Safety Evaluation Report

Related to the License Renewal of Vermont Yankee Nuclear Power Station

Supplement 2

Docket No. 50-271

Entergy Nuclear Operations, Inc.

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

February 2011

THIS PAGE INTENTIONALLY LEFT BLANK.

ABSTRACT

This document is a supplemental safety evaluation report (SSER) for the license renewal application for Vermont Yankee Nuclear Power Station (VYNPS) as filed by Entergy Nuclear Operations, Inc. and Entergy Nuclear Vermont Yankee, LLC. (Entergy or the applicant). By letter dated January 25, 2006, Entergy submitted its application to the United States Nuclear Regulatory Commission (NRC) for renewal of the VYNPS operating license for an additional 20 years. The NRC staff published a safety evaluation report (SER) in two volumes, dated May 2008, which summarizes the results of its safety review of the renewal application for compliance with the requirements of Title 10, Part 54, of the *Code of Federal Regulations,* (10 CFR 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." The NRC staff published Supplement 1 to the SER in October 2009 which documented the safety review results of confirmatory environmentally adjusted fatigue cumulative usage factors analyses for the reactor core spray nozzle and the reactor pressure vessel recirculation outlet nozzle at VYNPS. The applicant provided these analyses in response to the staff's proposed license condition that would require Entergy to perform these fatigue analyses no later than two years prior to entering the period of extended operation.

This SSER documents the staff's review of additional information provided by the applicant in annual updates and license renewal application amendments. This SSER documents the staff's review of supplemental information provided by the applicant since the issuance of Supplement 1 to the SER. This information includes annual updates required by 10 CFR 54.21(b), and updated information and commitments in response to the recent industry operating experience. This document only lists the changes to the SER and Supplement 1.

Paperwork Reduction Act Statement
This NUREG contains information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB), approval numbers 3150-0155; 3150-0011.

Public Protection Notification
The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting documents display a currently valid OMB control number.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Abstract iii

Abbreviations vii

1.0 Introduction and General Discussion 1-1

1.7 Summary of Proposed License Conditions 1-1

2.0 Structures Systems and Components 2-1

3.0 Aging Management Review Results 3-1

3.0.3 Aging Management Programs 3-1

3.0.3.1.3 Non Environmental Qualification Inaccessible Medium Voltage Cable Program 3-1

3.0.3.1.6 One-Time Inspection Program 3-3

3.0.3.1.7 Selective Leaching Program 3-5

3.0.3.1.13 Protective Coating Program 3-6

3.0.3.2.1 Buried Piping Inspection Program 3-9

3.0.3.2.7 BWR Vessel Internals Program 3-12

3.0.3.2.9 Diesel Fuel Monitoring Program 3-13

3.0.3.3.6 Vernon Dam FERC Inspection 3-16

3.0.3.3.9 Neutron Absorber Monitoring Program 3-16

3.3 Aging Management of Auxiliary Systems 3-18

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion 3-18

3.5 Aging Management of SC Supports 3-19

3.5.2.3.6 Bulk Commodities Summary of Aging Management Evaluation 3-19

3.6 Aging Management of Electrical and Instrumentation and Controls System 3-19

3.6.2.3.2 Aging Effect or Mechanism in Table 3.6.1 that are Not Applicable for VYNPS 3-19

4.0 Time Limited Aging Analysis 4-1

4.3.3 Effects of Reactor Environment on Fatigue Life 4-1

5.0 Review by the Advisory Committee on Reactor Safeguards 5-1

6.0 Conclusion 6-1

Appendices

Appendix A: List of Commitments A-1
Appendix B: Chronology B-1

THIS PAGE INTENTIONALLY LEFT BLANK

ABBREVIATIONS

ACRS	Advisory Committee on Reactor Safeguards
AMP	aging management program
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	America Water Works Association
CLB	current licensing basis
CFR	Code of Federal Regulations
CRD	control rod drive
CUF	cumulative usage factor
CUF_{en}	environmentally assisted fatigue cumulative usage factor
EPRI	Electric Power Research Institute
F_{en}	environmental fatigue life correction factor
GALL	Generic Aging Lessons Learned
GL	Generic Letter
GSI	generic safety issue
LER	licensee event report
LRA	license renewal application
mg	milligram
ml	milliliter
NFPA	National Fire Protection Association
NRC	Nuclear Regulatory Commission
NUMARC	Nuclear Management and Resources Council
ppm	parts per million
RG	Regulatory Guide
RPV	reactor pressure vessel
RR	reactor recirculation
SER	safety evaluation report
STI	Steel Tank Institute
SSER	supplemental safety evaluation report
UFSAR	updated final safety analysis report
ULSD	Ultra-Low Sulfur Diesel
USAS	United States of America Standard

VHS	Vernon Hydroelectric Station
VYNPS	Vermont Yankee Nuclear Power Station

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a supplemental safety evaluation report (SSER) for the license renewal application (LRA) for Vermont Yankee Nuclear Power Station (VYNPS) as filed by Entergy Nuclear Operations, Inc. and Entergy Nuclear Vermont Yankee, LLC. (Entergy, or the applicant). By letter dated January 25, 2006, Entergy submitted its application to the United States Nuclear Regulatory Commission (NRC) for renewal of the VYNPS operating license for an additional 20 years. The NRC staff (the staff) issued a safety evaluation report (SER) in two volumes, dated May 2008, which summarizes the results of its safety review of the renewal application for compliance with the requirements of Title 10, Part 54, of the *Code of Federal Regulations*, (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

The NRC staff published Supplement 1 to the SER in September 2009 which documented the safety review results of confirmatory environmentally adjusted fatigue cumulative usage factors analyses for the reactor core spray nozzle and the reactor pressure vessel recirculation outlet nozzle at VYNPS. The applicant provided these analyses in response to the staff's proposed license condition that would require Entergy to perform these fatigue analyses no later than two years prior to entering the period of extended operation.

This SSER documents the staff's review of additional information provided by the applicant since the staff's issuance of Supplement 1 to the SER in September 2009. This information includes annual updates required by 10 CFR 54.21(b), and updated information and commitments in response to the recent industry operating experience. This SSER supplements portions of SER Sections 3, 4, Appendix A, and Appendix B.

1.7 SUMMARY OF PROPOSED LICENSE CONDITIONS

As noted in this section of the SER, a fourth license condition required that the applicant perform and submit to the NRC for review and approval, an ASME (American Society of Mechanical Engineers) Code analysis for the reactor recirculation outlet nozzle and the core spray nozzle at least two years prior to the period of extended operation. With Entergy's submissions dated January 15, and March 12, 2009, this license condition has been met, as documented in Section 6 "Conclusion" of Supplement 1.

An additional license condition has been identified since the issuance of the SER. In accordance with Atomic Safety and Licensing Board Order LBP-08-25, dated November 24, 2008, which stated that the Board's legal conclusion is subject to the mandatory proviso that a renewed license include the following express condition:

> Notwithstanding any other provision, Entergy shall continue to perform and

implement the continuous parameter monitoring, moisture content monitoring, and visual inspections specified in the AMP [Steam Dryer Monitoring Plan], at the intervals specified in GE-SIL-644 [General Electric Services Information Letter 644], Revision 2. These shall continue for the full term of the PEO [period of extended operation] unless this provision of the license is duly amended.

The remaining license conditions proposed in the SER remain applicable.

SECTION 2

2.0 STRUCTURES SYSTEMS AND COMPONENTS

The staff does not have any changes or updates to this section of the safety evaluation report.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 3

3.0 AGING MANAGEMENT REVIEW RESULTS

3.0.3 Aging Management Programs

SER Table 3.0.3-1 presents the aging management programs (AMPs) credited by the applicant and described in LRA Appendix B and subsequent LRA supplements. The table also indicates the system, structure and components (SSCs) that credit the AMPs and the Generic Aging Lessons Learned (GALL) AMP with which the applicant claimed consistency and shows the SER section in which the staff's evaluation of the program is documented. The following is an amendment to SER Table 3.0.3-1 which lists the AMPs the applicant has added subsequent to the issuance of the SER. Note that all references to the GALL Report in this SER refer to Revision 1.

Table 3.0.3-1a VYNPS Aging Management Programs

VYNPS AMP (LRA Section)	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Neutron Absorber Monitoring Program (B.1.31)	Plant specific program	N/A	auxiliary systems	3.0.3.3.9
Protective Coating Program (B.1.32)	Consistent	XI.S8	SC supports	3.0.3.1.12

3.0.3.1.3 Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program

Summary of Technical Information in the Application. The staff does not have any changes or update to this section of the SER.

Staff Evaluation. The staff's evaluation of the applicant's proposed Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program is documented in Section 3.0.3.1.3 of the SER. The applicant provided additional information subsequent to the issuance of the SER. The staff's evaluation of the additional information related to the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program is discussed below.

