fundamental premise of LBB is that the materials used in nuclear power plant piping are sufficiently tough that even a large through-wall crack would remain stable and not result in a double-ended pipe rupture.

The NRC modified 10 CFR Part 50 General Design Criterion (GDC) 4, "Environmental and Missile Design Bases," in 1987. This change allows applicants to exclude the dynamic effects of postulated ruptures in primary coolant loop piping in the design of PWRs if LBB criteria are met. The methodology and criteria developed by the NRC for preparing LBB analyses are described in NUREG-1061, Volume 3, and summarized within the Draft Standard Review Plan, Section 3.6.3, Leak-Before-Break Evaluation Procedures.

The applicant stated that consistent with 10 CFR 54.21(c)(1)(ii), acceptable LBB evaluations have been projected to the end of the period of extended operation.

4.7B.3.2 Staff Evaluation

The applicant completed an evaluation of the RCS primary loop piping LBB analyses. The evaluation is documented in WCAP-10587, "Technical Bases for Eliminating Large Primary Loop Pipe Ruptures as the Structural Design Basis for Millstone Unit 3."

WCAP-10587 provides a plant-specific LBB analysis for RCS piping at Millstone Unit 3 based on a 40-year life of the nuclear power plant. The applicant stated that WCAP-10587 was reviewed and found acceptable for the period of extended operation. The staff review of WCAP-10587 found that additional information was needed to come to this conclusion. The applicant stated that "Millstone Unit 3 loads, material properties, transients and primary system geometry are enveloped by the parameters identified in WCAP-9558 and WCAP-10456." The staff review of these documents confirmed that they are based on a 40-year life of a nuclear power plant.

As such, the applicant needed to provide its LBB evaluations projected to the end of the period of extended operation. In accordance with GDC 4 and 10 CFR 54.21(c)(1)(ii), the applicant must demonstrate that the analyses have been projected to the end of the period of extended operation. In addition, if other piping, other than the RCS primary loop piping, was covered by LBB analyses, the applicant needed to address the analyses in accordance with 10 CFR 54.21(c)(1). This was identified as Open Item 4.7.4-1. These analyses needed to be reviewed and approved by the staff pursuant to the acceptance criteria in Section 4.7.3.1.2 of NUREG-1800, which states that the documented results of the revised analyses are to be reviewed to verify that their period of evaluation is extended such that they are valid for the period of extended operation. The analyses needed to include the thermal aging on the material properties of cast austenitic stainless steel and the effects on the fatigue crack growth analysis. The methodology and criteria developed by the NRC for preparing LBB analyses are described in NUREG-1061, Volume 3, and NUREG-0800, Standard Review Plan, Section 3.6.3, Leak-Before-Break Evaluation Procedures which were established after the applicant's topical report WCAP-10587.

By letter dated February 8, 2005, the applicant provided additional information to address Open Item 4.7.4-1. The applicant stated that for Millstone Unit 3, the reactor coolant system loop piping (hot leg, cold leg and crossover piping) has been evaluated for LBB. The materials evaluated for these components include carbon and low alloy steels, stainless steel (including CASS), and nickel-based alloys.

CASS used in the RCS are subject to thermal aging during service. Thermal aging causes an elevation in the yield strength of the material and a decrease in the fracture toughness. The decrease in fracture toughness is proportional to the level of ferrite in the material. Thermal aging in these stainless steels will continue until a saturation or fully aged point is reached. The applicant needed to address how fatigue will be evaluated or monitored to assure that the number of cycle counts for a transient set do not exceed its cycle limits which could invalidate the fatigue crack growth analysis. By letter dated February 8, 2005, the applicant provided information to address the LBB analyses for Millstone Unit 3. The applicant stated that each of the LBB analyses associated with these systems and components were evaluated for the period of extended operation. The discussion for the reactor coolant loop piping is intended to envelope all of the current design basis LBB analyses. The materials evaluated for the subject components include carbon and low alloy steels, stainless steel (including cast austenitic stainless steel (CASS)) and nickel-based alloys. For each LBB analysis, the inputs to the evaluation were reviewed to identify time-limited assumptions. Thermal aging of CASS materials and fatigue crack growth calculations were determined to be time-based inputs as defined in 10 CFR 54.3 and required evaluation for the period of extended operation. The TLAA evaluations of metal fatigue are discussed in LRA Section 4.3.1 and the staff's evaluation is provided in Section 4.3 of this report. The metal fatigue TLAA evaluations conclude that design basis limits are not exceeded for ASME Class 1 components (which envelopes the components evaluated for LBB) through the period of extended operation. Thermal aging of CASS materials for components that have been evaluated for LBB has been evaluated for its effect on fracture toughness. The applicant's review concluded that the analysis used fully aged values for fracture toughness. Corrosion of nickel-based alloys was also considered. Cracking due to PWSCC of nickel-based alloys is managed by the Inservice Inspection Program: Systems, Components, and Supports AMP described in LRA Section B2.1.18. Millstone Unit 3 has committed to follow the industry recommendations related to nickel-based alloys. This commitment is identified in Appendix A, Table A6.0-1, License Renewal commitments, Item 15. The staff finds that the applicant has provided an adequate demonstration that the TLAA for LBB evaluations for the subject components remain valid or have been projected to the end of the period of extended operation. Therefore, the staff concludes that Open Item 4.7.4.1 is closed.

4.7B.3.3 FSAR Supplement

Section A3.5.3 of Appendix A to the LRA provides the applicant's FSAR supplement regarding LBB for RCS piping. The FSAR supplement states, "The acceptability of eliminating Reactor Coolant System pipe LBB considerations for Millstone Unit 3 is contained within Westinghouse Topical Report WCAP-10587. The report has been re-evaluated and to be applicable for the period of extended operation." This paragraph was not clear on how the report was re-evaluated and why it is acceptable for the period of extended operation. In addition, the statement was not clear on what considerations are acceptable to be eliminated. The applicant needed to include in the summary how the report was re-evaluated and why it is applicable for the period of extended operation. The applicant also needed to address how thermal aging of CASS is supported in WCAP-10587 for the period of extended operation and how the fatigue-crack growth analysis is acceptable for the period of extended operation. On the basis of its review of the FSAR supplements, the staff concluded that the summary description of the applicant's TLAA evaluation to address LBB for the RCS piping for the period of extended operation required additional clarification to satisfy 10 CFR 54.21(d). This was identified as Confirmatory Item 4.7.4-1.

By letter dated April 1, 2005, the applicant provided the requested update to Section A3.5.3 of Appendix A to provide a summary description of the evaluation of the TLAA for LBB. The staff reviewed the revised summary description and finds that the revised summary description of the applicant's TLAA evaluation to address LBB for the period of extended operation is now adequate and satisfies 10 CFR 54.21(d). Based on the above, Confirmatory Item 4.7.4-1 is closed.

4.7B.3.4 Conclusion

The staff concludes that, pursuant to 10 CFR 54.21(c)(1), the applicant has provided an acceptable demonstration that, for the TLAA on LBB, will remain valid for the period of extended operation, and that the applicant will adequately manage the effects of aging on the pressure boundary function for the period of extended operation. The staff also concludes that the FSAR supplement contains an adequate summary description of the evaluation of the TLAA for LBB, as required by 10 CFR 54.21(d).

4.8 <u>Conclusion for Time-Limited Aging Analyses</u>

The staff has reviewed the information in LRA Section 4, "Time-Limited Aging Analysis." On the basis of its review, the staff concludes that the applicant has provided an adequate list of TLAAs, as defined in 10 CFR 54.3. Further, the staff concludes that the applicant has demonstrated that (1) the TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i), (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii), or (3) that the aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff has also reviewed the FSAR supplement for the TLAAs and finds that the FSAR supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes that no plant-specific exemptions are in effect that are based on TLAAs, as required by 10 CFR 54.21(c)(2).

With regard to these matters, the NRC staff has concluded that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the current licensing basis, and that any changes made to the MPS current licensing basis in order to comply with 10 CFR 54.29(a) are in accord with the Act and the Commission's regulations.

5. REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The NRC staff issued its Safety Evaluation Report (SER) with Open Items related to the renewal of operating licenses for the Millstone Power Station (MPS), Units 2 and 3, on February 24, 2005. On April 6, 2005, the applicant presented its license renewal applications, and the staff presented it review findings to the Advisory Committee on Reactor Safeguards (ACRS) Plant License Renewal Subcommittee. The staff reviewed the applicant's comments on the SER with Open Items and completed its review of the license renewal applications. The staff's evaluation is documented in an SER that was issued by letter dated August 1, 2005.

