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Volume 1

Final Safety Evaluation Report

Related to the Combined Licenses for Vogtle Electric Generating Plant, Units 3 and 4

Volume 1

Docket Nos. 52-025 and 52-026

Office of New Reactors

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ABSTRACT

This final safety evaluation report[1] (FSER) documents the U.S. Nuclear Regulatory Commission (NRC) staff's technical review of the combined license (COL) application submitted by Southern Nuclear Operating Company (SNC or the applicant), for the Vogtle Electric Generating Plant (VEGP) Units 3 and 4. The SER also documents the NRC staff's technical review of the limited work authorization (LWA) activities for which SNC has requested approval.

By letter dated March 28, 2008, SNC, acting on behalf of itself and the proposed owners (Georgia Power Company (GPC), Oglethorpe Power Corporation (an electric membership corporation), Municipal Electric Authority of Georgia, and the City of Dalton, Georgia, an incorporated municipality in the State of Georgia acting by and through its Board of Water, Light and Sinking Fund Commissioners), submitted its application to the NRC for COLs for two AP1000 advanced passive pressurized-water reactors (PWRs) pursuant to the requirements of Sections 103 and 185(b) of the Atomic Energy Act of 1954, as amended; Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, certifications and approvals for nuclear power plants"; and the associated material licenses under 10 CFR Part 30, "Rules of general applicability to domestic licensing of byproduct material"; 10 CFR Part 40, "Domestic licensing of source material"; and 10 CFR Part 70, "Domestic licensing of special nuclear material." These reactors are identified as VEGP Units 3 and 4, and will be located on the existing VEGP site in Burke County, Georgia.

In October 2009, SNC supplemented its COL application to include a request for an LWA. The LWA, in accordance with 10 CFR 50.10(d), would authorize installation of reinforcing steel, sumps, drain lines, and other embedded items along with placement of concrete for the nuclear island foundation base slab.

The initial application incorporated by reference 10 CFR Part 52, Appendix D, "Design Certification Rule for the AP1000 Design," and the Westinghouse Electric Corporation's (Westinghouse's) application for amendment of the AP1000 design, as described in Revision 16 of the Design Control Document (DCD) (submitted May 26, 2007), as well as Westinghouse Technical Report (TR)-134, APP-GW-GLR-134, "AP1000 DCD Impacts to Support COLA Standardization," Revision 4 (which was submitted on March 18, 2008). The initial application also referenced the VEGP Early Site Permit (ESP) Application, Revision 4, dated March 28, 2008. Subsequent to the initial application, in its submittal dated December 11, 2009, SNC incorporated by reference the VEGP ESP Application, Revision 5, dated December 23, 2008, as approved by the NRC in the VEGP ESP and LWA (ESP-004), dated August 26, 2009. In a letter dated August 6, 2010, SNC incorporated by reference the three amendments issued (on May 21, 2010; June 25, 2010; and July 9, 2010) to the ESP. In a letter dated June 24, 2011(submittal number 8), SNC incorporated by reference AP1000 DCD, Revision 19. The results of the NRC staff's evaluation of the AP1000 DCD are documented in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements. The results of the NRC staff's evaluation related to the VEGP ESP are documented in NUREG-1923, "Safety Evaluation Report for Early Site Permit (ESP) at the Vogtle Electric Generating Plant (VEGP) ESP Site."

[1] This FSER documents the NRC staff's position on all safety issues associated with the combined license application. The Advisory Committee on Reactor Safeguards (ACRS) independently reviewed those aspects of the application that concern safety, as well as the advanced safety evaluation report without open items (an earlier version of this document), and provided the results of its review to the Commission in a report dated January 24, 2011. This report is included as Appendix F to this SER.

This FSER presents the results of the staff's review of information submitted in conjunction with the COL application, except those matters resolved as part of the referenced ESP or design certification rule. In Appendix A to this FSER, the staff has identified certain license conditions and inspections, tests, analyses and acceptance criteria (ITAAC) that the staff recommends the Commission impose, should COLs be issued to the applicant. Appendix A includes the applicable permit conditions and ITAAC from the ESP. Therefore, Appendix A includes COL and ESP conditions, recognizing that should COLs be issued to the applicant, the ESP will be subsumed into the COLs. In addition to the ITAAC in Appendix A, the ITAAC found in the AP1000 DCD, Revision 19 Tier 1 material will also be incorporated into the COLs should COLs be issued to the applicant.