The applicant, in letters dated September 3, and December 21, 2010, and February 4, 2011, provided supplemental information that provided enhancements to the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program. Vermont Yankee Nuclear Power Station (VYNPS) stated that these enhancements reflect recent industry, NRC, and VYNPS correspondence as well as industry correspondence related to Generic Letter (GL) 2007-01 "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients." The applicant proposed the following changes to LRA Sections A.2.1.19 and B.1.17 for the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program:

- Removal of the “exposure to significant voltage” criterion (defined as system voltage for more than 25 percent of the time)
- Expand the voltage range to include 400V to 2kV inaccessible power cables
- Increase inspections for water collection in manholes from at least once every two years to at least once every year
- Cable testing under the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program is revised from at least once every 10 years to at least once every 6 years
- Include condition-based inspections of manholes based on potentially high water table conditions indicated by high river level and after periods of heavy rain
- Corrective actions address modifying the cable test frequency and the manhole inspection frequency based on test or inspection results

The applicant stated that the 4.16kV cables between the unit auxiliary transformer and Bus 1 and Bus 2 are an exception in that these cables will not be tested prior to the period of extended operation under the applicant’s Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program. The applicant stated that these cables have no previous evidence of exposure to moisture, are continuously energized during normal operation, and are currently subject to insulation resistance testing during each refueling outage. In addition, the applicant further stated that these cables are to be replaced and tested with the unit auxiliary transformer replacement scheduled for the first refueling outage following the commencement of the period of extended operation. The staff finds the applicant’s exception to not test the 4.16kV cables between the unit auxiliary transformer and Bus 1 and Bus 2 prior to the period of extended operation acceptable because there is operating history that shows no previous exposure to moisture, the cables are scheduled for replacement, and subsequent testing of the new cable will be performed under the applicant’s Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program during the period of extended operation.

The applicant stated that a review of the VYNPS response to GL 2007-01 indicated that VYNPS reported no failures involving low-voltage inaccessible cables. The applicant also stated that operating experience subsequent to the response to GL 2007-01, as researched in the corrective action database, also indicated that VYNPS has not experienced age-related failures of inaccessible low voltage cables subject to aging management.

The application of GALL AMP XI.E3 to inaccessible medium voltage cables was based on the operating experience available at the time Revision 1 of the Generic Aging Lessons Learned (GALL) Report was developed. More recent industry operating experience indicate that the presence of water or moisture can be a contributing factor in inaccessible power cable failures at lower service voltages (400V and above). The staff identified operating experience identified in licensee responses to GL 2007-01, “Inaccessible or Underground Power cable Failures that Disable Accident Mitigating Systems or Cause Plant Transients,” which included failures of power cables operating at service voltages of less than 2kV where water was considered a contributing factor. The staff has concluded that, based on this recently identified operating experience, that these cables should be addressed in an AMP. Therefore, the applicant’s enhancement of the LRA to expand the voltage range of the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program to include greater than or equal to 400V inaccessible power cable is consistent with the staff’s recommendation.

The staff also finds that an increased manhole inspection frequency to at least once a year with the inspection frequency based on inspection results is consistent with industry operating experience. The addition of condition based (event driven) inspections reflects industry operating experience and is consistent with staff recommendations.

The increase in testing frequency from at least every ten years to at least every six years is consistent with industry operating experience, and plant specific operating experience has also not revealed failures of inaccessible power cable within the scope of the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program. In addition, the operating experience program will continue to evaluate industry and plant-specific operating experience during the period of extended operation.

The removal of the "exposure to significant voltage" criterion increases the scope of inaccessible medium voltage power cables included in the applicant's Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program and is also consistent with industry operating experience and staff recommendations.

The staff finds that, with the enhancements discussed above, the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program will adequately manage the aging effects of inaccessible power cables, consistent with industry operating experience, such that there is reasonable assurance that inaccessible power cables (400V to 35kV) subject to significant moisture will be adequately managed during the period of extended operation.

<u>UFSAR Supplement</u>. In LRA Section A.2.1.19, the applicant provided the UFSAR supplement for the Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program. By letters dated September 3, 2010, and December 21, 2010, the applicant revised LRA Section A.2.1.19 to include 400V to 35kV inaccessible power cables and condition based inspections. The applicant also deleted the "exposure to significant voltage" criteria, and revised inaccessible power cable inspections and test frequencies. Commitment No.13 was also revised by the applicant to incorporate the change in inspection and test frequencies.

The applicant committed (Commitment No. 13) to implement its Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program by March 21, 2012.

The staff reviewed LRA Section A.2.1.19 as amended by letters dated September 3, 2010 and December 21, 2010 and concludes that this section of the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. The staff does not have any changes or update to this section of the SER.

3.0.3.1.6 One-Time Inspection Program

<u>Summary of Technical Information in the Application</u>. The staff does not have any changes or update to this section of the SER.

<u>Staff Evaluation.</u> The staff's evaluation of the applicant's proposed One-Time Inspection Program is documented in Section 3.0.3.1.6 of the SER. The applicant provided additional

information subsequent to the issuance of the SER. The staff's evaluation of the additional information related to the One-Time Inspection Program is discussed below.

By letter dated October 14, 2010, the applicant provided supplemental information related to the One-Time Inspection Program. The applicant stated that it will revise the program to inspect American Society of Mechanical Engineers (ASME) Code Class 1 small-bore socket welds using volumetric examinations and that the inspection volume is in accordance with guidelines established in MRP-146, "Materials Reliability Program Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines," June 2005. The staff noted that MRP-146 recommends examination of the base metal half an inch beyond the toe of the weld.

The staff noted that this proposed inspection methodology may not be adequate to manage age-related degradation of ASME Code Class 1 small-bore piping, because industry operating experience has demonstrated numerous failures in small bore piping, predominantly in the form of cracking in the weld metal. The staff noted that that many of these failures are documented in Licensee Event Reports (LERs). The staff is concerned that MRP-146 recommends only examination of the base metal of the small-bore piping and does not recommend examination of the socket weld metal where cracking may be occurring. The staff is also concerned that cracking in the socket weld metal could be occurring and remains undetected if examinations of the socket weld metal is not performed. It was not clear to the staff if the applicant's proposal was to inspect the base metal only without inspecting the weld metal. Therefore, the staff sent a draft request for additional information to the applicant requesting that the applicant justify how the examination volume is sufficient and capable of detecting cracking in the subject welds. In addition, the staff requested that the applicant justify the adequacy of the sampling methodology. The staff held a teleconference with the applicant on November 22, 2010, to discuss the staff's draft RAI.

In its response dated December 21, 2010, the applicant provided supplemental information to its One-Time Inspection Program and Commitment No. 53. The applicant stated that it will perform volumetric examinations of 10 percent of its ASME Code Class 1 small-bore welds, up to a maximum of 25 welds for socket welds and butt welds. The applicant further stated that the inspection will be volumetric, using demonstrated ultrasonic techniques capable of examining both the weld metal and the base metal. The staff finds that the proposed inspection methodology, which includes a volumetric examination capable of detecting cracking in welds, acceptable because it is consistent with the recommendations of the "detection of aging effects" program element of GALL AMP XI.M35 to inspect ASME Code Class 1 small bore piping with a volumetric examination.

With regard to the applicant's proposed inspection methodology, which consists of inspecting 10 percent of the weld population up to a maximum of 25 welds for both butt welds and socket welds, the staff notes that it will be a focused inspection which will select the most susceptible and risk-significant welds to ensure a high probability of detecting cracking, if it exists. The staff also notes that if cracking is detected during the inspection, there will be an extent of condition review to evaluate the inspection sample size to ensure that it is adequate to identify cracking that could occur at other locations. The staff finds the applicant's proposed inspection methodology acceptable because the inspections will focus on the most susceptible and risk-significant welds and an adequate number of inspections will be performed to ensure that cracking is detected which is consistent with the recommendations of GALL AMP XI.M35.

The applicant also stated in the December 21, 2010 letter that for socket weld examinations, in lieu of a volumetric examination, it may perform a destructive examination, in which each destructive weld examination will be considered equivalent to performing two volumetric weld examinations. The staff finds the applicant's proposed alternative acceptable because welds that are destructively examined provide more information when compared to the information obtained from a weld that is examined with nondestructive techniques.

The applicant stated in the December 21, 2010 letter that inspections will be completed by December 2016. The applicant will potentially be entering the period of extended operation in March 21, 2012. The staff finds it reasonable and timely for the applicant to complete the small bore piping inspections by December 2016, since this would allow sufficient time for the applicant to plan and schedule outage inspections prior to this date. This timeline will also be sufficient for the applicant to qualify a demonstrated technique to volumetrically inspect small bore socket welds; to develop plant-specific procedures; and to qualify personnel to perform the inspections.

Based on its review, the staff determined that the applicant's proposed aging management of ASME Code Class 1 small bore piping is adequate because the program includes a sufficient number of welds to be inspected, an adequate selection methodology that focuses on susceptibility, welds and risk-significance, and the program will also be implemented in a reasonable timeframe.

By letter dated January 21, 2011, the applicant submitted supplemental information regarding the sampling of components inspected by the One-Time Inspection Program. The applicant stated that representative samples are chosen from each population where a population is a group of components with the same material and environment combination. The applicant also stated that the sample size will be based on Chapter 4 of Electric Power Research Institute (EPRI)-TR 107514, "Age Related Degradation Inspection Method and Demonstration," except for populations of less than 100 where the criterion will be modified such that the sample size is at least 20 percent of the population with no less than 2 inspections. The applicant further stated that inspection locations will focus on the bounding or lead component most susceptible to aging due to time in-service and severity of operating conditions, where practical. The staff finds the applicant's supplemental information acceptable because the applicant's sampling methodology ensures that a representative sample of material and environment combinations is considered, ensures sample locations will focus on the most susceptible components, and includes an appropriate sample size.

Operating Experience. The staff does not have any changes or update to this section of the SER.

UFSAR Supplement. The staff does not have any changes or update to this section of the SER.

Conclusion. The staff does not have any changes or update to this section of the SER.

3.0.3.1.7 Selective Leaching Program

Summary of Technical Information in the Application. The staff does not have any changes or update to this section of the original SER.