During the 524th meeting of the ACRS, September 8-10, 2005, the ACRS completed its review of the MPS license renewal application and the NRC staff's SER. The ACRS documented its findings in a letter to the Commission dated September 22, 2005. A copy of this letter is provided on the following pages of this SER Section.

ACRSR-2150

September 22, 2005

The Honorable Nils J. Diaz
Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL APPLICATIONS FOR THE MILLSTONE POWER STATION, UNITS 2 AND 3

Dear Chairman Diaz:

During the 525th meeting of the Advisory Committee on Reactor Safeguards (ACRS), September 8-10, 2005, we completed our review of the license renewal applications for the Millstone Power Station (MPS), Units 2 and 3 and the final Safety Evaluation Report (SER) prepared by the NRC staff. Our Plant License Renewal Subcommittee also reviewed this matter during a meeting on April 6, 2005. During these reviews, we had the benefit of discussions with the staff, Dominion Nuclear Connecticut, Inc. (DNC), and a member of the public representing the Connecticut Coalition Against Millstone. We also had the benefit of the documents referenced. This report fulfills the requirements of 10 CFR 54.25, which requires that the ACRS review and report on all license renewal applications.

CONCLUSION AND RECOMMENDATION

(1) The programs committed to and established by the applicant to manage age-related degradation provide reasonable assurance that MPS, Units 2 and 3 can be operated in accordance with their current licensing basis for the period of extended operation without undue risk to the health and safety of the public.

(2) DNC's applications for renewal of the operating licenses for MPS, Units 2 and 3 should be approved.

BACKGROUND AND DISCUSSION

Millstone Power Station consists of three nuclear units on a 500-acre site on the north shore of Long Island Sound in the town of Waterford, Connecticut. Each of the three Millstone units was supplied by a different nuclear steam supply system vendor. Unit 1, a Mark 1 boiling water reactor which was shut down in the late 1990s, is not the subject of the license renewal applications being considered here. Unit 2 is a 2700 MWt (895 MWe) 4-loop (two steam generators) Combustion Engineering pressurized water reactor (PWR). Unit 3 is a 3411 MWt (1195 MWe) 4-loop Westinghouse PWR. The applicant has requested renewal of the current operating licenses for Units 2 and 3 for an additional 20 years beyond their current terms, which expire on July 31, 2015, and November 25, 2025, respectively.

Those long-lived passive structures, systems, and components (SSCs) from Unit 1 that service Units 2 and 3 fall within the scope of this license renewal. Although DNC submitted separate license renewal applications for Unit 2 and Unit 3, the staff consolidated its SER to address both applications. Since the applicant will apply identical aging management programs (AMPs) to both units, the staff's consolidation of the SER is appropriate.

In the final SER, the staff documented its review of the DNC's license renewal applications and other information submitted by the applicant or obtained during the staff's audits and inspections at the plant site. The staff reviewed the completeness of the applicant's identification of SSCs that are within the scope of license renewal; the integrated plant assessment process; the applicant's identification of plausible aging mechanisms associated with passive, long-lived components; the adequacy of the applicant's aging management programs; and the identification and assessment of time-limited aging analyses (TLAAs).

The DNC applications demonstrate consistency with, or justify deviations from, the approaches specified in the Generic Aging Lessons Learned Report.

In its draft SER the staff identified a number of issues requiring further definition, analysis, or modification by the applicant to satisfy the requirements of the license renewal rule. Among these issues were the following:

> The staff questioned the applicant's definition of the "first equivalent anchor point" for determining the endpoint of nonsafety-related piping attached to safety-related systems to be included within the scope of the rule. The applicant resolved this issue by changing the definition of the "first equivalent anchor point" to be consistent with the current licensing basis.
>
> The staff questioned the applicant's neglect of effects other than thermal cycling, such as vibration, that could lead to age-related loss of preload of bolting. The applicant modified its Bolting Integrity Program to reflect such aging effects.
>
> The staff questioned the exclusion of the reactor vessel flange leak detection lines in Units 2 and 3 from the scope of license renewal. The applicant initially argued that the break flow through a failed leak detection line would be limited by a restriction in the reactor vessel flange geometry to a flow less than the makeup capability of the chemical and volume control system. However, the applicant finally decided to include the reactor vessel flange leak detection lines within the scope of aging management, satisfying the staff's concern.
>
> The staff questioned the adequacy of the leak-before-break (LBB) analyses for Units 2 and 3 for the period of extended operation. The applicant submitted additional information on the methods and assumptions used to update these analyses for the period of extended operation. The current LBB analyses are for the reactor coolant system loop piping and components, the pressurizer surge line, and portions of the safety injection and shutdown cooling lines of Unit 2, and for the reactor coolant system loop piping and components of Unit 3. The analyzed systems and components were constructed of carbon and low-alloy steel, stainless steel [including cast austenitic stainless steel (CASS)], and nickel-based alloys. TLAAs were performed that account for fatigue crack growth, the thermal aging of CASS, and the corrosion of nickel-based alloys. DNC demonstrated that the analyses for fatigue crack growth and thermal aging of CASS, assuming fully aged materials, are adequate for the period of extended

operation. The corrosion of nickel-based alloys will be managed by the use of the Inservice Inspection Program. In addition, DNC has committed to follow the industry recommendations regarding the aging effects and appropriate aging management of nickel-based alloys for Units 2 and 3 and to submit an aging management program at least 24 months prior to entering the period of extended operation. These commitments are documented in the SER.

Analyses of reactor vessel neutron embrittlement (upper shelf energy, pressurized thermal shock screening criterion, and pressure-temperature limits) performed by the applicant and independently verified by the staff demonstrate that the limiting reactor vessel beltline welds and plate materials will satisfy the acceptance criteria for the period of extended operation. Both the applicant and the staff chose to use a conservative lifetime capacity factor of 90 percent for determining neutron fluence. We agree.

The staff requested confirmatory analyses or other technically justifiable responses to six confirmatory issues. DNC has supplied information regarding these confirmatory items and the staff has determined that the applicant's responses are satisfactory to close these confirmatory items.

We agree with the resolution of all open items identified in the draft SER. DNC has made appropriate commitments to carry out the tasks identified by the staff and agreed to by DNC to satisfy outstanding issues related to these applications. The staff has included appropriate license conditions in the SER to satisfy remaining documentation issues and action items.

DNC's applications for renewal of the licenses for MPS, Units 2 and 3 are of high quality and DNC's responses to the staff's requests for additional information are thorough, timely, and complete. The staff's evaluation is technically comprehensive and well documented in the SER. The inspections and audits performed by the NRC staff for evaluating the applicant's proposed and existing programs and analyses are effective. They reduce the amount of paperwork and staff and applicant time needed to prepare and respond to written requests for additional information.

No issues related to the matters described in 10 CFR 54.29(a)(1) and (a)(2) preclude renewal of the operating licenses for MPS, Units 2 and 3. The programs committed to and established by the applicant provide reasonable assurance that MPS, Units 2 and 3 can be operated in accordance with their current licensing basis for the period of extended operation without undue risk to the health and safety of the public. The applications for renewal of the operating licenses for MPS, Units 2 and 3 should be approved.

Drs. Mario Bonaca and George Apostolakis did not participate in the Committee's deliberations regarding this matter.