On the basis of the staff's review[2] of the application, as documented in this FSER, the staff recommends that the Commission find the following with respect to the safety aspects of the COL application: 1) the applicable standards and requirements of the Atomic Energy Act and Commission regulations have been met, 2) Required notifications to other agencies or bodies have been duly made, 3) there is reasonable assurance that the facility will be constructed and will operate in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's regulations, 4) the applicant is technically and financially qualified to engage in the activities authorized, and 5) issuance of the license will not be inimical to the common defense and security or to the health and safety of the public.

[2] An environmental review was also performed of the COL application and its evaluation and conclusions are documented in NUREG-1947, "Final Supplemental Environmental Impact Statement for Combined Licenses (COLs) for Vogtle Electric Generating Plant Units 3 and 4."

CONTENTS

The chapter and section layout of this SER is consistent with the format of: (1) NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)"; (2) Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants"; and (3) the applicant's final safety analysis report. Where applicable, references to other regulatory actions (design certifications, ESPs) are included in the text of the SER.

APPENDICES

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EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52 include requirements for licensing new nuclear power plants.[3] These regulations include the NRC's requirements for early site permit (ESP), design certification, and combined license (COL) applications. The ESP process (10 CFR Part 52, Subpart A, "Early Site Permits") is intended to address and resolve siting-related issues. The design certification process (10 CFR Part 52, Subpart B, "Standard Design Certifications") provides a means for a vendor to obtain NRC certification of a particular reactor design. Finally, the COL process (10 CFR Part 52, Subpart C, "Combined Licenses") allows an applicant to seek authorization to construct and operate a new nuclear power plant. A COL may reference an ESP, a certified design, both, or neither. As part of demonstrating that all applicable NRC requirements are met, a COL applicant referencing an ESP or certified design must demonstrate compliance with any requirements not already resolved as part of the referenced ESP or design certification before the NRC issues that COL.

This FSER describes the results of a review by the NRC staff of a COL application submitted by Southern Nuclear Operating Company (SNC or the applicant), acting on behalf of itself and the proposed owners (Georgia Power Company (GPC), Oglethorpe Power Corporation (an electric membership corporation), Municipal Electric Authority of Georgia, and the City of Dalton, Georgia, an incorporated municipality in the State of Georgia acting by and through its Board of Water, Light and Sinking Fund Commissioners), for two new reactors to be located at the Vogtle Electric Generating Plant (VEGP) site. The staff's review was to determine the applicant's compliance with the requirements of Subpart C of 10 CFR Part 52, as well as the applicable requirements under 10 CFR Parts 30, 40, and 70 governing the possession and use of applicable source, byproduct, and special nuclear materials. This FSER serves to identify the staff's conclusions with respect to the COL safety review.

The NRC regulations also require an applicant to submit an environmental report pursuant to 10 CFR Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions." The NRC reviews the environmental report as part of the Agency's responsibilities under the National Environmental Policy Act of 1969, as amended. The NRC presents the results of that review in a final environmental impact statement (FEIS), which is a report separate from this FSER. The NRC staff previously prepared an FEIS as part of its review of the VEGP ESP, which is referenced in the VEGP COL application. NUREG-1872, "Final Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site," was issued in August 2008, and can be accessed through the Agencywide Documents Access and Management System (ADAMS) at ML082260190.[4]

[3] Applicants may also choose to seek a construction permit (CP) and operating license in accordance with 10 CFR Part 50, "Domestic licensing of production and utilization facilities," instead of using the 10 CFR Part 52 process.

[4] Agencywide Documents Access and Management System (ADAMS) is the NRC's information system that provides access to all image and text documents that the NRC has made public since November 1, 1999, as well as bibliographic records (some with abstracts and full text) that the NRC made public before November 1999. Documents available to the public may be accessed via the Internet at http://www.nrc.gov/reading-rm/adams/web-based.html. Documents may also be viewed by visiting the NRC's Public Document Room at One White Flint North, 11555 Rockville Pike, Rockville, Maryland. Telephone assistance for using web-based ADAMS is available at (800) 397-4209 between 8:30 a.m. and 4:15 p.m., Eastern Time, Monday through Friday, except Federal holidays. The staff is also making this FSER available on the NRC's new reactor licensing public web site at http://www.nrc.gov/reactors/new-reactors/col/vogtle/documents/ser-final.html.