Staff Evaluation. The staff's evaluation of the applicant's proposed Selective Leaching Program is documented in Section 3.0.3.1.7 of the SER. The applicant provided additional information subsequent to the issuance of the SER. The staff's evaluation of the additional information related to the Selective Leaching Program is discussed below.

By letter dated January 21, 2011, the applicant submitted supplemental information regarding the sampling of components inspected by the Selective Leaching Program. The applicant stated that representative samples are chosen from each population where a population is a group of components with the same material and environment combination. The applicant also stated that the sample size will be based on Chapter 4 of EPRI-TR 107514 except for populations of less than 100 where the criterion will be modified such that the sample size is at least 20 percent of the population with no less than 2 inspections. The applicant further stated that inspection locations will focus on the bounding or lead component most susceptible to aging due to time in-service and severity of operating conditions, where practical. The staff finds the applicant's response acceptable because the applicant's sampling methodology ensures a representative sample of material and environment combinations is considered, ensures sample locations will focus on the most susceptible components, and includes an appropriate sample size.

By letter dated January 21, 2011, the applicant also revised its Selective Leaching Program to allow hardness verification using mechanical inspection techniques including destructive testing (when the opportunity arises), chipping, or scraping. The applicant stated that a hardness measurement of all the components in the sample population may not be feasible due to component location and configuration. The staff finds the applicant's addition of these mechanical inspection techniques to detect selective leaching acceptable because they are standard industry techniques which are capable of detecting loss of material due to selective leaching.

Operating Experience. The staff does not have any changes or update to this section of the SER.

UFSAR Supplement. The staff does not have any changes or update to this section of the SER.

Conclusion. The staff does not have any changes or update to this section of the SER.

3.0.3.1.13 Protective Coating Program

Summary of Technical Information in the Application. By letter dated December 21, 2010, the applicant amended its LRA to include the new Protective Coating Program in LRA Section B.1.32. In a supplement dated February 4, 2011, the applicant provided a detailed description of their Protective Coating Program. The program description provided by the applicant is as follows:

> The Protective Coating Program manages the effects of aging on Service Level I coatings inside containment.

> Service Level I protective coatings are not credited to manage the effects of aging, however, proper maintenance of protective coatings inside containment is essential to ensure operability of post-accident safety systems that rely on water recycled through the containment. The proper monitoring and maintenance of Level I coatings ensures there is no coating degradation that would impact safety functions.

The VYNPS Protective Coatings Program complies with Regulatory Guide 1.54 Revision 2 with respect to inspection and maintenance of Service Level I Coatings. The VYNPS Protective Coatings Program is consistent with the program elements described in GALL AMP XI.S8.

Staff Evaluation. The staff reviewed the applicant's program focusing on how the program manages aging effects through the effective incorporation of 10 elements. Specifically, the staff reviewed the following program elements of the applicant's program: (1) "scope of the program," (2) "preventive actions," (3) "parameters monitored or inspected," (4) "detection of aging effects," (5) "monitoring and trending," (6) "acceptance criteria."

The staff confirmed consistency with GALL AMP XI.S8 for elements (1) "scope of the program," (2) "preventive actions," and (3) "parameters monitored or inspected." The applicant provided enhancements to elements (4) "detection of aging effects," (5) "monitoring and trending," and (6) "acceptance criteria." The enhancements and the staff's evaluation for those elements are described below.

(4) Detection of Aging Effects

> Enhance the Protective Coating Program by clearly defining qualifications for inspection personnel, the inspection coordinator, and the inspection results evaluator, as defined by [American Society for Testing and Materials] ASTM D 5163-08 and for inspection to include a thorough visual on all coatings near sumps or screens associated with the Emergency Core Cooling Systems (ECCS)
>
> Enhance the Protective Coating Program by clearly identifying the instruments and equipment required for the inspection which include but may not be limited to flashlights, mirrors, measuring instruments, magnifiers, cameras and binoculars.

GALL AMP XI.S8 recommends ASTM D5163-05 for defining the criteria for qualifying inspection personnel, the inspection coordinator and the inspection results evaluator. The staff finds the applicant's proposed enhancement to the "detection of aging effects" element acceptable because the qualification requirements defined in ASTM D5163-08 are consistent with the criteria in ASTM D5163-05 and are therefore consistent with the recommendations in the GALL Report.

The applicant's enhancement to identify the acceptable instruments and equipment is consistent with the GALL Report recommendations that visual inspections be completed. Therefore, the staff finds the applicant's proposal acceptable.

(5) Monitoring and Trending

> Enhance the Protective Coating Program to specify that the coating inspector conduct a pre-inspection review of the previous two inspection reports. Also, revise the program to specify that the inspection report prioritize the repair areas as either needing repair during the same outage or as acceptable to postpone to future outages with appropriate surveillance in the interim period.

GALL AMP XI.S8 recommends a pre-inspection review of the previous two monitoring reports, and that the inspection report should prioritize repair areas as either needing repair during the same outage or postponed to future outages, but under surveillance in the interim period. Based on its review the staff determines that the applicant's proposed enhancement to the "monitoring and trending" element is consistent with the GALL Report recommendations and therefore acceptable.

(6) Acceptance Criteria

> Enhance the program to specify the acceptance criteria in accordance with ASTM D 5163-08 and to specify an evaluation of the inspection reports by the responsible coating evaluator who prepares a summary of findings and recommendations for future surveillance or repair.

GALL AMP XI.S8 recommends ASTM D5163-05 for determining acceptability of coatings. As previously stated, the recommendations in ASTM D 5163-08 are consistent with ASTM D5163-05. Based on its review the staff determines that the applicant's proposed enhancement to the "acceptance criteria" element is consistent with the GALL Report recommendations and therefore acceptable.

The staff confirmed that the applicant has demonstrated that the condition of Service Level I containment coatings are adequately managed to ensure that post-accident accumulation of failed coating debris on containment sump strainers does not exceed the strainers design limits, consistent with the CLB, for the period of extended operation. Based on its review, the staff finds that elements one through six of the applicant's Protective Coating Program, with acceptable enhancements, are consistent with the program elements of GALL AMP XI.S8, and therefore acceptable.

<u>Operating Experience</u>. The staff reviewed the operating experience described in the applicant's February 4, 2011, supplement. A summary of the operating experience is described below.

As early as 1972, the coating system in the torus vapor space exhibited signs of degradation. The coating system was an inorganic zinc primer topcoated with a phenolic epoxy. The topcoat was blistered and cracked as a result of errors in the application of the inorganic zinc primer. The applicant stated that errors in the application of the primer resulted in an inadequate bond with the topcoat. The applicant's original remediation method was to scrape the blistered topcoat and recoat the area. Subsequent remediation methods involved scraping the loose topcoat and leaving the primer exposed. During the 1998 refueling outage, the applicant blasted and recoated the lower torus shell from one foot above the waterline. The new coating was an un-topcoated inorganic zinc coating.

An inspection of the torus coatings in 2010 verified that the coatings below the waterline had experienced no degradation. There was one area that required repair due to tape having been left between the coating and the substrate. The foreign material (tape) was removed and the area was recoated.

In May 2010 the applicant inspected the primary containment. This inspection identified degraded coatings in the upper elevations of the drywell. The applicant determined that degradation was limited to the topcoat of the coating system and was attributed to elevated temperature in the upper elevations of the drywell. The applicant documented the affected surface area and evaluated the impact of the degraded coatings on ECCS performance. The applicant's evaluation showed that the degraded coatings did not threaten ECCS performance.

Based on its review of the application the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the OE program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.38 the applicant provided the UFSAR supplement for the Protective Coating Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2. The staff also notes that the applicant committed (Commitment No. 55) to enhance the safety-related coatings program and procedures to be consistent with the recommendations of GALL AMP XI.S8.

The staff reviewed this section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Protective Coating Program, the staff finds all program elements consistent with the GALL Report. 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). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.1 Buried Piping Inspection Program

Summary of Technical Information in the Application. The staff does not have any changes or update to this section of the SER.

Staff Evaluation. The staff's evaluation of the applicant's proposed Buried Piping Inspection Program is documented in Section 3.0.3.2.1 of the SER. The applicant provided additional information subsequent to the issuance of the SER. The staff's evaluation of the additional information related to the Buried Piping Inspection Program is discussed below.

By letters dated October 14 and December 21, 2010, and February 4 and 10, 2011, the applicant described changes to its Buried Piping Inspection Program based upon industry and plant-specific operating experience.