Sincerely,

/RA/

Graham B. Wallis
Chairman

References:
(1) U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of the Millstone Power Station, Units 2 and 3," August 2005
(2) U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with Open Items Related to the License Renewal of the Millstone Power Station, Units 2 and 3," February 2005
(3) Dominion Nuclear Connecticut, Inc., "Millstone Power Station Unit 2 Application for Renewed Operating License Technical and Administrative Information," January 2004
(4) Dominion Nuclear Connecticut, Inc., "Millstone Power Station Unit 3 Application for Renewed Operating License Technical and Administrative Information," January 2004
(5) U.S. Nuclear Regulatory Commission, "Millstone Power Station Unit 2 and Unit 3 - License Renewal Application Inspection Report Nos. 05000336/2004009, 05000423/2004009," December 3, 2004
(6) U.S. Nuclear Regulatory Commission, "Millstone Power Station Unit 2 and Unit 3 - License Renewal Application Inspection Report Nos. 05000336/2004010, 05000423/2004010," December 3, 2004
(7) Information Systems Laboratories, Inc., "Audit and Review Report for Plant Aging Management Reviews and Programs, Millstone Power Station - Units 2 & 3," February 2, 2005
(8) Letter to Graham Wallis, Chairman, Advisory Committee on Reactor Safeguards, from Nancy Burton, Connecticut Coalition Against Millstone, Subject: Millstone Nuclear Power Station, September 7, 2005
(9) Letter to the Advisory Committee on Reactor Safeguards from Nancy Burton, Connecticut Coalition Against Millstone, Subject: Millstone Nuclear Power Station Application for License Renewal, April 5, 2005
(10) Letter to Paul G. Kroh, Chief Inspector, Region I, U.S. Nuclear Regulatory Commission, from Nancy Burton, Connecticut Coalition Against Millstone, Subject: Millstone Nuclear Power Station, April 1, 2005

6. CONCLUSIONS

The staff of the U.S. Nuclear Regulatory Commission (NRC or the Commission) reviewed the license renewal applications for the Millstone Power Station, Units 2 and 3, in accordance with Commission regulations and NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. Title 10, Section 54.29, of the *Code of Federal Regulations* (10 CFR 54.29) provides the standards for issuance of a renewed license.

On the basis of its evaluation of the license renewal applications, the NRC staff concludes that the requirements of 10 CFR 54.29(a) have been met and all open items and confirmatory items of the safety evaluation report have been resolved.

The staff notes that any requirements of Subpart A of 10 CFR Part 51 are documented in Supplement 22 to NUREG-1437 "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Millstone Power Station, Units 2 and 3 Final Report," dated July 18, 2005.

APPENDIX A: COMMITMENTS FOR LICENSE RENEWALS OF MPS Units 2 and 3

During the review of the Millstone Power Station, Units 2 and 3, LRAs by the NRC staff, the applicant made commitments related to aging management programs (AMPs) to manage aging effects of structures and components (SCs) prior to the periods of extended operation. The following tables list these commitments, along with the implementation schedules and the sources of the commitment.

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
1	The existing inspection program will be modified to include those battery racks that require monitoring for license renewal, but are not already included in the program.	A2.1.1, Battery Rack Inspection	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.1
2	Implementing procedures will be modified to include loss of material as a potential aging effect and to provide guidance on the inspection of items (such as anchorages, bracing and supports, side and end rails, and spacers), which contribute to battery rack integrity or seismic design of the battery racks.	A2.1.1, Battery Rack Inspection	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.1
3	A baseline inspection of the in-scope buried piping located in a damp soil environment will be performed for a representative sample of each combination of material and protective measures. Inspection for the loss of material due to selective leaching will be performed by visual, and mechanical or other appropriate methods.	A2.1.4, Buried Pipe Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.4 July 7, 2004, LRA Supplement Attachment 1, Page 12

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
4	The maintenance and work control procedures will be revised to ensure that inspections of buried piping are performed when the piping is excavated during maintenance or for any other reason. These procedures will include the inspection for the loss of material due to selective leaching which will be performed by visual, and mechanical or other appropriate methods.	A2.1.4, Buried Pipe Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.4 July 7, 2004, LRA Supplement Attachment 1, Page 12
5	The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be established.	A2.1.8, Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.8
6	Fuse holders meeting the requirements will be evaluated prior to the period of extended operation for possible aging effects requiring management. The fuse holder will either be replaced, modified to minimize the aging effects, or this program will manage the aging effects. The program (if needed for fuse holders) will consider the aging stressors for the metallic clips.	A2.1.8, Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation Completed	LRA Appendix B, Section B2.1.8 February 15, 2005 Letter Attachment, Page 4

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
7	Procedures will be developed to employ an alternate testing methodology to confirm the condition of cables and connectors in circuits that have sensitive, low level signals and where the instrumentation is not calibrated in situ.	A2.1.9, Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency Thereafter	LRA Appendix B, Section B2.1.9
8	A baseline visual inspection will be performed on a representative sample of the buried fire protection piping and components, whose internal surfaces are exposed to raw water, to confirm there is no degradation.	A2.1.10, Fire Protection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.10
9	Testing a representative sample of fire protection sprinkler heads or replacing those that have been in service for 50 years will be included in the Fire Protection Program.	A2.1.10, Fire Protection Program	Prior to the Sprinkler Heads Achieving 50 Years of Service Life Not to Exceed a 10 Year Frequency Thereafter	LRA Appendix B, Section B2.1.10 July 7, 2004, LRA Supplement Attachment 1, Page 1

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
10	The procedures and training for personnel performing General Condition Monitoring inspections and walkdowns will be enhanced to provide expectations that identify the requirements for the inspection of aging effects.	A2.1.13, General Condition Monitoring	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.13
11	In-scope cable found to be submerged will be subject to an engineering evaluation and corrective action. The evaluation of cables having significant voltage found to be submerged in standing water for an extended period of time will be based on appropriate testing (using available technology consistent with NRC positions) of cables that are determined to be wetted for a significant period of time. The Engineering evaluation will also address the appropriate testing requirements for the corresponding ten-year intervals during the period of extended operation. The test will use a proven methodology for detecting deterioration of the insulation system due to wetting. Examples of such tests include power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, Effects of Moisture on the Life of Power Plant Cables, or other appropriate testing. Testing will have acceptance criteria defined in accordance with the specific test identified. Occurrence of degradation that is adverse to quality is entered into the Corrective Action Program.	A2.1.14, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation During the Corresponding 10 Year Interval (If Applicable)	July 7, 2004 LRA Supplement Attachment 1, Page 17

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
12	The Infrequently Accessed Areas Inspection Program will be established.	A2.1.15, Infrequently Accessed Areas Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.15
13	Millstone will follow the industry efforts on reactor vessel internals regarding such issues as thermal or neutron irradiation embrittlement (loss of fracture toughness), void swelling (change in dimensions), stress corrosion cracking (PWSCC and IASCC), and loss of pre-load for baffle and former-assembly bolts and will implement the appropriate recommendations resulting from this guidance. The revised program description, including a comparison to the 10 program elements of the NUREG-1801 program, will be submitted to the NRC for approval.	A2.1.17, Inservice Inspection Program: Reactor Vessel Internals	At Least Two Years Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.17 July 7, 2004, LRA Supplement Attachment 1, Page 1 February 8, 2005 LRA Supplement Attachment 2, Page 30

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
14	Millstone will follow the industry efforts investigating the aging effects applicable to nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) and identifying the appropriate aging management activities and will implement the appropriate recommendations resulting from this guidance. The revised program description will be submitted prior to the period of extended operation for staff review and approval to determine if the program demonstrates the ability to manage the effects of aging in nickel based components per 10 CFR 50.54.21(a)(3).	A2.1.18, Inservice Inspection Program: Systems, Components and Supports A2.1.22, Steam Generator Structural Integrity	At Least Two Years Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.18 April 1, 2005 Attachment 2, Page 8
15	The existing inspection program will be modified to include those lifting devices that require monitoring for license renewal, but are not already included in the program.	A2.1.19, Inspection Activities: Load Handling Cranes and Devices	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.19
16	Implementing procedures and documentation will be modified to include visual inspections for the loss of material on the crane and trolley structural components and the rails in the scope of license renewal added in Commitment 15.	A2.1.19, Inspection Activities: Load Handling Cranes and Devices	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.19