For a COL application that references an ESP, the NRC staff, pursuant to 10 CFR 51.75(c), prepares a supplement to the ESP environmental impact statement (EIS) in accordance with 10 CFR 51.92(e). NRC regulations related to the environmental review of COL applications are in 10 CFR Part 51 and 10 CFR Part 52, Subpart C. Pursuant to 10 CFR 51.50(c)(1), a COL applicant referencing an ESP need not submit information or analyses regarding environmental issues that were resolved in the ESP EIS, except to the extent that the COL applicant has identified new and significant information regarding such issues. In addition, under 10 CFR 52.39, "Finality of early site permit determinations," matters resolved in the ESP proceedings are considered to be resolved in any subsequent proceedings, absent identification of new and significant information. The staff issued a supplement to the ESP EIS, NUREG-1947, "Final Supplemental Environmental Impact Statement for Combined Licenses (COLs) for Vogtle Electric Generating Plant Units 3 and 4," for the COL on March 25, 2011, which can be accessed through ADAMS at ML11076A010.

In a letter dated March 28, 2008, the SNC, acting on behalf of itself and the proposed owners, submitted its application to the NRC for COLs for two AP1000 advanced passive pressurized-water reactors (PWRs) (ADAMS Accession No. ML081050133) to be located at the VEGP site. SNC identified the two units as VEGP Units 3 and 4. The VEGP site is located on a coastal plain bluff on the southwest side of the Savannah River in eastern Burke County, Georgia. The site is approximately 26 miles southeast of Augusta, Georgia, and 100 miles northwest of Savannah, Georgia. Directly across from the site, on the eastern side of the Savannah River, is the U.S. Department of Energy's (DOE's) Savannah River site in Barnwell County, South Carolina. The proposed VEGP Units 3 and 4 would be built on the VEGP site adjacent to two existing nuclear power reactors, VEGP Units 1 and 2, operated by SNC.

In October 2009, SNC supplemented its COL application to include a request for an LWA. The LWA, in accordance with 10 CFR 50.10(d), would authorize installation of reinforcing steel, sumps, drain lines, and other embedded items along with placement of concrete for the nuclear island foundation base slab.

The initial application incorporated by reference 10 CFR Part 52, Appendix D, "Design Certification Rule for the AP1000 Design," and the Westinghouse Electric Corporation's (Westinghouse's) application for amendment of the AP1000 design, as supported by Revision 16 of the Design Control Document (DCD) (submitted May 26, 2007) as well as Westinghouse Technical Report (TR)-134, APP-GW-GLR-134, "AP1000 DCD Impacts to Support COLA Standardization," Revision 4 (which was submitted on March 18, 2008). The initial application also referenced the VEGP Early Site Permit (ESP) Application, Revision 4, dated March 28, 2008. Subsequent to the initial application, in its submittal dated December 11, 2009, SNC incorporated by reference the VEGP ESP Application, Revision 5, dated December 23, 2008, as approved by the NRC in the VEGP ESP and LWA (ESP-004), dated August 26, 2009. In a letter dated August 6, 2010, SNC incorporated by reference the three amendments issued (on May 21, 2010; June 25, 2010; and July 9, 2010) to the ESP. In a letter dated June 24, 2011(submittal number 8), SNC incorporated by reference AP1000 DCD, Revision 19. The results of the NRC staff's evaluation of the AP1000 DCD are documented in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements. The results of the NRC staff's evaluation related to the VEGP ESP are documented in NUREG-1923, "Safety Evaluation Report for Early Site Permit (ESP) at the Vogtle Electric Generating Plant (VEGP) ESP Site." This FSER presents the results of the staff's review of information submitted in conjunction with the COL application, including any matters that were not already resolved as part of the referenced ESP or the referenced design certification, or subject to resolution in the pending design certification amendment proceeding.

The staff has identified in Appendix A to this FSER certain license conditions, and inspections, tests, analyses and acceptance criteria (ITAAC) that the staff recommends the Commission impose, should COLs be issued to the applicant. Appendix A includes the applicable permit conditions and ITAAC from the ESP. Therefore, Appendix A includes COL and ESP conditions, recognizing that should COLs be issued to the applicant, the ESP will be subsumed into the COLs. In addition to the ITAAC in Appendix A, the ITAAC found in the AP1000 DCD, Revision 19 Tier 1 material will also be incorporated into the COLs should COLs be issued to the applicant.

Inspections conducted by the NRC have verified, where appropriate, the conclusions in this FSER. The inspections focused on selected information in the COL application and its references. The FSER identifies applicable inspection reports as reference documents.