In LRA Section B.1.1, the applicant originally stated that steel piping was excavated and inspected on several occasions during the past seven years and these inspections did not reveal loss of material due to external surface corrosion. In its responses dated October 14 and December 21, 2010, and February 4 and 10, 2011, the applicant stated that the following lengths of buried in-scope piping were inspected and found to be in good condition with no loss of material: approximately six feet of service water piping in 2003, approximately eight feet each of fire protection and service water piping in 2008, and in approximately 40 feet of fuel oil piping in 2010. Additionally, the applicant stated that a review of plant records indicated no age-related failures of in-scope buried piping due to external corrosion. To help clarify the salient points of the Buried Piping Inspection Program, the applicant also provided the following program information:

- Buried in-scope piping is coated with tar wrap or epoxy coating.
- Original construction backfill consisted of gravel and sand mix with particle sizes less than one-half inch. Recent backfill activities have consisted of gravel and sand mix with particle sizes less than one and one-half inch. As evidenced by recent piping excavations and inspections, the backfill is free of debris and large rocks that may damage coatings on piping during placement.
- Buried in-scope piping is not protected by a cathodic protection system.
- The below-grade environment is non-aggressive, as per LRA Section 3.5.2.2.1.1, with pH greater than 5.5, chlorides less than 500 parts per million (ppm), and sulfates less than 1,500 ppm. The applicant also stated that buried in-scope piping is located above the groundwater level.
- A ten-foot minimum length of piping will be visually inspected during each excavated inspection.
- Locations for inspections will be selected based on an assessment of the impact risk and corrosion risk to ensure that the most susceptible locations will be inspected. Impact risk considers factors such as environmental risk, impact on plant operation, and safety classification while corrosion risk considers factors such as soil resistivity, soil drainage, piping material, and coating.
- The fiberglass piping exposed to soil in LRA Table 3.3.2-6 is a ten foot length of vent piping for the John Deere fuel oil storage tank. No aging effect requiring management or AMP is proposed because the pipe is not exposed to ultraviolet light, ozone, or high voltage current, and it is well above the water table. This length of fiberglass piping is not continuously exposed to water or hydraulic pressure.
- As an alternative to inspecting buried fire protection piping, the applicant will monitor leakage for the system by trending unexplained electric fire pump starts. The fire protection system is provided with makeup from the service water system through a line with an installed orifice capable of making up at a rate of thirty gallons per minute. The fire protection system pumps are sized to provide adequate system flow to compensate for the potential loss of thirty gallons per minute.
- Prior to the period of extended operation, the applicant will inspect a minimum of two ten-foot segments of the buried in-scope standby gas treatment piping.

- The applicant will inspect eight percent of the fuel oil piping (approximately forty feet, equivalent to four inspections), two ten-foot segments of the standby gas treatment system, and four ten-foot segments of the service water system during each ten-year period within the period of extended operation.
- Soil samples will be obtained prior to the period of extended operation and once every ten years during the period of extended operation. The applicant also stated it will sample two locations near each in-scope system. The applicant further stated that soil composition, pH, chlorides, sulfates, redox potential, and resistivity would be used to determine the corrosiveness of the soil using America Water Works Association (AWWA) Standard C105 Appendix A rating factors.
- If the soil corrosivity rating factor exceeds 10, or soil resistivity is less than 20,000 ohm-cm, the applicant will increase the number of inspections of the fuel oil system to six (equivalent to 12 percent), standby gas treatment system to three, and service water system to six during each ten-year period during the period of extended operation.
- The applicant will use trending in the corrective action program to identify the need for additional inspections of susceptible locations, alternative coatings or replacement.
- Non-visual methods will be capable of detecting both general and pitting corrosion and will be qualified methods with demonstrated capability.
- The applicant reviewed its System Walkdown Program (LRA Section B.1.28) in light of plant-specific operating experience, (i.e., a leak that occurred in the underground advanced off gas system piping). As a result of this review, the applicant has determined that some in-scope underground piping (i.e, below grade, but are contained within a tunnel or vault such that they are in contact with air and are located where access for inspection is restricted) is not readily accessible during normal operation and refueling outages; however, all in-scope underground piping will be inspected at least once every five years. Direct visual inspections of all in-scope underground piping were conducted, which included the service water system in 2008 and the emergency core cooling system in 2010. LRA Section A.2.1.32 was revised to include inspection attributes and intervals for piping that is inaccessible during plant operation.

The staff finds this program acceptable because:

- Buried in-scope piping is coated with tar wrap or epoxy coating.
- Original construction backfill plant-specific specifications ensure that damage will not occur to piping coatings and recent inspections have demonstrated that the backfill meets the specifications.
- A ten-foot minimum length of piping will be visually inspected during each excavated inspection.
- Locations for inspections will be selected based on a risk assessment combining impact risk and corrosion risk to ensure that the most susceptible locations will be inspected.
- The fiberglass vent piping for the John Deere fuel oil storage tank is not exposed to any environmental stressors that would result in an aging effect requiring management.
- The proposed alternative to inspecting buried fire protection piping is consistent with alternatives for inspecting fire protection systems as stated in GALL AMP XI.M41.
- The soil sampling frequency, parameters, and analysis rating factors are consistent with AWWA Standard C105 Appendix A, a recognized industry standard for determining soil corrosivity.

- The number of inspections conducted or being conducted in the ten-year period prior to the period of extended operation (nine inspections total) and those that will be conducted during the period of extended operation (ten inspections total during each ten year period within the period of extended operation), including any increased inspections if the soil is determined to be corrosive, establish a reasonable basis for the staff to conclude that the current licensing basis (CLB) function(s) of the buried in-scope systems will be maintained.
- If non-visual methods will be used to inspect buried pipe in lieu of excavated direct inspections, the applicant stated that the method will be qualified with performance demonstrations to ensure that it is capable of detecting both general and pitting corrosion.
- All in-scope underground piping will be inspected at least once every five years and the applicant revised LRA Section A.2.1.32 to include inspection intervals for piping that is inaccessible during plant operation.

On the basis of its review of the applicant's revised commitments for the Buried Piping Inspection Program, 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). The staff also reviewed the revised UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Operating Experience</u>. The staff does not have any changes or update to this section of the SER.

<u>UFSAR Supplement</u>. The staff reviewed the revised UFSAR supplement description of the program and noted that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2 and 3.3-2. The staff also noted that the applicant provided a new commitment (Commitment No. 54) to implement the soil sampling and inspections as described above. The staff further noted that Commitment No. 44 was replaced with Commitment No. 54 in that the former commitment stated a lesser number of inspections and allowed for inspections without excavating the pipe.

<u>Conclusion</u>. The staff does not have any changes or update to this section of the SER.

3.0.3.2.7 BWR Vessel Internals Program

<u>Summary of Technical Information in the Application</u>. The staff does not have any changes or update to this section of the SER.

<u>Staff Evaluation</u>. The staff's evaluation of the applicant's proposed BWR Vessel Internals Program is documented in Section 3.0.3.2.7 of the SER. The applicant provided additional information subsequent to the issuance of the SER. The staff's evaluation of the additional information related to the BWR Vessel Internals Program is discussed below.

In the VYNPS License Renewal application annual update letter dated December 30, 2010, the applicant described changes to its BWR Vessel Internals Program, which is documented in LRA Section B.1.7 and described as consistent, with exceptions and enhancements, with GALL AMP XI.M9, "BWR Vessel Internals." The applicant made the following modifications to the program as discussed below:

- LRA Commitment No. 29 was modified to change the timeframe for completion of a plant-specific analysis to determine acceptance criteria for continued inspection of core plate hold down bolting in accordance with BWRVIP-25 and submit the inspection plan and analysis to the NRC from two years down to one year prior to the period of extended operation.

The staff reviewed the revised LRA Commitment No. 29 and noted that the proposed revision of the commitment, supplying an analysis one year prior to the period of extended operation instead of two years prior will allow the staff adequate time to review the potential analysis before the applicant enters the period of extended operation. Therefore, the staff finds the proposed commitment modification acceptable.

Operating Experience. The staff does not have any changes or update to this section of the SER.

UFSAR Supplement. The staff does not have any changes or update to this section of the SER.

Conclusion. The staff does not have any changes or update to this section of the SER.

3.0.3.2.9 Diesel Fuel Monitoring Program

Summary of Technical Information in the Application. The staff does not have any changes or update to this section of the SER.

Staff Evaluation. The staff's evaluation of the applicant's proposed Diesel Fuel Monitoring Program is documented in Section 3.0.3.2.9 of the SER. The applicant provided additional information subsequent to the issuance of the SER. The staff's evaluation of the additional information related to the Diesel Fuel Monitoring Program is discussed below.

By letters dated December 30, 2010, and February 4, 2011, the applicant provided changes to its Diesel Fuel Monitoring Program based upon plant operating procedures and industry guidance.

LRA Section B.1.9 as supplemented by letter dated March 23, 2007, describe the existing Diesel Fuel Monitoring Program as consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry." In the supplemental letters, the applicant revised its use of several guidance documents related to this AMP by updating revision numbers as well as applicability. As a result, the applicant made the following modifications to exceptions and enhancements along with the corresponding commitments as discussed below:

- The program element "program description" was modified to change the revision number of ASTM Standard D975 to revision 09.

GALL AMP XI.M30 states that ASTM D975-04 or other appropriate standards may be used to develop fuel oil quality acceptance criteria. The staff noted that the ASTM D975-09 standard contains all of the requirements contained in the D975-02 and D975-04 editions, with an additional requirement for Ultra-Low Sulfur Diesel (ULSD). The staff finds this ASTM Standard revision change to be acceptable based on the use of a more stringent version of the ASTM standard than is recommended by the GALL Report.

- The note applicable to Exception 1 was clarified to state that the D2276 acceptance criterion is more stringent that that of D6217, and is therefore the reason why ASTM D6217 is not necessary for the determination of particulates.

The staff finds that the applicant is using one of the methods (ASTM D2276) which is recommended by the GALL Report. During the review, the applicant stated that the ASTM D6217 provides guidance on determining particulate contamination by sample filtration at an offsite laboratory. However, the use of ASTM D2276 provides for guidance on determining particulate contamination using a field monitor which provides for rapid assessment of changes in contamination. In addition, the applicant stated that the acceptance criteria for ASTM D2276 is more stringent than for ASTM D6217, namely 10 milligrams (mg) per milliliter(ml) versus 24 mg/ml. The staff finds the use of only ASTM D2276 to be conservative.

The staff finds this exception acceptable based on using the more stringent of the ASTM standards recommended by the GALL Report with the added advantage of the quick assessment of contamination changes.

- Exception 3 was modified to state that ASTM Standard D2709 is used for determination of water standards. The note relating to Exception 3 was also clarified to state that ASTM Standard D2709 is the appropriate standard for the determination of water and sediment in the VYNPS fuel oil.