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
17	The implementing procedure will be modified to include American Concrete Institute (ACI) Standard 349.3R-96, "Evaluation of Existing Nuclear Safety Related Concrete Structures," dated 1996, and American Nuclear Standards Institute/American Society of Civil Engineers (ANSI/ASCE) Standard 11-90, "Guideline for Structural Condition Assessment of Existing Buildings," dated 1990, as references and input documents for the inspection program.	A2.1.23, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
18	The Structures Monitoring Program and implementing procedures will be modified to include all in-scope structures.	A2.1.23, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
19	Groundwater samples will be taken on a periodic basis, considering seasonal variations, to ensure that the groundwater is not sufficiently aggressive to cause the below-grade concrete to degrade.	A2.1.23, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
20	The Structures Monitoring Program and implementing procedures will be modified to alert the appropriate engineering organization if the structures inspections identify that medium-voltage cables in the scope of license renewal have been submerged.	A2.1.23, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
21	The maintenance and work control procedures will be revised to ensure that inspections of inaccessible areas are performed when the areas become accessible by such means as excavation or installation of shielding during maintenance or for any other reason.	A2.1.23, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
22	Appropriate inspections of sealants and caulking used for moisture intrusion prevention in and around aboveground tanks will be performed.	A2.1.24, Tank Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.24
23	Non-destructive volumetric examination of the in-scope inaccessible locations, such as the external surfaces of tank bottoms, will be performed prior to the period of extended operation. Subsequent inspections will be performed on a frequency consistent with scheduled tank internals inspection activities.	A2.1.24, Tank Inspection Program	Prior to Period of Extended Operation A Frequency Consistent with Scheduled Tank Internals Inspection Activities	LRA Appendix B, Section B2.1.24
24	The security diesel fuel oil tank and diesel fire pump fuel oil tank are in-scope for license renewal and will be included on the respective Tank Inspection Program inspection plan.	A2.1.24, Tank Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.24

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
25	Changes will be made to maintenance and work control procedures to ensure that inspections of plant components and plant commodities will be appropriately and consistently performed and documented for aging effects during maintenance activities.	A2.1.25, Work Control Process	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.25
26	Dominion actively participates in a comprehensive industry initiative, in response to NRC Generic Issue 23 (GI-23), "Reactor Coolant Pump Seal Failure." Dominion is following the industry efforts on this issue and will implement the appropriate recommendations resulting from this guidance prior to the period of extended operation.	Environmental Report	Prior to Period of Extended Operation	Environmental Report - SAMA Analysis
27	For potentially susceptible CASS materials, either enhanced volumetric examinations or a unit or component specific flaw tolerance evaluation (considering reduced fracture toughness and unit specific geometry and stress information) will be used to demonstrate that the thermally-embrittled material has adequate fracture toughness in accordance with NUREG-1801 Section XI.M12.3.	A2.1.18, Inservice Inspection Program: Systems, Components and Supports	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 5

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
28	Millstone will follow industry efforts that will provide specific guidance to license renewal applicants for evaluating the environmental effects of fatigue on applicable locations, other than those identified in NUREG/CR-6260. Millstone will also implement the appropriate recommendations resulting from this guidance.	A3.2.3 Environmentally Assisted Fatigue	Prior to the Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1
29	A baseline visual inspection will be performed of the accessible areas of the shell side (including accessible portions of the exterior side of the tubes) of one: • Millstone Unit 2 Reactor Building Closed Cooling Water heat exchanger, • Millstone Unit 2 Emergency Diesel Generator Jacket Cooling Water heat exchanger, and • Millstone Unit 3 Emergency Diesel Generator Jacket Cooling Water heat exchanger.	A2.1.7, Closed-Cycle Cooling Water System	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 6
30	Using the Work Control Process, a baseline inspection for the loss of material due to selective leaching will be performed on a representative sample of locations for susceptible materials by visual, and mechanical or other appropriate methods	A2.1.25, Work Control Process	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 14

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
31	A review of the Work Control Process inspection opportunities for each material and environment group, supplemental to the initial review conducted during the development of the LRA, will be performed. Baseline inspections will be performed for the material and environment combinations that have not been inspected as part of the Work Control Process.	A2.1.25, Work Control Process	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 20
32	Calibration results for cable tested in situ will be reviewed to detect severe aging degradation of the cable insulation. The initial review will be completed prior to entering the period of extended operation and will include at least 5 years of surveillance test data for each cable reviewed. Subsequent reviews will be performed on a period not to exceed 10 years.	A2.1.9, Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency Thereafter	December 3, 2004, LRA Supplement Attachment 3, Page 1
33	The in scope cables in Unit 3 duct lines # 929 (SBO Diesel to Unit 3 4.16kV Normal Switchgear) and # 973 (RSST 3RTXXSR-B to 6.9kV Normal Switchgear Bus 35A, 35B, 35C and 35D) will be tested to demonstrate that water treeing will not prevent the cables from performing their intended function	A2.1.14, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency Thereafter	December 3, 2004, LRA Supplement Attachment 3, Page 3

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
34	In addition to the testing specified in Commitment 33, a representative sample of in-scope medium-voltage cables will be tested to demonstrate that water treeing will not prevent the cables from performing their intended function.	A2.1.14, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency Thereafter	January 11, 2005, Attachment 3, Page 1
35	Complete the SAMA evaluation of the capability to flash the Diesel Generator field in the event of extended loss of DC power with a loss of offsite power. If this SAMA is cost beneficial (i.e., can be accomplished without a hardware modification), a Severe Accident Management Guideline (SAMG) addressing this mitigation strategy will be developed.	Environmental Report	Prior to Period of Extended Operation	August 13, 2004, RAI Responses, Page 2
36	Dominion will replace the Millstone Unit 2 pressurizer using materials that are resistant to PWSCC.	A2.1.18, Inservice Inspection Program: Systems, Components and Supports	Prior to Period of Extended Operation	February 8, 2005, Attachment 2, Page 33

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 2				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
37	Updated USE, RT_{PTS}, and P-T limits based on fluence values developed in accordance with Regulatory Guide 1.190 requirements, as amended or superseded by future regulatory guidance changes, will be submitted to the NRC for review.	A3.1 Reactor Vessel Neutron Embrittlement	At Least Two Years Prior to Period of Extended Operation	February 8, 2005, Attachment 2, Page 11

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
1	The existing inspection program will be modified to include those battery racks that require monitoring for license renewal, but are not already included in the program.	A2.1.1, Battery Rack Inspection	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.1
2	Implementing procedures will be modified to include loss of material as a potential aging effect and to provide guidance on the inspection of items (such as anchorages, bracing and supports, side and end rails, and spacers), which contribute to battery rack integrity or seismic design of the battery racks.	A2.1.1, Battery Rack Inspection	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.1
3	A baseline inspection of the in-scope buried piping located in a damp soil environment will be performed for a representative sample of each combination of material and protective measures. Inspection for the loss of material due to selective leaching will be performed by visual, and mechanical or other appropriate methods.	A2.1.3, Buried Pipe Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.4 July 7, 2004, LRA Supplement Attachment 1, Page 12

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
4	The maintenance and work control procedures will be revised to ensure that inspections of buried piping are performed when the piping is excavated during maintenance or for any other reason. These procedures will include the inspection for the loss of material due to selective leaching which will be performed by visual, and mechanical or other appropriate methods.	A2.1.3, Buried Pipe Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.4 July 7, 2004, LRA Supplement Attachment 1, Page 12
5	The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be established.	A2.1.7, Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.8
6	Fuse holders meeting the requirements will be evaluated prior to the period of extended operation for possible aging effects requiring management. The fuse holder will either be replaced, modified to minimize the aging effects, or this program will manage the aging effects. The program (if needed for fuse holders) will consider the aging stressors for the metallic clips.	A2.1.7, Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation Completed	LRA Appendix B, Section B2.1.8 February 15, 2005 Letter Attachment, Page 4

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
7	Procedures will be developed to employ an alternate testing methodology to confirm the condition of cables and connectors in circuits that have sensitive, low level signals and where the instrumentation is not calibrated in situ.	A2.1.8, Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency	LRA Appendix B, Section B2.1.9
8	A baseline visual inspection will be performed on a representative sample of the buried fire protection piping and components, whose internal surfaces are exposed to raw water, to confirm there is no degradation.	A2.1.9, Fire Protection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.10
9	Testing a representative sample of fire protection sprinkler heads or replacing those that have been in service for 50 years will be included in the Fire Protection Program.	A2.1.9, Fire Protection Program	Prior to the Sprinkler Heads Achieving 50 Years of Extended Life Not to Exceed a 10 Year Interval Thereafter	LRA Appendix B, Section B2.1.10 July 7, 2004, LRA Supplement Attachment 1, Page 1