The NRC's Advisory Committee on Reactor Safeguards (ACRS) also reviewed the bases for the conclusions in this report. The ACRS independently reviewed those aspects of the application that concern safety, as well as the advanced safety evaluation report without open items earlier version of this document, and provided the results of its review to the Commission in a report dated January 24, 2011. Appendix F includes a copy of the report by the ACRS on the COL application, as required by 10 CFR 52.87, "Referral to the Advisory Committee on Reactor Safeguards (ACRS)."

ABBREVIATIONS

χ/Q	atmospheric dispersion
A2LA	American Association for Laboratory Accreditation
ac	alternating current
ACI	American Concrete Institute
ACP	access control parts
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
ADS	automatic depressurization system
AE	architect-engineer
AFFF	aqueous film forming foam
ALARA	as low as is reasonably achievable
ALI	annual limits on intake
ALWR	advanced light-water reactor
ANI	American Nuclear Insurers
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOO	anticipated operational occurrence
AOV	air-operated valve
ARS	amplified response spectra
ASCE	American Society of Civil Engineers
ASE	advanced safety evaluation
ASLB	Atomic Safety and Licensing Board
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATE	advisory to evacuate
ATWS	anticipated transients without scram
AWWA	American Water Works Association
BBM	Blue Bluff Marl
BCEMA	Burke County Emergency Management Agency
BDBE	beyond-design basis event
BL	Bulletin
BLN	Bellefonte Nuclear Station
BOP	balance of plant
BPV	Boiler & Pressure Vessel Code (ASME BPV Code)
BTP	Branch Technical Position
BWR	boiling-water reactor
C	Celsius
C&C	command & control
CAS	central alarm station
CAV	cumulative absolute velocity
CCS	component cooling water system
CDA	critical digital asset
CDE	committed dose equivalent

CDF	core damage frequency
CDI	conceptual design information
CDM	certified design material
CECC	Central Emergency Control Center
CEUS	Central and Eastern United States
cfm	cubic feet per minute
CFR	*Code of Federal Regulations*
cGy	centiGray
cm	centimeters
CMT	core makeup tank
COL	combined license
COLA	combined license application
CP	construction permit
cpm	counts per minute
CR	control room
CRDM	control rod drive mechanism
CRDS	control rod drive system
CS	containment system
CS	core supports
CSA	control support area
CSC	Communication Support Center
CSDRS	certified seismic design response spectra
CSP	Cyber Security Plan
CST	cyber security team
CTA	critical target area analysis
CVCS	chemical and volume control system
CVS	portions of the chemical and volume control system
CWS	circulating water system
D/Q	dry deposition factor
DAC	derived air concentration
DAS	Diverse Actuation System
DBA	design-basis accident
DBT	design-basis threat
dc	direct current
DC	design certification
DCA	design certification amendment
DCD	design control document
DCP	Design Change Package
DCRA	design-centered review approach
DECT	Digital Enhanced Cordless Telecommunication
DEP	Departure
DG	diesel generator
DHEC	Department of Health and Environmental Control
DHS	Department of Homeland Security
DNBR	departure from nucleate boiling ratio
DOE	Department of Energy
DOT	Department of Transportation
D-RAP	Design Reliability Assurance Program
DTS	demineralized water treatment system
DWS	demineralized water system

EAB	exclusion area boundary
EAL	emergency action level
EAS	Emergency Alert System
ECCS	emergency core cooling system
ED	Emergency Director
EDMG	Extensive Damage Mitigation Guidelines
EIP	emergency implementing procedure
EIS	Environmental Impact Statement
El.	Elevation
ELS	plant lighting system
EMA	Emergency Management Agency
ENC	Emergency News Center
ENN	Emergency Notification Network
ENS	Emergency Notification System
EOC	Emergency Operations Center
EOF	Emergency Operations Facility
EOM	Emergency Offsite Manager
EOP	emergency operating procedure
EP	Emergency Plan
EP	emergency planning
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005
EPC	Engineering, Procurement and Construction
EPI	Emergency Public Information
EPIO	Emergency Public Information Office
EPIP	emergency plan implementing procedures
EP-ITAAC	emergency planning-inspections, tests, analyses, and acceptance criteria
EPM	Emergency Plant Manager
EPOS	Emergency Plant Operations Supervisor
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
EQ	environmental qualification
EQMEL	Environmental Qualification Master Equipment List
ER	Environmental Report
ERDS	Emergency Response Data System
ERF	emergency response facilities
ERO	emergency response officer
ERO	Emergency Response Organization
ESF	engineered safety feature
ESP	Early Site Permit
ESPA	Early Site Permit Application
ESSX	Electric Switch System Exchange
ETE	evacuation time estimate
ETS	Emergency Telecommunications System
F	Fahrenheit
FAA	Federal Aviation Administration
FAC	flow-accelerated corrosion
FBI	Federal Bureau of Investigation
FCEMS	Fairfield County Emergency Medical Services