The GALL Report recommends both ASTM Standards D1796 and D2709 for determining the water and sediment contamination in diesel fuel. Both of these standards are applicable to the diesel fuel used at VYNPS. The ASTM Standards D1796 and D2709 are both referenced in ASTM D975 which VYNPS is referenced in the plant technical specifications bases.

The staff finds this exception acceptable since either standard would be appropriate for the VYNPS diesel fuel; the staff accepted the use of ASTM D2709 to determine the water and sediment in the diesel fuel.

- Enhancement 2 was modified to state that UT measurements of the fuel oil storage bottom surface will have acceptance criterion in accordance with American Petroleum Institute (API) standard API 653 and UT measurements of the fire pump diesel storage (day) tank bottom surface will have acceptance criterion in accordance with Steel Tank Institute (STI) standard STI SP001. LRA Commitment No. 4 was also updated to reflect this change.

By letter dated February 4, 2011, the applicant also stated that the fuel oil storage tank was fabricated in accordance with National Fire Protection Association Standard, NFPA No. 30. Section 22.17.2 of the standard states that each aboveground steel tank shall be inspected and maintained in accordance with API 653, “Tank Inspection, Repair, Alteration, and Reconstruction” or STI SP001, “Standard for Inspection of Aboveground Storage Tanks.”

GALL AMP XI.M30 does not provide an acceptance criterion for the bottom surface thickness of the diesel fuel storage tank. The staff noted that periodic ultrasonic thickness measurements of the fuel oil storage and fire pump diesel storage (day) tank bottom surfaces performed in conjunction with industry standard acceptance criterion and a rigid corrective action program will provide additional assurance that the effects of aging will be detected before the loss of intended function.

On this basis, the staff finds this enhancement acceptable since, with the enhancement implemented, the Diesel Fuel Monitoring Program, will be consistent with GALL AMP XI.M30 and will provide additional assurance that the effects of aging will be adequately managed.

- Enhancement 3 was modified to change the revision number of ASTM Standard D975 to revision 09. LRA Commitment No. 46 was updated to reflect this change.

GALL AMP XI.M30 states that ASTM D975-04 or other appropriate standards may be used to develop fuel oil quality acceptance criteria. The staff notes that the ASTM D975-09 standard contains all of the requirements contained in the D975-02 and D975-04 editions, with an additional requirement for ULSD. The staff finds this ASTM Standard revision change to be acceptable based on the use of a more stringent version of the ASTM standard recommended by the GALL Report.

On this basis, the staff finds this enhancement acceptable since the ultrasonic testing will be accomplished in accordance with industry standards and will provide additional assurance that the effects of aging will be adequately managed.

- Enhancement 5 was modified to change the revision number of ASTM Standard D975 to revision 09 and also refer to ASTM Standard D2709 as previously discussed in the changes to Exception 3. LRA Commitment No. 47 was updated to reflect these changes.

GALL AMP XI.M30 states that ASTM D975-04 or other appropriate standards may be used to develop fuel oil quality acceptance criteria. The staff noted that the ASTM D975-09 standard contains all of the requirements contained in the D975-02 and D975-04 editions, with an additional requirement for ULSD. The staff finds this ASTM Standard revision change to be acceptable based on the use of a more stringent version of the ASTM standard recommended by the GALL Report.

On this basis, the staff finds this enhancement acceptable since, with the enhancement implemented, the Diesel Fuel Monitoring Program will be consistent with GALL AMP XI.M30 and will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the applicant's revised exceptions, enhancements, and commitments for the Diesel Fuel Monitoring Program, 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). The staff also reviewed the revised FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Operating Experience. The staff does not have any changes or update to this section of the SER.

UFSAR Supplement. The staff does not have any changes or update to this section of the SER.

Conclusion. The staff does not have any changes or update to this section of the SER.

3.0.3.3.6 Vernon Dam FERC Inspection

Summary of Technical Information in the Application. The staff does not have any changes or update to this section of the SER.

Staff Evaluation. The staff's evaluation of the applicant's proposed Vernon Dam FERC Inspection Program is documented in Section 3.0.3.3.6 of the SER. The applicant provided additional information subsequent to the issuance of the SER. The staff's evaluation of the additional information related to the Vernon Dam FERC Inspection Program is discussed below.

In the VYNPS License Renewal application Annual Update letter dated December 30, 2010, the applicant described changes to its Vernon Dam FERC Inspection Program, which is documented in LRA Section B.1.27.3 and described as an existing, plant-specific program. The applicant made the following modifications to the program as discussed below:

- LRA Commitment No. 50 was modified to correct a typographical error and change the reference document to BVY 97-025.

The staff reviewed the revised LRA Commitment No. 50, and noted that the typographical error occurred in the original commitment only, and that the staff had completed and documented it in the SER as the BVY 97-025 reference document as intended. The staff finds that the revised LRA Commitment No. 50 adequately documents the correct document reference.

Operating Experience. The staff does not have any changes or update to this section of the SER.

UFSAR Supplement. The staff does not have any changes or update to this section of the SER.

Conclusion. The staff does not have any changes or update to this section of the SER.

3.0.3.3.9 Neutron Absorber Monitoring Program

Summary of Technical Information in the Application. By letter dated December 21, 2010, the applicant amended its LRA to include the new Neutron Absorber Monitoring Program in LRA Section B.1.31. By letters dated February 4 and 10, 2011 the applicant provided a detailed description of the program as well as a commitment to perform surveillance testing of Boral coupons prior to the period of extended operation. The applicant provided the following program description:

> The Neutron Absorber Monitoring Program is a new program that manages loss of material and reduction of neutron absorption capacity of Boral neutron absorption panels in the spent fuel racks. The program will rely on periodic inspection, testing, monitoring and analysis of the criticality design to assure that the required five percent subcriticality margin is maintained during the period of

extended operation.

The program will be initiated prior to the period of extended operation. One coupon will be tested prior to the PEO to measure B-10 areal density and to assess the geometric and physical condition of the tested coupon. If coupons are not able to be retrieved and tested or if coupons cannot be demonstrated representative of the Boral in the Holtec racks, then neutron attenuation testing using in-situ methods, as described in BVY 11-010, (BADGER or blackness testing method) will be completed prior to the end of 2014.

Staff Evaluation. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M40. The staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M40. The staff finds that elements one through six of the applicant's Neutron Absorber Monitoring Program are consistent with the corresponding program elements of GALL AMP XI.M40 and, therefore, acceptable.

The applicant has Boral that was manufactured by two different companies. Seven racks were manufactured by Nuclear Energy Services (NES). Two racks were manufactured by Holtec. Coupons are available for the NES racks; however, none are available for the Holtec racks. The licensee has committed to remove and perform testing on a coupon from the NES racks prior to the period of extended operation. The testing will include areal density measurement to determine the materials neutron attenuation capability. The licensee will perform an evaluation to determine if the coupon is representative of both the Holtec and the NES racks. If the coupon cannot be verified to represent the Holtec racks, then in-situ testing will be performed to verify the material condition and neutron attenuation capability of the Holtec racks.

The staff finds that the applicant's commitment (Commitment No. 52) to perform testing prior to the PEO, in addition to the testing described in the Neutron Absorber Monitoring Program, will effectively manage the loss of neutron-absorbing capacity and degradation of Boral.

Operating Experience. By letter dated February 4, 2011, the applicant provided an LRA amendment related to LRA Section B.1.31 and summarized operating experience related to the Neutron Absorber Monitoring Program.

In 1989, when nine of the VYNPS spent fuel pool storage racks were replaced with Boral racks, three strings of monitoring coupons were installed—each monitoring string consisted of eight 304L stainless steel coupons and three Boral coupons. The applicant analyzed coupons in 1991 and 1996. In 1996, the Boral coupon on a string exhibited blistering on the bottom side of the coupon. The applicant determined that the blistering did not result in degradation of the Boral's neutron absorption capability. The applicant has not tested coupons since the 1996 test because no deterioration of the material was identified when comparing the 1991 testing to the 1996 testing. To confirm that the neutron absorbing capacity of the material has not degraded since the 1996 testing, the applicant has committed to perform areal density testing of a coupon prior to the period of extended operation.

The staff reviewed the operating experience information in the LRA amendment to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. The staff confirmed that the "operating experience" program element satisfies the guidance in SRP-LR Section A.1.2.3.10, since the operating experience supports the conclusion that the Neutron Absorber Monitoring Program will be able to effectively manage the loss of neutron-absorbing capacity and degradation of Boral. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.37 the applicant provided the UFSAR supplement for the Neutron Absorber Monitoring Program. The staff notes that the applicant committed (Commitment No. 52) to implement the Neutron Absorber Monitoring Program prior to entering the period of extended operation and to test one coupon prior to the period of extend operation to measure B-10 areal density and assess the geometric and physical condition of the tested coupon. The applicant further committed to perform in-situ testing if coupons cannot be retrieved or cannot be determined to be representative of the Hotec racks prior to the end of 2014.

The staff reviewed LRA Section A.2.1.37 and determined that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Neutron Absorber Monitoring Program, the staff finds all program elements consistent with the GALL Report. 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). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.3 Aging Management of Auxiliary Systems

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

The staff reviewed LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6.

LRA Section 3.3.2.2.6 addresses the loss of material and cracking of Boral spent fuel storage racks exposed to a treated water environment due to general corrosion.