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
10	The procedures and training for personnel performing General Condition Monitoring inspections and walkdowns will be enhanced to provide expectations that identify the requirements for the inspection of aging effects.	A2.1.12, General Condition Monitoring	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.13
11	In-scope cable found to be submerged will be subject to an engineering evaluation and corrective action. The evaluation of cables having significant voltage found to be submerged in standing water for an extended period of time will be based on appropriate testing (using available technology consistent with NRC positions) of cables that are determined to be wetted for a significant period of time. The Engineering evaluation will also address the appropriate testing requirements for the corresponding ten-year intervals during the period of extended operation. The test will use a proven methodology for detecting deterioration of the insulation system due to wetting. Examples of such tests include power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, Effects of Moisture on the Life of Power Plant Cables, or other appropriate testing. Testing will have acceptance criteria defined in accordance with the specific test identified. Occurrence of degradation that is adverse to quality is entered into the Corrective Action Program.	A2.1.13, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation During the Corresponding 10 Year Interval (If Applicable)	LRA Appendix B, Section B2.1.14 July 7, 2004, LRA Supplement Attachment 1, Page 17

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
12	The Infrequently Accessed Areas Inspection Program will be established.	A2.1.14, Infrequently Accessed Areas Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.15
13	Millstone will follow the industry efforts on reactor vessel internals regarding such issues as thermal or neutron irradiation embrittlement (loss of fracture toughness), void swelling (change in dimensions), stress corrosion cracking (PWSCC and IASCC), and loss of pre-load for baffle and former-assembly bolts and will implement the appropriate recommendations resulting from this guidance. The revised program description, including a comparison to the 10 program elements of the NUREG-1801 program, will be submitted to the NRC for approval.	A2.1.16, Inservice Inspection Program: Reactor Vessel Internals	At Least Two Years Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.17 July 7, 2004, LRA Supplement Attachment 1, Page 1 February 8, 2005 LRA Supplement Attachment 2, Page 30
14	Augmented inspections of the MPS Unit 3 core barrel holddown spring will be performed. In particular, the inspection will detect gross indication of loss of preload as an aging effect. As an alternative to performing an augmented inspection, the holddown spring will be replaced.	A2.1.16. Inservice Inspection Program: Reactor Vessel Internals	At Least Two Years Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.17

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
15	Millstone will follow the industry efforts investigating the aging effects applicable to nickel-based alloys (i.e., PWSCC in Alloy 600 base metal and Alloy 82/182 weld metals) and identifying the appropriate aging management activities and will implement the appropriate recommendations resulting from this guidance. The revised program description will be submitted prior to the period of extended operation for the staff review and approval to determine if the program demonstrates the ability to manage the effects of aging in nickel based components per 10 CFR 50.54.21(a)(3).	A2.1.17, Inservice Inspection Program: Systems, Components and Supports A2.1.21, Steam Generator Structural Integrity	At Least Two Years Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.18 April 1, 2005, Attachment 2, Page 8
16	The existing inspection program will be modified to include those lifting devices that require monitoring for license renewal, but are not already included in the program.	A2.1.18, Inspection Activities: Load Handling Cranes and Devices	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.19
17	Implementing procedures and documentation will be modified to include visual inspections for the loss of material on the crane and trolley structural components and the rails in the scope of license renewal added in Commitment 16.	A2.1.18, Inspection Activities: Load Handling Cranes and Devices	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.19

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
18	The implementing procedures will be modified to include American Concrete Institute (ACI) Standard 349.3R-96, "Evaluation of Existing Nuclear Safety Related Concrete Structures," dated 1996, and American Nuclear Standards Institute/American Society of Civil Engineers (ANSI/ASCE) Standard 11-90, "Guideline for Structural Condition Assessment of Existing Buildings," dated 1990, as references and input documents for the inspection program.	A2.1.22, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
19	The Structures Monitoring Program and implementing procedures will be modified to include all in-scope structures.	A2.1.22, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
20	Groundwater samples will be taken on a periodic basis, considering seasonal variations, to ensure that the groundwater is not sufficiently aggressive to cause the below-grade concrete to degrade.	A2.1.22, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
21	The structures monitoring program and implementing procedures will be modified to alert the appropriate engineering organization if the structures inspections identify that medium-voltage cables in the scope of license renewal have been submerged.	A2.1.22, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
22	The maintenance and work control procedures will be revised to ensure that inspections of inaccessible areas are performed when the areas become accessible by such means as excavation or installation of shielding during maintenance or for any other reason.	A2.1.22, Structures Monitoring Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.23
23	Appropriate inspections of sealants and caulking used for moisture intrusion prevention in and around aboveground tanks will be performed.	A2.1.23, Tank Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.24
24	Non-destructive volumetric examination of the in-scope inaccessible locations, such as the external surfaces of tank bottoms, will be performed prior to the period of extended operation. Subsequent inspections will be performed on a frequency consistent with scheduled tank internals inspection activities.	A2.1.23, Tank Inspection Program	Prior to Period of Extended Operation A Frequency Consistent with Scheduled Tank Internals Inspection Activities.	LRA Appendix B, Section B2.1.24
25	The security diesel fuel oil tank and diesel fire pump fuel oil tank are in-scope for license renewal and will be included on the respective Tank Inspection Program inspection plan.	A2.1.23, Tank Inspection Program	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.24

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
26	Changes will be made to maintenance and work control procedures to ensure that inspections of plant components and plant commodities will be appropriately and consistently performed and documented for aging effects during maintenance activities.	A2.1.24, Work Control Process	Prior to Period of Extended Operation	LRA Appendix B, Section B2.1.25
27	Consistent with 10 CFR 54.21(c)(1), (iii), the effects of environmentally assisted fatigue for those specific locations with a CUF greater and 1.0 will be managed by the Metal Fatigue of Reactor Coolant Pressure Boundary program. If the specific locations are not repaired, replaced, or successfully re-analyzed, a modified inspection program description, including a comparison to the 10 program elements of NUREG-1801 program, will be submitted to the NRC for approval.		Prior to Period of Extended Operation	Environmental Assisted Fatigue TLAA
28	For potentially susceptible CASS materials, either enhanced volumetric examinations or a unit or component specific flaw tolerance evaluation (considering reduced fracture toughness and unit specific geometry and stress information) will be used to demonstrate that the thermally-embrittled material has adequate fracture toughness in accordance with NUREG-1801 Section XI.M12.3.	A3.2.3 Environmentally Assisted Fatigue	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 3 December 12, 2004, LRA Supplement, Attachment 1, Page 102

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
29	Millstone will follow industry efforts that will provide specific guidance to license renewal applicants for evaluating the environmental effects of fatigue on applicable locations, other than those identified in NUREG/CR-6260. Millstone will also implement the appropriate recommendations resulting from this guidance. Until these recommendations are available, Millstone 3 commits to using the pressurizer surge line nozzle as a leading indicator to address environmental effects of fatigue on pressurizer sub-components during the period of extended operation.	A3.2.3 Environmentally Assisted Fatigue	Prior to Period of Extended Operation	Environmental Assisted Fatigue TLAA July 7, 2004, LRA Supplement, Attachment 1, Page 3 December 3, 2004, LRA Supplement, Attachment 1, Page 102
30	A baseline visual inspection will be performed of the accessible areas of the shell side (including accessible portions of the exterior side of the tubes) of one: • Millstone Unit 2 Reactor Building Closed Cooling Water heat exchanger, • Millstone Unit 2 Emergency Diesel Generator Jacket Cooling Water heat exchanger, and • Millstone Unit 3 Emergency Diesel Generator Jacket Cooling Water heat exchanger.	A2.1.6, Closed-Cycle Cooling Water System	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 6

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
31	Using the Work Control Process, a baseline inspection for the loss of material due to selective leaching will be performed on a representative sample of locations for susceptible materials by visual, and mechanical or other appropriate methods	A2.1.24, Work Control Process	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 14
32	A review of the Work Control Process inspection opportunities for each material and environment group, supplemental to the initial review conducted during the development of the LRA, will be performed. Baseline inspections will be performed for the material and environment combinations that have not been inspected as part of the Work Control Process.	A2.1.24, Work Control Process	Prior to Period of Extended Operation	July 7, 2004, LRA Supplement Attachment 1, Page 20
33	Calibration results for cable tested in situ will be reviewed to detect severe aging degradation of the cable insulation. The initial review will be completed prior to entering the period of extended operation and will include at least 5 years of surveillance test data for each cable reviewed. Subsequent reviews will be performed on a period not to exceed 10 years.	A2.1.8, Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency Thereafter	December 3, 2004, LRA Supplement Attachment 3, Page 1