FD1W	Feeder Ditch 1
FEIS	final environmental impact statement
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFD	fitness-for-duty
FIFO	first-in-first-out
FIRS	foundation input response spectra
FIV	flow induced vibration
FMCRD	fine motion control rod drive
FMEA	failure mode and effects analysis
fps	feet per second
FPS	fire protection system
FR	*Federal Register*
FRS	floor response spectra
FSAR	final safety analysis report
FSER	final safety evaluation report
ft	feet
FTS	Federal Telecommunications System
GALL	Generic Aging Lessons Learned
GCC	Georgia Transmission Control Center
GDC	General Design Criteria (Criterion)
GEMA	Georgia Emergency Management Agency
GIS	Geographical Information System
GL	Generic Letter
GMRS	ground motion response spectra
GPC	Georgia Power Company
gpm	gallons per minute
GPSC	Georgia Public Service Commission
GSI	Generic Safety Issue
GSM	Global System for Mobile Communications
GSU	generator step-up
GTS	generic technical specification
GWMS	gaseous waste management system
h	hour
HCLPF	high confidence, low probability of failure
HCM	Highway Capacity Manual
HCU	hydraulic control unit
HDPE	high-density polyethylene
HEPA	high efficiency particulate air
HFE	human factors engineering
HICs	high integrity containers
HLD	heavy lift derrick
HP	health physics
HPN	Health Physics Network
HPS	Health Physics Society
HRA	human reliability analysis
HSI	human-system interface
HV	high voltage

HVAC	heating, ventilation, and air conditioning
Hz	Hertz
I&C	instrumentation and controls
IC	initiating conditions
ICM	Interim Compensatory Measures
ICMO	interim compensatory order
iDEN	Integrated Digital Enhanced Network
IDLH	immediate danger to life and health
IEC	International Electrotechnical Commission
IED	Interim Emergency Director
IEEE	Institute of Electrical and Electronic Engineers
IFR	interim findings report
IGSCC	intergranular stress corrosion cracking
IHP	integrated head package
IIS	incore instrumentation system
ILAC	International Laboratory Accreditation Cooperation
in.	inches
INPO	Institute of Nuclear Power Operations
IPEEE	Individual Plant Examination of External Events
IPSAC	Investment Protection Short-Term Availability Control
IPZ	Ingestion Pathway Emergency Planning Zone
IRWST	in-containment refueling water storage tank
ISA	Independent Safety Assessment
ISFSI	independent spent fuel storage installation
ISG	Interim Staff Guidance
ISI	inservice inspection
ISO	International Standardization Organization
ISRS	in-structure response spectra
IST	inservice testing
ITAAC	inspections, tests, analyses, and acceptance criteria
ITP	initial test program
JIC	joint information center
JOG	Joint Owners Group
JTWG	Joint Test Working Group
KI	radio-protective drugs
Kips	kilo pounds
km	kilometers
kPa	kilopascals
kV	kilovolt
kVA	kilovolt amps
kWe	kilowatt electric
LAN	Local Area Network
lb/ft^2	pounds per square foot
LBB	leak-before-break
LCEMS	Lexington County Emergency Medical Services
LCO	limiting condition for operation
LEFM	Leading Flow Edge Meter
LFL	lower flammability limit

LLEA	local law enforcement agency
LLHS	light-load handling system
LLNL	Lawrence Livermore National Laboratory
LLRW	low-level radioactive waste
LOA	Letters of Agreement
LOCA	loss-of-coolant accident
LOLA	loss of large areas
LOOP	loss of offsite power
lpm	liter(s) per minute
LPZ	low population zone
LRF	large release frequency
LSS	low strategic significance
LTOP	low-temperature overpressure protection
LWA	limited work authorization
LWMS	liquid waste management system
LWR	light-water reactor
m	meter(s)
MC	main condenser
MC&A	material control and accounting
MCL	Management Counterpart Link
MCR	main control room
MEAG	Municipal Electric Authority of Georgia
MEI	maximally exposed individual
MERT	Medical Emergency Response Team
mi	mile(s)
MIT	Massachusetts Institute of Technology
MN	Mega Newton
M-O	Mononobe-Okabe
MOU	Memorandum of Understanding
MOV	motor-operated valve
MOX	mixed-oxide
MPA	methoxypropylamine
mph	miles per hour
MR	Maintenance Rule
MRA	Mutual Recognition Arrangement
mrem	millirem
MSD	Mitigative Strategies Description
msl	mean sea level
MSLB	main steam line break
MSSS	main steam supply system
MST	Mitigative Strategies Table
mSv	millisievert
MT	magnetic particle
MUR	measurement uncertainty recapture
MVAR	mega volt amp reactive
MW	megawatt
MWe	megawatts electric
MWt	megawatts thermal