SRP-LR Section 3.3.2.2.6 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion may occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or treated borated water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

By letter dated February 15, 2011, the applicant revised LRA Section 3.3.2.2.6 to state that:

> Loss of material and cracking are aging effects requiring management for Boral spent fuel storage racks exposed to a treated water environment. These aging effects are managed by the Water Chemistry Control-BWR Program.
>
> The Neutron Absorber Monitoring Program manages the reduction in neutron-

absorbing capacity and loss of material.

The staff's evaluations of the applicant's Water Chemistry Control-BWR Program and Neutron Absorber Monitoring Program are documented in SER Sections 3.0.3.1.11 and 3.0.3.3.9 respectively.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.6 criteria. For those line items that apply to LRA Section 3.3.2.2.6, the staff determines that the LRA is consistent with the GALL Report and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5 Aging Management of SC Supports

3.5.2.3.6 Bulk Commodities Summary of Aging Management Evaluation—LRA Table 3.5.2-6

In addition to the AMR results documented in the SER dated May 2008 for LRA Table 3.5.2-6, by letter dated December 30, 2009, the applicant proposed to manage fiberglass reinforced plastic (FRP) material for component types cooling tower vents and louvers exposed to weather environment using the Structures Monitoring Program.

The staff reviewed the applicant's Structures Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.17. The Structures Monitoring Program is in accordance with 10 CFR 50.65 (Maintenance Rule) and based on Regulatory Guide (RG) 1.160 "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and Nuclear Management and Resources Council (NUMARC) 93-01 "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." These two documents provided the guidance for development of the Structures Monitoring Program 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 line item reference Note J and plant-specific Note 505, which states, "aging effects are not expected for fiberglass reinforced plastic (FRP). However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." Since the applicant has credited an appropriate aging management program for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, and AMP combinations 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 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 Aging Management of Electrical and Instrumentation and Controls System

3.6.2.3.2 Aging Effect or Mechanism in Table 3.6.1 that are Not Applicable for VYNPS

The staff documented its review of LRA Table 3.6.1, which provides a summary of aging management evaluations for the electrical and instrument and controls (I&Cs) structures and components evaluated in the GALL Report, in SER Section 3.6.2.3.2. SER Section 3.6.2.3.2 states in part that:

> In response to the staff's concern about not testing inaccessible medium cables at [Vernon Hydroelectric Station] VHS, the applicant, in a letter dated March 23, 2007, revised LRA Table 3.6.2-1 and stated that VYNPS will include testing of the underground medium-voltage cables at VHS in the Non-EQ Inaccessible Medium-Voltage Cable Program. Testing will be performed before the extended operation and within 10 -year periods after the initial test. This is Commitment No. 43.

By letters dated September 3 and December 21, 2010, and February 4, 2011, the applicant expanded the scope of the Non-EQ Inaccessible Medium-Voltage Program to include low-voltage (400V to 2kV) inaccessible power cables. In the LRA supplement to the Non-EQ Inaccessible Medium-Voltage Program, the applicant revised cable test frequencies to at least once every 6 years. As part of this change, the applicant also changed the cable inspection frequency for Commitment No. 43 from at least every 10 years to at least once every 6 years. The change to Commitment No. 43 is consistent with the LRA supplement changes for LRA Sections B.1.17 and A.2.1.19. The change in program scope for the Non-EQ Inaccessible Medium-Voltage Program is discussed in SER Section 3.0.3.1.3.

The remainder of SER Section 3.6.2.3.2 is unaffected by this supplemental SER.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 4

4.0 TIME LIMITED AGING ANALYSIS

4.3.3 Effects of Reactor Water Environment on Fatigue Life

4.3.3.1 Summary of Technical Information in the Application

The staff does not have any changes or updates to this section of the safety evaluation report (SER).

4.3.3.2 Staff Evaluation

SER Section 4.3.3.2 presents the staff's evaluation of the applicant's time limited aging analysis (TLAA) related to the effects of reactor water environment on fatigue life. The staff's analysis in SER Section 4.3.3.2 was supplemented in SER Supplement 1. The following is the staff's evaluation of additional information provided by the applicant and is supplemental to the information provided in the SER and SER Supplement 1.

By letter dated February 8, 2011, the applicant provided supplemental information regarding its environmentally-assisted fatigue (EAF) evaluations to confirm and justify that the plant-specific locations listed in LRA Table 4.3-3 are bounding for the generic NUREG/CR-6260 components. The applicant stated that, subsequent to LRA submittal, refined and confirmatory analyses were completed for the NUREG/CR-6260 components. The applicant also stated that, for each NUREG/CR-6260 component, the combination of the cumulative usage factor (CUF) and environmental fatigue life correction factor (F_{en}) was evaluated for each constituent material to determine the most limiting CUF_{en}. The applicant discussed that, for example, the low alloy steel core spray nozzle, the nickel alloy safe end, and the stainless steel piping associated with the core spray nozzle were all evaluated.

For the reactor vessel shell and lower head, the applicant compared the CUF_{en} of control rod drive (CRD) penetration locations to that of the shroud support and confirmed that the CRD penetration locations are less limiting than the shroud support. The staff notes that, by letter dated January 30, 2008, the applicant provided an updated CUF_{en} of 0.74 for the shroud support and the staff compared this to the CUF_{en} of 0.08 for the reactor pressure vessel (RPV) vessel shell bottom head. Based on its review, the staff finds that the comparison of CUF_{en} values for the shroud support, the RPV vessel shell bottom head, and the CRD penetrations supports the applicant's previous conclusion that the shroud support, with a CUF_{en} of 0.74, remains the limiting location for EAF for the reactor vessel shell and bottom head.

The staff reviewed UFSAR Section 4.8.5 and noted that the residual heat removal system piping was designed in accordance with ANSI B31.1. The staff also reviewed UFSAR Section 11.8.3.10 and notes that the feedwater system piping was designed in accordance with United States of America Standard (USAS) B31.1. The staff notes that ANSI B31.1 and USAS B31.1 did not require an analysis of cumulative fatigue usage for piping design; instead, secondary stresses (e.g., stress due to thermal expansion and anchor movements) are analyzed for fatigue using stress intensification factors and stress range allowables to account for thermal cycling. However, in order to address EAF, as indicated in the close-out of Generic Safety Issue (GSI)-190, the applicant, by letter dated September 17, 2007, calculated a CUF_{en} of 0.74 for the reactor recirculation (RR) ASME Code Class 1 piping (return tee) and a CUF_{en} of 0.29 for the feedwater piping rise to the RPV nozzle to address the effects of reactor water environment. Based on these existing fatigue evaluations which include cumulative usage factors, the staff finds that the applicant's previous conclusion conservatively considered a bounding location in the residual heat removal system piping and feedwater system piping to address the effects of reactor water environment.

Based on its review, the staff finds the applicant's conclusion, that the locations selected for EAF analyses in LRA Table 4.3-3 are the bounding locations for the generic NUREG/CR-6260 components, acceptable. The staff finds the applicant's conclusion acceptable because the applicant reviewed its design basis ASME Code Class 1 fatigue evaluations for its NUREG/CR-6260 locations, compared various CUF_{en} in the refined and the confirmatory analyses and confirmed that those CUF_{en} values are bounding.

By letter dated February 8, 2011, the applicant also provided supplemental information, regarding its EAF evaluations to confirm and justify that the locations selected for EAF analyses in LRA Table 4.3-3 are the most limiting locations for the plant. The applicant stated that it reviewed the design basis Class 1 fatigue analyses not already addressed as NUREG/CR-6260 components. The applicant stated that the environmental effects were evaluated for each material at the reviewed locations, and the NUREG/CR-6909 methodology was used to obtain CUF and F_{en} values for Alloy 600 materials. The staff finds that the use of NUREG/CR-6909, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials," for Alloy 600 materials is acceptable because it incorporates the most recent fatigue data for determining the F_{en} factor of nickel alloys.

The applicant also stated in the letter dated February 8, 2011, also that it did not apply EAF F_{en} values to the CUF for the mainsteam outlet nozzle because this location is exposed to dry steam, not reactor water, when the plant is in operation. The applicant also stated that EAF F_{en} values are also not applied to the closure studs and the refueling bellows because these locations are not exposed to the reactor water environment. The staff finds it acceptable that the applicant did not apply EAF F_{en} values to the CUF for the mainsteam outlet nozzle, the closure studs, and the refueling bellows because the test data demonstrates that the environmental effects on component fatigue life occur when the components are exposed to water environment.

The applicant stated that it evaluated the shroud repair hardware and determined that the limiting locations are the Alloy 600 shroud repair rod threaded ends and the shroud support plate slotted holes. Furthermore, the stainless steel repair bracket was also evaluated. The applicant stated that these items are not part of the reactor coolant pressure boundary. The staff notes that, even when the applicant applied conservative F_{en} factors, the applicant calculated CUF_{en} values of less than 0.4 for these locations, which is less than the CUF_{en} of 0.74 for the shroud support, which is a NUREG/CR-6260 location.

The applicant stated that it determined that the closure flange and the CRD return nozzle remain exempt from fatigue evaluations in accordance with the requirements in paragraph N-415.1 of ASME Code Section III. The staff notes that subparagraphs (a)-(f) of N-415.1, detailing the requirements outlined in ASME Code Section III, permit exemption from fatigue analysis. The staff notes that this exemption was based on the premise that the stress from pressure, temperature, and mechanical loads would not be significant. The staff finds it acceptable that the closure flange and the CRD return nozzle are not evaluated for the effects of reactor water environment on component fatigue life because these components are exempt from fatigue analyses, in accordance with the requirements in paragraph N-415.1 of ASME Code Section III.