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	**Commitment**	**LRA Appendix A**	**Implementation Schedule**	**Source**
34	The in scope cables in Unit 3 duct lines # 929 (SBO Diesel to Unit 3 4.16kV Normal Switchgear) and # 973 (RSST 3RTXXSR-B to 6.9kV Normal Switchgear Bus 35A, 35B, 35C and 35D) will be tested to demonstrate that water treeing will not prevent the cables from performing their intended function	A2.1.13, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency Thereafter	December 3, 2004, LRA Supplement Attachment 3, Page 3
35	In addition to the testing specified in Commitment 34, a representative sample of in-scope medium-voltage cables will be tested to demonstrate that water treeing will not prevent the cables from performing their intended function.	A2.1.13, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to Period of Extended Operation Not to Exceed a 10 Year Frequency Thereafter	January 11, 2005, Attachment 3, Page 1
36	Complete the SAMA evaluation of the ability to manually control the Turbine Driving Auxiliary Feedwater Pump. If this SAMA is cost beneficial (i.e., can be accomplished without a hardware modification), a Severe Accident Management Guideline (SAMG) addressing this mitigation strategy will be developed.	Environmental Report	Prior to Period of Extended Operation	August 13, 2004, RAI Responses, Page 2

APPENDIX A: COMMITMENTS FOR LICENSE RENEWAL OF MPS UNIT 3				
Item No.	Commitment	LRA Appendix A	Implementation Schedule	Source
37	The pressurizer spray head assembly will be either replaced or inspected utilizing the best currently available (at the time of inspection) techniques for detecting cracking resulting from SCC.	A2.1.17, Inservice Inspection Program: Systems, Components and Supports	Prior to Period of Extended Operation	February 8, 2005, Attachment 2, Page 12

APPENDIX B: CHRONOLOGY

This appendix contains a chronological listing of the routine licensing correspondence between the U.S. Nuclear Regulatory Commission (NRC) staff and the Millstone Power Station (MPS), and other correspondence regarding the NRC staff's reviews of the Millstone Power Station, Units 2 and 3 (MPS), (under Docket Number 50-336 and 50-423 respectively) license renewal application (LRA).

January 20, 2004	Millstone Unit 2, Application for Renewed Operating License, Technical and Administrative Information through Appendix D (Accession No. ML040260101)
January 20, 2004	Millstone Unit 3, Application for Renewed Operating License, Technical and Administrative Information through Appendix D (Accession No. ML040260103)
January 20, 2004	Applicant's Environmental Report - Operating License Renewal Stage, Millstone Power Station Units 2 and 3 (Accession No. ML040260098)
January 20, 2004	Letter from Dominion Nuclear Connecticut, Inc. (DNC) to the NRC regarding Applications for Renewed Operating Licenses (Accession No. ML040260070)
January 20, 2004	Letter from David A. Christian, Dominion Nuclear Connecticut, Inc., to the NRC transmitting Applications for Renewed Operating Licenses - Reference Drawings (Accession No. ML040260076)
January 20, 2004	Letter from Dominion to the NRC regarding Applications for Renewed Operating Licenses, Withheld Reference Drawings (Accession No. ML040260079)
January 23, 2004	Press Release-04-011 from NRC News: NRC Makes License Renewal Application Available for the Millstone Nuclear Power Plant (Accession No. ML040230280)
January 26, 2004	Memorandum from Russell Arrighi, NRC, to Samson S. Lee, NRC, regarding the notice of a meeting between the NRC staff and Dominion Nuclear Connecticut, Inc. to discuss the License Renewal Application for Millstone Nuclear Power Station Units 2 and 3 (Accession No. ML040260283)
January 28, 2004	Letter from Pao-Tsin Kuo, NRC to David A. Christian, Dominion Nuclear Connecticut, Inc. acknowledging the receipt and availability of the LRA for the Millstone Power Station, Units 2 and 3 (Accession No. ML040280258)
January 29, 2004	Memorandum from Johnny Eads, NRC to Samson S. Lee, NRC regarding a forthcoming meeting for the NRC to describe the license renewal process (Accession No. ML040330844)

February 5, 2004	Letter from Richard L. Emch, Jr., NRC, to Judy Liskov, Waterford public library regarding maintenence of referenced material for the Millstone Power Station Units 2 and 3 License Renewal Application (Accession No. ML040400209)
February 5, 2004	Letter from Richard L. Emch, Jr., NRC, to Mildred Hodge, Thames River Campus regarding maintenance of referenced material for Millstone Power Station Units 2 and 3 License Renewal Application (Accession No. ML040400181)
February 6, 2004	Press Release-I-04-002 from NRC News announcing NRC to hold a forthcoming public information meeting in Waterford, Connecticut (Accession No. ML040370209)
February 6, 2004	Millstone License Renewal Application (LRA) Submittal Presentation Handout and consistency with NUREG-1801 Handout (Accession No. ML040560327)
February 12, 2004	Certificate of Service of Petition to Intervene and Request for Hearing (Accession No. ML040760946)
February 12, 2004	Petition to Intervene and Request for Hearing (Accession No. ML041040332)
February 13, 2004	Letter from David R. Lewis, Shaw Pittman LLP, to Annette Vietti-Cook, Secretary for the Commission, NRC, indicating that the Petition to Intervene and Request for Hearing of The Coalition Against Millstone is Premature (Accession No. ML040760954)
February 20, 2004	Memorandum from Russell J. Arrighi, NRC, summarizing the meeting between the NRC and Dominion Nuclear Connecticut, Inc. to discuss Millstone Power Station Units 2 and 2 License Renewal Application (Accession No. ML040560319)
March 1, 2004	Letter from Nancy Burton, Attorney at Law, to the Office of the Secretary, NRC in response to the letter of David R. Lewis of February 13, 2004, (Accession No. ML040760958)
March 2, 2004	Letter from Paul B. Eccard, Town of Waterford, to Russell J. Arrighi, NRC, requesting that NRC consider the Town of Waterford a party to all preceedings for the re-licensing of Millstone Units 2 and 3 (Accession No. ML040700550)
March 3, 2004	Annual Assessment Letter - Millstone Power Station (Report 05000336/2004001 and 05000423/2004001) (Accession No. ML040630159)
March 4, 2004	Letter from David R. Lewis, Shaw Pittman LLP, to Annette Vietti-Cook, Secretary for the Commission, NRC, objecting to the March 1, 2004, Nancy Burton letter and emphasizing that the Burton Petition to Intervene was still premature (Accession No. ML040760961)

March 4, 2004	Letter from the Secretary to Nancy Burton Returning Millstone Intervention Petition (Accession No. ML040760940)
March 8, 2004	Determination of acceptability and sufficiency for docketing, proposed review schedule, and opportunity for a hearing regarding the applications from Dominion Nuclear Connecticut, Inc. for renewal of the operating licenses for the Millstone Power Station, Units 2 and 3 (TAC Nos. MC1825 and MC1826) (Accession No. ML040680968)
March 10, 2004	Letter from Margaret J. Bupp and Catherine L. Marco, Office of General Counsel, NRC, to Annette Vietti-Cook, Secretary for the Commission, NRC, stating that Connecticut Coalition Against Millstone's petition to intervene and a request for hearing filed February 12, 2004, is premature (Accession No. ML040830141)
March 12, 2004	Press Release 04-033 from NRC News announcing opportunity for hearing on application to renew Millstone Nuclear Plant, Units 2 and 3, operating licenses (Accession No. ML040720480)
March 16, 2004	Request for Party Status and Designation of Representative, per Millstone, Units 2 and 3, Applications for Renewed Operating Licenses (Accession No. ML040790721)
March 19, 2004	Request for Withholding Information From Public Disclosure From Millstone Units 2 and 3, granted (Accession No. ML040820974)
March 22, 2004	Motion to Vacate NRC Secretary Determination of Petition Prematurity and to Accept Petition to Intervene and Request for Hearing as of Date of Filing and to Apply 'Old' CFR Hearing Rules to Said Petition (Accession No. ML041040339)
March 24, 2004	Commission Order dated March 24, 2004 (Accession No. ML040850646)
March 30, 2004	March 8 and March 16, 2004, Telephone Summary Between the U.S. Nuclear Regulatory Commission (NRC) Staff and Dominion Nuclear Connecticut, Inc. Representatives to Discuss the Millstone Power Station, Units 2 and 3 License Renewal Applications (Accession No. ML040900525)
March 30, 2004	March 3, 2004, Telephone Summary Between the U.S. Nuclear Regulatory Commission (NRC) Staff and Dominion Nuclear Connecticut, Inc. Representatives to Discuss the Millstone Power Station, Units 2 and 3 License Renewal Applications (Accession No. ML040900469)
April 1, 2004	Acknowledgment of Receipt of Letters from Paul Eccard, First Selectman, Town of Waterford, Requesting Party Status and Designation of Representatives Regarding the Re-Licensing of Millstone Power Station, Units 2 and 3 (Accession No. ML040920601)