The applicant confirmed that the CUF_{en} values previously submitted in the LRA and LRA amendments for its NUREG/CR-6260 components are bounding for the generic NUREG/CR-6260 locations. The applicant also confirmed that its NUREG/CR-6260 locations are the most limiting locations for the plant.

Based on its review, the staff finds the applicant's conclusion, that the locations selected for EAF analyses in LRA Table 4.3-3 are the bounding locations for the plant, acceptable. The staff finds the applicant's conclusion acceptable because (1) the applicant reviewed its design basis ASME Code Class 1 fatigue evaluations and confirmed that the CUF_{en} values from the refined and the confirmatory analyses for its NUREG/CR-6260 components are bounding for the plant, (2) the applicant considered the effect of different material types on F_{en} in determining the limiting locations, (3) the methodology used in the evaluation of Alloy 600 components was consistent with NUREG/CR-6909, and (4) components not exposed to reactor water and components exposed to dry steam are not subjected to the effects of reactor coolant environment and (5) it is consistent with the recommendations in the GALL AMP X.M1, to consider environmental effects for the NUREG/CR-6260 locations, at a minimum.

4.3.3.2 **UFSAR Supplement**

The staff does not have any changes or updates to this section of the SER.

4.3.3.3 **Conclusion**

The staff does not have any changes or updates to this section of the SER.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 5

5.0 REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The staff has provided the Advisory Committee on Reactor Safeguards with a copy of this supplemental safety evaluation report.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 6

6.0 CONCLUSION

The staff concludes that the additional information provided by Entergy Nuclear Operations, Inc., does not alter the conclusion proffered in the SER and that the requirements of 10 CFR 54.29(a) have been met.

APPENDIX A

VYNPS LICENSE RENEWAL COMMITMENTS

During the review of the Vermont Yankee Nuclear Power Station (VYNPS) license renewal application (LRA) by the staff of the US Nuclear Regulatory Commission (NRC) (the staff), Entergy Nuclear Operations, Inc. (the applicant) made commitments related to aging management programs (AMPs) to manage the aging effects of structures and components prior to the period of extended operation. The following table lists these commitments along with the implementation schedules and the sources for each commitment.

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
1	Guidance for performing examinations of buried piping will be enhanced to specify that coating degradation and corrosion are attributes to be evaluated.	March 21, 2012	B.1.1
2	Fifteen (15) percent of the top guide locations will be inspected using enhanced visual inspection technique, EVT-1, within the first 18 years of the period of extended operation, with at least one-third of the inspections to be completed within the first 6 years and at least two-thirds within the first 12 years of the period of extended operation. Locations selected for examination will be areas that have exceeded the neutron fluence threshold.	As stated in the commitment	B.1.7
3	The Diesel Fuel Monitoring Program will be enhanced to ensure ultrasonic thickness measurement of the fuel oil storage and fire pump diesel storage (day) tank bottom surfaces will be performed every 10 years during tank cleaning and inspection.	March 21, 2012	B.1.9

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
4	The Diesel Fuel Monitoring Program will be enhanced to specify that UT measurements of the fuel oil storage tank bottom surface will have acceptance criterion in accordance with American Petroleum Institute standard API 653 and UT measurements of the fire pump diesel storage (day) tank bottom surface will have acceptance criterion in accordance with Steel Tank Institute standard STI SP001.	March 21, 2012	B.1.9
5	The Fatigue Monitoring Program will be modified to require periodic update of cumulative fatigue usage factors (CUFs), or to require update of CUFs if the number of accumulated cycles approaches the number assumed in the design calculation.	March 21, 2012	B.1.11
6	A computerized monitoring program (e.g., FatiguePro) will be used to directly determine cumulative fatigue usage factors (CUFs) for locations of interest.	March 21, 2012	B.1.11
7	The allowable number of effective transients will be established for monitored transients. This will allow quantitative projection of future margin.	March 21, 2012	B.1.11
8	Procedures will be enhanced to specify that fire damper frames in fire barriers will be inspected for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion.	March 21, 2012	B.1.12.1
9	Procedures will be enhanced to state that the diesel engine subsystems (including the fuel supply line) will be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running; such as fuel oil, lube oil, coolant, or exhaust gas leakage.	March 21, 2012	B.1.12.1
10	Fire Water System Program procedures will be enhanced to specify that in accordance with NFPA 25 (2002 edition), Section 5.3.1.1.1, when sprinklers have been in place for 50 years a representative sample of sprinkler heads will be submitted to a recognized testing laboratory for field service testing. This sampling will be repeated every 10 years.	March 21, 2012	B.1.12.2

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
11	The Fire Water System Program will be enhanced to specify that wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion/MIC (bio-fouling). These inspections will be performed before the end of the current operating term and during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.	March 21, 2012	B.1.12.2
12	Implement the Heat Exchanger Monitoring Program as described in LRA Section B.1.14.	March 21, 2012	B.1.14
13	Implement the Non-EQ Inaccessible Medium-Voltage Cable Program as described in LRA Section B.1.17. Inspections for water accumulation in manholes containing inaccessible low-voltage and medium-voltage cables with a license renewal intended function will be performed at least once every year. Additional condition-based inspections of these manholes will be performed based on: a) potentially high water table conditions, as indicated by high river level, and b) after periods of heavy rain. The inspection results are expected to indicate whether the inspection frequency should be modified. Inaccessible low-voltage cables (400 V to 2 kV) with a license renewal intended function are included in this program. Inaccessible low-voltage cables will be tested for degradation of the cable insulation prior to the period of extended operation and at least once every six years thereafter. A proven, commercially available test will be used for detecting deterioration due to wetting of the insulation system for inaccessible low-voltage cables.	March 21, 2012	B.1.17

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
14	Implement the Non-Environmental Qualification Instrumentation Circuits Test Review Program as described in LRA Section B.1.18.	March 21, 2012	B.1.18
15	Implement the Non-Environmental Qualification Insulated Cables and Connections Program as described in LRA Section B.1.19.	March 21, 2012	B.1.19
16	Implement the One-Time Inspection Program as described in LRA Section B.1.21.	March 21, 2012	B.1.21
17	Enhance the Periodic Surveillance and Preventive Maintenance Program to assure that the effects of aging will be managed as described in LRA Section B.1.22.	March 21, 2012	B.1.22
18	Enhance the Reactor Vessel Surveillance Program to proceduralize the data analysis, acceptance criteria, and corrective actions described in the program description in LRA Section B.1.24.	March 21, 2012	B.1.24
19	Implement the Selective Leaching Program as described in LRA Section B.1.25.	March 21, 2012	B.1.25
20	Enhance the Structures Monitoring Program to specify that process facility crane rails and girders, condensate storage tank (CST) enclosure, CO_2 tank enclosure, N_2 tank enclosure and restraining wall, CST pipe trench, diesel generator cable trench, fuel oil pump house, service water pipe trench, man-way seals and gaskets, and hatch seals and gaskets are included in the program.	March 21, 2012	B.1.27.2
21	Guidance for performing structural examinations of wood to identify loss of material, cracking, and change in material properties will be added to the Structures Monitoring Program.	March 21, 2012	B.1.27.2

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
22	Guidance for performing structural examinations of elastomers (seals and gaskets) to identify cracking and change in material properties (cracking when manually flexed) will be enhanced in the Structures Monitoring Program procedure.	March 21, 2012	B.1.27.2
23	Guidance for performing structural examinations of PVC cooling tower fill to identify cracking and change in material properties will be added to the Structures Monitoring Program procedure.	March 21, 2012	B.1.27.2
24	System walkdown guidance documents will be enhanced to perform periodic system engineer inspections of systems in-scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject system will include SSCs that are in-scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).	March 21, 2012	B.1.28
25	Implement the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as described in LRA Section B.1.29.	March 21, 2012	B.1.29
26	Procedures will be enhanced to flush the John Deere Diesel Generator cooling water system and replace the coolant and coolant conditioner every three years.	March 21, 2012	B.1.30.1

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
27	At least 2 years prior to entering the period of extended operation, for the locations identified in NUREG/CR-6260 for BWRs of the VY vintage, VY will refine our current fatigue analyses to include the effects of reactor water environment and verify that the cumulative usage factors (CUFs) are less than 1. This includes applying the appropriate Fen factors to valid CUFs determined in accordance with one of the following: 1. For locations, including NUREG/CR-6260 locations, with existing fatigue analysis valid for the period of extended operation, use the existing CUF to determine the environmentally adjusted CUF. 2. More limiting VY-specific locations with a valid CUF may be added in addition to the NUREG/CR-6260 locations. 3. Representative CUF values from other plants, adjusted to or enveloping the VY plant-specific external loads may be used if demonstrated applicable to VY. 4. An analysis using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case) may be performed to determine a valid CUF. During the period of extended operation, VY may also use one of the following options for fatigue management if ongoing monitoring indicates a potential for a condition outside the analysis bounds noted above: (1) Update and/or refine the affected analyses described above. (2) Implement an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC). (3) Repair or replace the affected locations before exceeding a CUF of 1.0.	March 21, 2012 March 21, 2010 for performing a fatigue analysis that addresses the effects of reactor coolant environment on fatigue (in accordance with an NRC approved version of the ASME Code)	4.3.3
28	Revise program procedures to indicate that the Instrument Air Program will maintain instrument air quality in accordance with ISA S7.3	March 21, 2012	B.1.16

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
29	VYNPS will perform one of the following: 1. Install core plate wedges, or, 2. Complete a plant-specific analysis to determine acceptance criteria for continued inspection of core plate hold down bolting in accordance with BWRVIP-25 and submit the inspection plan and analysis to the NRC one year prior to the period of extended operation for NRC review and approval.	March 21, 2012	B.1.7
30	Revise System Walkdown Program to specify CO_2 system inspections every 6 months.	March 21, 2012	B.1.28
31	Revise Fire Water System Program to specify annual fire hydrant gasket inspections and flow tests.	March 21, 2012	B.1.12.2
32	Implement the Metal Enclosed Bus Program. Details are provided in an LRA Amendment 16, Attachment 3 and LRA Amendment 23, 7.	March 21, 2012	B.1.32
33	Include within the Structures Monitoring Program provisions that will ensure an engineering evaluation is made on a periodic basis (at least once every five years) of groundwater samples to assess aggressiveness of groundwater to concrete. Samples will be monitored for sulfates, pH and chlorides.	March 21, 2012	B.1.27
34	Implement the Bolting Integrity Program. Details are provided in an LRA Amendment 16, Attachment 2 and LRA Amendment 23, Attachment 5.	March 21, 2012	B.1.31
35	Provide within the System Walkdown Training Program a process to document biennial refresher training of Engineers to demonstrate inclusion of the methodology for aging management of plant equipment as described in EPRI Aging Assessment Field Guide or comparable instructional guide.	March 21, 2012	B.1.28

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
36	If technology to inspect the hidden jet pump thermal sleeve and core spray thermal sleeve welds has not been developed and approved by the NRC at least two years prior to the period of extended operation, VYNPS will initiate plant-specific action to resolve this issue. That plant-specific action may be justification that the welds do not require inspection.	March 21, 2010	B.1.24
37	Continue inspections in accordance with the steam dryer monitoring plan, Revision 3 in the event that the BWRVIP-139 is not approved prior to the period of extended operation.	March 21, 2010	B.1.24
38	The BWRVIP-116 report which was approved by the Staff will be implemented at VYNPS with the conditions documented in Sections 3 and 4 of the Staff's final SE dated March 1, 2006, for the BWRVIP-116 report.	March 21, 2012	B.1.24
39	If the VYNPS standby capsule is removed from the reactor vessel without the intent to test it, the capsule will be stored in a manner which maintains it in a condition which would permit its future use, including during the period of extended operation, if necessary.	March 21, 2012	B.1.24
40	This Commitment has been deleted and replaced with Commitment 43	N/A	N/A
41	This Commitment has been deleted and replaced with Commitment 43	N/A	N/A
42	Implement the Bolted Cable Connections Program. Details are provided in LRA Amendment 23, Attachment 7.	March 21, 2012	B.1.33
43	Establish and implement a program that will require testing of the two 13.8 kV cables from the two Vernon Hydro Station 13.8 kV switchgear buses to the 13.8 kV / 69 kV step up transformers before the period of extended operation and at least once every 6 years after the initial test.	March 21, 2012	B.1.17
44	This Commitment has been deleted and replaced with Commitment 54.	N/A	N/A

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
45	Enhance the Service Water Integrity Program to require a periodic visual inspection of the RHRSW pump motor cooling coil internal surface for loss of material.	March 21, 2012	B.1.26
46	Enhance the Diesel Fuel Monitoring Program to specify that fuel oil in the fire pump diesel storage (day) tank will be analyzed according to ASTM D975 and for particulates per ASTM D2276. Also, fuel oil in the John Deere diesel storage tank will be analyzed for particulates per ASTM D2276.	March 21, 2012	B.1.9
47	Enhance the Diesel Fuel Monitoring Program to specify that fuel oil in the common portable fuel oil storage tank will be analyzed according to ASTM D975, per ASTM D2276 for particulates, and per ASTM D2709 for water and sediment.	March 21, 2012	B.1.9
48	Perform an internal inspection of the underground Service Water piping before entering the period of extended operation.	March 21, 2012	B.1.1
49	Revise station procedures to specify fire hydrant hose testing, inspection, and replacement, if necessary, in accordance with NFPA code specifications for fire hydrant hoses.	March 21, 2012	B.1.12
50	During the period of extended operation, review the Vernon Dam owner FERC required report(s) at a minimum of every five years to confirm that the Vernon Dam owner is performing the required FERC inspections. Document deficiencies in the Entergy Corrective Actions Program and evaluate operability as described in BVY 96-043 and BVY 97-043 if it is determined that the required inspections are not being performed.	March 21, 2012	B.1.27.3
51	Entergy will perform an evaluation of operating experience at extended power uprate (EPU) levels prior to the period of extended operation to ensure that operating experience at EPU levels is properly addressed by the aging management programs. The evaluation will include Vermont Yankee (VY) and other BWR plants operating at EPU levels.	March 21, 2012	B.1.31

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
52	Implement the Neutron Absorber Monitoring Program as described in LRA Section B.1.31. Test one coupon prior to the PEO to measure B-10 areal density and assess the geometric and physical condition of the tested coupon. If coupons are not able to be retrieved and tested or if coupons cannot be demonstrated representative of the Boral in the Holtec racks, then perform neutron attenuation testing using in-situ methods, as described in BVY 11-010, (BADGER or blackness testing method) prior to the end of 2014.	March 21, 2012	B.1.31
53	During the period of extended operation, VYNPS will perform periodic volumetric examinations of small-bore Class 1 socket and butt welds. The examinations will include 10% of the Class 1 weld population greater than or equal to 1 and less than 4 inch NPS up to a total of 25 welds of each weld type. In lieu of a volumetric examination for socket welds, a destructive examination may be performed. Each destructive exam will be equivalent to two ultrasonic examinations when determining the number of completed inspections. The examination method will be a volumetric examination of the base and weld metal using a demonstrated ultrasonic examination technique. Inspection results will determine the need for additional or periodic examinations. The examinations will be performed by December 2016.	March 21, 2012	B.1.21

Number	Commitment	Enhancement or Implementation Schedule	LRA Section
54	Prior to the PEO, VYNPS will inspect portions of the standby gas treatment system buried piping. The inspections will consist of direct visual examination of a minimum of two sections of piping and cover the entire circumference of at least ten linear feet of piping in each section. During the PEO, inspections of two carbon steel piping segments in the standby gas treatment system and four carbon steel piping segments in the service water system will be performed every 10 years if measured soil resistivity is > 20,000 ohm-cm and the soil corrosivity index is 10 or less using AWWA C105. If the soil resistivity is < 20,000 ohm-cm or the soil corrosivity index is higher than 10 points using AWWA C105, the number of inspections of the standby gas treatment system buried piping will be increased to three and the number of inspections of the service water system buried piping will be increased to six. Each of these direct visual inspections following excavation will cover the entire circumference of at least ten linear feet of piping. During the PEO, two inspections covering at least 8% of the total length of in-scope buried fuel oil piping (~40 feet) will be performed at least once every 10 years. If the soil resistivity is < 20,000 ohm-cm or the soil corrosivity index is higher than 10 points using AWWA C105, the percentage of fuel oil buried piping inspected will be increased to 12%. Soil samples will be taken prior to the period of extended operation and at least once every 10 years thereafter to confirm the initial sample results.	March 21, 2012	B.1.1

APPENDIX B

CHRONOLOGY

This appendix contains a chronological listing of the licensing correspondence between the staff of the U.S. Nuclear Regulatory Commission and Entergy Nuclear Operations, Inc. This appendix updates the correspondence regarding the staff's review of the Vermont Yankee Nuclear Power Station license renewal application (under Docket No. 50-271) since the publication of Supplement 1 to NUREG-1907 in October 2009.

CHRONOLOGY	
Date	**Subject**
September 30, 2009	NUREG-1907 "Safety Evaluation Report Related to the License Renewal of Vermont Yankee Nuclear Power Station," Supplement 1 (ML092740567)
December 30, 2009	License Renewal Application Annual Update Vermont Yankee Nuclear Power Station Docket No. 50-271 License No. DPR-28 (BVY 09-073) (ML100050072)
September 3, 2010	Audit Report Regarding the Vermont Yankee Nuclear Power Station License Renewal Application (TAC NO. MC9668) (ML102070412)
September 30, 2010	License Renewal Application Supplemental Information Vermont Yankee Nuclear Power Station Docket No. 50-271 License No. DPR-28 (BVY 10-050) (ML102500065)
October 14, 2010	License Renewal Application Supplemental Information Vermont Yankee Nuclear Power Station Docket No. 50-271 License No. DPR-28 (BVY 10-052) (ML102920153)
December 21, 2010	License Renewal Application Supplemental Information Vermont Yankee Nuclear Power Station Docket No. 50-271 License No. DPR-28 (BVY 10-058) (ML103630357)
December 30, 2010	License Renewal Application Annual Update Vermont Yankee Nuclear Power Station Docket No. 50-271 License No. DPR-28 (BVY 10-069) (ML110040117)
February 4, 2011	License Renewal Application Supplemental Information Vermont Yankee Nuclear Power Station Docket no. 50-271 License No. DPR-27 (BVY 11-007) (ML110400114)
February 4, 2011	License Renewal Application Supplemental Information Vermont Yankee Nuclear Power Station Docket no. 50-271 License No. DPR-27 (BVY 11-010) (ML110400113)
February 8, 2011	License Renewal Application Supplemental Information Vermont Yankee Nuclear Power Station Docket no. 50-271 License No. DPR-27 (BVY 11-012) (ML110460051)
February 10, 2011	License Renewal Application Supplemental Information Vermont Yankee Nuclear Power Station Docket No. 50-271 License No. DPR-28 (BVY 11-013) (ML110490053)