April 1, 2004	NRC Staff's Unopposed Motion for an Extension of Time to Respond to Connecticut Coalition Against Millstone's Petition to Intervene and Request for Hearing (Accession No. ML040930079)
April 2, 2004	Dominion's Answer to CCAM's Motion to Vacate Secretary Determination (Accession No. ML040990158)
April 2, 2004	NRC Staff's Response to Connecticut Coalition Against Millstone's Motion to Vacate and to Accept Petition to Intervene and Request for Hearing (Accession No. ML040970522)
April 2, 2004	Letter from David R. Lewis, Shaw Pittman, LLP, to Chief Administrative Judge Bollwerk re submission of Dominion's answer opposing CCAM's motion to vacate (Accession No. ML040990178)
April 14, 2004	Summary of Telephone Conference on April 8, 2004, Between the U.S. Nuclear Regulatory Commission and Dominion Nuclear Connecticut, Inc., Concerning Draft Requests for Additional Information Pertaining to the Millstone Power Station, Units 2 and 3, License Renewal Applications (Accession No. ML041050831)
April 22, 2004	Notice of May 7, 2004, Exit Meeting With Dominion Nuclear Connecticut, Inc. On License Renewal Scoping and Screening Methodology Audit for Millstone Power Station, Units 2 and 3 (Accession No. ML041130326)
May 4, 2004	SRM-M040504A - Affirmation Session: SECY-04-0066 - Dominion Nuclear Connecticut (Millstone Nuclear Power Station, Units 2 and 3) (Rejection by the Secretary of Petition to Intervene in License Renewal Proceedings as Premature (Accession No. ML041250488)
May 4, 2004	M040504A - Affirmation Session: SECY-04-0066 - Dominion Nuclear Connecticut (Millstone Nuclear Power Station, Units 2 and 3) (Rejection by Secretary of Petition) (Accession No. ML041260073)
May 4, 2004	Commission Memorandum and Order (CLI-04-12) (Accession No. ML041250232)
May 14, 2004	Motion for Reconsideration of CLI-04-12 (Accession No. ML041420177)
May 18, 2004	Commission Order denying CCAM's Motion for Reconsideration of CLI-04-12 (Accession No. ML041390500)
May 19, 2004	Establishment of Atomic Safety and Licensing Board (Accession No. ML041470149)
June 7, 2004	NRC Staff Answer to Petition to Intervene and Request for Hearing of Connecticut Coalition Against Millstone (Accession No. ML041600187)
June 7, 2004	Dominion's Answer to CCAM's Petition to Intervene and Request for Hearing (Accession No. ML041680556)

June 16, 2004	Connecticut Coalition Against Millstone Motion for Leave to File Reply to Licensee and NRC Staff Answers to Petition, Amended Petition and Declarations of CCAM's Members *NUNC PRO TUNC* (Accession No. ML041800056)
June 18, 2004	Notice of July 13, 2004, Exit Meeting With Dominion Nuclear Connecticut, on License Renewal Audits of aging Management Programs and Reviews for Millstone Power Station, Units 2 and 3 (Accession No. ML041700332)
June 25, 2004	Press Release 04-078 from NRC News announcing NRC Atomic Safety and Licensing Board to Hold Prehearing Conference June 30 on Proposed Millstone License Renewal (Accession No. ML041770406)
June 27, 2004	Connecticut Coalition Against Millstone Motion for Stay of Proceedings (Accession No. ML041910373)
June 30, 2004	Transcript of the Dominion Nuclear Connecticut Initial Prehearing Conference held in New London, CT on June 30, 2004; pp. 1-182 (Accession No. ML041950013)
July 7, 2004	Dominion Nuclear Connecticut Additional Information in Support of Applications for Renewed Operating Licenses (Accession No. ML041900407)
July 7, 2004	Dominion Nuclear Connecticut Additional Information in Support of Applications for Renewed Operating Licenses (Accession No. ML041900370)
July 9, 2004	Notice of Appeal of the Connecitcut Coalition Against Millstone regarding the decision of the Atomic Safety and Licensing Board Memorandum and Order (Accession No. ML042300617)
July 19, 2004	Unopposed Motion of Dominion Nuclear Connecticut, Inc. To Intervene (Accession No. ML042570109)
July 26, 2004	Dominion Nuclear Connecticut Response to Request for Additional Information License Renewal Applications (Accession No. ML042080210)
July 28, 2004	Memorandum and Order (Ruling on Standing and Contentions) (LBP-04-15) (Accession No. ML042110313)
August 8, 2004	Declaration of Ernest J. Sternglass (Accession No. ML042330247)
August 9, 2004	Connecticut Coalition Against Millstone Motion for Reconsideration and Request for Leave to Amend Petition (Accession No. ML042320548)
August 16, 2004	Federal Respondents' Motion to Dismiss (Accession No. ML042570117)
August 18, 2004	NRC Staff Response to Connecticut Coalition Against Millstone's Motion for Reconsideration and Request for Leave to Amend Petition (Accession No. ML042320500)

August 18, 2004	NRC Staff Answer to Notice of Appeal of Connecticut Coalition Against Millstone (Accession No. ML042320445)
August 18, 2004	Letter from David R. Lewis, Shaw Pittman LLP, regarding Connecticut Coalition Against Millstone's Notice of Appeal, dated August 9, 2004, (Accession No. ML042390031)
August 26, 2004	Response by Dominion Nuclear in Support of Motion to Dismiss, dated August 26, 2004, (Accession No. ML042610296)
September 3, 2004	Petitioner's Objection to Motion to Dismiss (Accession No. ML042610301)
September 9, 2004	Notice of September 22, 2004, Meeting with Dominion Nuclear Connecticut Regarding License Renewal for the Millstone Power Station, Units 2 and 3 (Accession No. ML042530373)
September 10, 2004	Federal Respondent's Reply to Petitioner's Objection to Motion to Dismiss (Accession No. ML042610304)
September 20, 2004	Audit Trip Report Regarding the Dominion Nuclear Connecticut, Inc., License Renewal Application for the Millstone Power Station, Units 2 and 3, Dated January 22, 2004, (Accession No. ML042640548)
September 20, 2004	Memorandum and Order (Denying Motion for Reconsideration and Request for Leave to Amend Petition) (Accession No. ML042640524)
October 8, 2004	Notice of October 20, 2004, Millstone Public Meeting with Dominion Nuclear Connecticut, Inc. to discuss team inspection covering scoping and aging management portions of Dominion's application for a renewed license (Accession No. ML042820632)
October 15, 2004	Press Release I-04-047 from NRC News announcing NRC, Dominion Nuclear To Discuss Inspections on Millstone License Renewal on October 20 (Accession No. ML042890059)
October 18, 2004	NRC Staff's Brief in Opposition to Appeal by Connecticut Coalition Against Millstone of LBP-04-15 and LBP-04-22 (Accession No. ML042930658)
October 18, 2004	Dominion Nuclear Connecticut's Brief in Opposition to the Appeals of Connecticut Coalition Against Millstone (Accession No. ML043010494)
October 19, 2004	E-mail from Brooke Poole to Administrative Judges and Participants regarding missing page 3 to Staff's Brief filed on October 18, 2004 (Accession No. ML043070098)
October 27, 2004	Audit and Review Plan for Plant Aging Management Reviews and Programs - Millstone Power Station, Units 2 and 3 (Accession No. ML043290430)

November 9, 2004	Dominion Nuclear Connecticut Response to Request for Additional Information for License Renewal Applications (Accession No. ML043200606)
December 3, 2004	Dominion Nuclear Connecticut Response to Request for Additional Information for License Renewal Applications (Accession No. ML043450341)
December 3, 2004	Millstone Power Station Unit 2 and Unit 3 - License Renewal Application Inspection Report Nos. 05000336/2004010, 05000423/2004010 (Accession No. ML043410193)
December 3, 2004	Millstone Power Station Unit 2 and Unit 3 - License Renewal Application Inspection Report Nos. 05000336/2004009, 05000423/2004009 (Accession No. ML043410201)
December 8, 2004	Commission Memorandum and Order (CLI-04-36) regarding Connecticut Coalition Against Millstone intervenor status (Accession No. ML043430498)
December 27, 2004	Letter from Annette Vietti-Cook, Secretary of the Commission, to Christine Malafi, Esq. responding to the County of Suffolk's December 17, 2004, Motion to Intervene (Accession No. ML043630023)
January 11, 2005	Dominion Nuclear Connecticut Response to Request for Additional Information for License Renewal Applications (Accession No. ML050190289)
January 12, 2005	Dominion Nuclear Connecticut Annual Update Information for License Renewal Applications (Accession No. ML050210041)
February 2, 2005	Audit and Review Report for Plant Aging Management Reviews and Programs for the Millstone Power Station - Units 2 & 3 Prepared by NRC (Accession No. ML050330059)
February 8, 2005	Letter from Dominion to the NRC regarding additional information in support of license renewal applications (Accession No. ML050460323)
February 15, 2005	Letter from Dominion to the NRC regarding additional information in support of license renewal applications (Accession No. ML050550068)
February 24, 2005	Letter from NRC to Dominion transmitting the Safety Evaluation Report with Open Items Related to License Renewal of MPS (Accession No. ML050600172)
April 1, 2005	Letter from Dominion to NRC regarding response to SER with Open Items (Accession No. ML051020128)
April 19, 2005	Letter from Dominion to NRC regarding license renewal comments on SER with Open Items (Accession No. ML051100470)

June 2, 2005	Letter from Dominion to NRC regarding additional information in support of license renewal applications (Accession No. ML051590137)
July 14, 2005	Letter from Dominion to NRC regarding additional information in support of license renewal applications (Accession No. ML051960166)
July 21, 2005	Letter from Dominion to NRC regarding additional information in support of license renewal applications (Accession No. ML052020434)
September 22, 2005	Letter from ACRS to Chairman, Nuclear Regulatory Commission providing its conclusions and recommendations on the renewal of the operating licenses for the Millstone Power Station, Units 2 and 3. (Accession No. ML052650478)

APPENDIX C: PRINCIPAL CONTRIBUTORS

NAME	RESPONSIBILITY
F. Akstulewicz	Management Oversight
H. Ashar	Structural Engineering
R. Barret	Management Oversight
W. Bateman	Management Oversight
S. Black	Management Oversight
B. Boger	Management Oversight
J. Calvo	Management Oversight
T. Chan	Management Oversight
K. Chang	GALL Audit and Review
S. Coffin	Management Oversight
K. Corp	Technical Support
R. Dennig	Management Oversight
Y. Diaz-Castillo	Material Engineering
J. Eads	Lead Project Manager
J. Fair	Mechanical Engineering
T. Ford	Reactor Systems
G. Galletti	Quality Assurance
F. Gillespie	Management Oversight
R. Goel	Containment Systems
J. Hannon	Management Oversight
J. Honcharik	Material Engineering
K. Hsu	GALL Audit and Review
E. Imbro	Management Oversight
N. Igbal	Plant Systems
R. Jenkins	Management Oversight
A. Keim	Material Engineering
P. Kuo	Management Oversight
S. Lee	Management Oversight
C. Li	Plant Systems
M. Li	SER Support
Y. Li	Mechanical Engineering
L. Lois	Reactor Systems
L. Lund	Management Oversight
J. Ma	Mechanical Engineering
K. Manoly	Management Oversight
D. Matthews	Management Oversight
R. McNally	Mechanical Engineering
J. Medoff	Materials Engineering
M. Modes	Region I Inspection
G. Morris	Electrical Engineering
D. Nguyen	Electrical Engineering
R. Pettis	Quality Assurance
B. Poole	Legal Counsel
T. Quay	Management Oversight

B. Radlinski	Plant Systems
J. Rajan	Mechanical Engineering
S. Saba	Electrical Engineering
D. Shum	Plant Systems
D. Solorio	Management Oversight
J. Strnisha	Mechanical Engineering
R. Subbaratnam	GALL Audit and Review
D. Terao	Management Oversight
D. Thatcher	Management Oversight
L. Tran	GALL Audit and Review
N. Trehan	Electrical Engineering
J. Uhle	Management Oversight
H. Walker	Containment Systems
S. Weerakkody	Management Oversight
J. Wermiel	Management Oversight
S. West	Management Oversight

CONTRACTORS

CONTRACTOR	TECHNICAL AREA
Brookhaven National Laboratory	Containment Systems
Information Systems Laboratories	GALL Audit/Plant Systems
Legin Group, Inc.	SER Support

APPENDIX D: REFERENCES

This appendix contains a listing of references used in the preparation of the Safety Evaluation Report prepared during the review of the license renewal application for Millstone Power Station, Units 2 and 3, Docket Numbers 50-336 and 50-423, respectively.

(1) NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," April 2001

(2) NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule, Revision 3," August 2001

(3) NUREG-1801, "Generic Aging Lessons Learned Report (GALL)," April 2001

(4) Letter From NRC to Dominion Nuclear Connecticut, Inc., "Request For Additional Information (RAI) Regarding The License Renewal Application For The Millstone Power Station, Units 2 and 3"

(5) MPS License Renewal Technical Report MP-LR–3/4000, "System/Structure Scoping"

(6) MPS License Renewal Technical Report MP-LR–3/4002, "Fire Protection," Revision 2

(7) MPS License Renewal Technical Report MP-LR–3/4003, "Anticipated Transient Without Scram," Revision 2

(8) MPS License Renewal Technical Report MP-LR–3/4004, "Pressurized Thermal Shock," Revision 0

(9) MPS License Renewal Technical Report MP-LR–3/4005, "Fire Protection," Revision 4

(10) MPS License Renewal Technical Report MP-LR–3/4006, "Station Blackout," Revision 3

(11) MPS License Renewal Technical Report MP-LR–3/4901, "Treatment of Consumables"

(12) MPS License Renewal Technical Report MP-LR–3/4903, "Interim Staff Guidance"

(13) MPS License Renewal Technical Report MP-LR-3655/4655, "Aging Management Review Cables and Connectors"

(14) MPS License Renewal Technical Report MP-LR-3656/4656, "Aging Management Review Bus Ducts"

(15) MPS License Renewal Technical Report MP-LR-3657, "Aging Management Review Electrical Penetrations"

(16) MPS License Renewal Technical Report MP-LR-3920/4920, "Review of Stored Equipment Millstone Power Station"

(17) Letter from Ashok Thadani, Director of Nuclear Regulatory Research, To William Travors, Executive Director of Operations, "Closeout of Generic Safety Issue 190, (Fatigue Evaluation of Metal Components For 60 Year Plant Live)," December 1999

NRC FORM 335 (9-2004) NRCMD 3.7 U.S. NUCLEAR REGULATORY COMMISSION **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1838 Vol. 2
2. TITLE AND SUBTITLE Safety Evaluation Report Related to the License Renewal of the Millstone Power Station, Units 2 and 3	3. DATE REPORT PUBLISHED MONTH: October YEAR: 2005 4. FIN OR GRANT NUMBER
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Division of Regulatory Improvement Programs (DRIP)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This safety evaluation report (SER) documents the technical review of the Millstone Power Station (MPS), Units 2 and 3, license renewal applications (LRAs) by the staff of the U.S. Nuclear Regulatory Commission (NRC). By letter dated January 20, 2004, Dominion Nuclear Connecticut, Inc. submitted the LRAs for MPS in accordance with Title 10, Part 54, of the Code of Federal Regulations. Dominion is requesting renewal of the operating licenses for MPS Units 2 and 3, (Facility Operating License Numbers DPR-65 and NPF-49, respectively) for a period of 20 years beyond the current expiration dates of midnight July 31, 2015, and midnight November 25, 2025.

The MPS site is located in Waterford, CT, on the north shore of Long Island Sound. The NRC issued the construction permits for MPS Units 2 and 3 on December 12, 1970, and August 9, 1974, respectively. The operating licenses were issued on September 26, 1975, for Unit 2 and January 31, 1986, for Unit 3.

This SER presents the status of the staff's review of information submitted to the NRC in the applications. The staff's conclusion of its review of the MPS LRAs can be found in Section 6 of this SER.

The NRC license renewal project manager is Mr. Johnny H. Eads. Mr. Eads may be reached at (301) 415-1471. Written correspondence should be addressed to the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

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