NDCT	natural draft cooling tower
NDL	nuclear data ink
NDQAM	Nuclear Development and Construction Quality Assurance Manual
NEI	Nuclear Energy Institute
NEMA	National Electrical Manufacturers Association
NERC	North American Electric Reliability Corporation
NFPA	National Fire Protection Association
NI	nuclear island
NIRMA	Nuclear Information and Records Management Association
NIST	National Institute of Standards and Technology
NNR	non-nuclear safety
NOV	Notice of Violation
NPIR	Nuclear Plant Interface Requirement
NPPENF	Nuclear Power Plant Emergency Notification
NRC	U.S. Nuclear Regulatory Commission
NRO	Office of New Reactors
NS	nonseismic
NSSS	nuclear steam system supply
NUMARC	Nuclear Management and Resources Council
NVLAP	National Voluntary Laboratory Accreditation Program
NWS	National Weather Service
OBE	operating basis earthquake
OCA	owner controlled area
OCL	Operational Center Local
ODCM	Offsite Dose Calculation Manual
OE	operating experience
OER	operating experience review
OHLHS	overhead heavy-load handling system
OM	Operations and Maintenance (ASME OM Code)
OPC	Oglethorpe Power Corporation
OPRAA	operational phase reliability assurance activity
ORE	occupational radiation exposure
ORM	Onsite Radiation Manager
OSC	Operations Support Center
p.u.	per unit
PA	protected area
PAD	protective action decisions
PAG	protected area guidelines
PAR	protective action recommendations
PAZ	protective action zones
PC	Permit Condition
PCC	Power Coordination Center
PCCAWST	passive containment cooling ancillary water storage tank
PCCWST	passive containment cooling water storage tank
PCP	Process Control Program
PCS	passive containment cooling system
PDC	Personal Digital Cellular
PDP	procedure development program
PE	polyethylene

PGA	peak ground acceleration
PGP	procedures generation package
PM	preventive maintenance
PMCL	Protective Measures Counterpart Link
PMF	probable maximum flood
PMH	probable maximum hurricane
PMP	probable maximum precipitation
PMS	protection and safety monitoring
PMT	probable maximum tsunami
PMWP	probable maximum winter precipitation
PMWS	probable maximum wind storm
PNS	Prompt Notification System
POV	power-operated valve
ppm	parts per million
PRA	probabilistic risk assessment
PRHR	passive residual heat removal
psf	pounds per square foot
PSHA	probabilistic seismic hazard analysis
PSI	preservice inspection
psi	per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PS-ITAAC	physical security-inspection, test, analysis, and acceptance criteria
PSO	power systems operations
PSP	Physical Security Plan
PSS/E	Power System Simulator for Engineering
P-T	pressure temperature
PT	liquid penetrant
PT&O	plant test and operations
PTLR	pressure-temperature limits report
PTS	pressurized thermal shock
PTS	plant-specific technical specifications
PWR	pressurized-water reactor
PWS	potable water system
PWSCC	primary water stress corrosion cracking
PXS	passive core cooling system
QA	quality assurance
QAPD	Quality Assurance Program description
QAPD	Quality Assurance Program Document
QATR	Quality Assurance Topical Report
QC	quality control
QDF	queue discharge flow
QG	quality group
RAI	request for additional information
RAP	reliability assurance program
RAT	reserve auxiliary transformer
RCCA	rod cluster control assembly
RCL	reactor coolant loop
R-COL	reference combined license

RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
REAC/TS	Radiation Emergency Assistance Center / Training Site
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
REP	radiological emergency preparedness
RERP	radiological emergency response plan
RET	Radiological Emergency Team
RETS	radiological effluent technical specification
RG	regulatory guide
RIS	Regulatory Issue Summary
RLE	review-level earthquake
RMS	radiation monitoring system
RNS	normal residual heat removal system
RO	reactor operator
RPP	Radiation Protection Program
RPV	reactor pressure vessel
RRS	required response spectrum
RSCL	Reactor Safety Counterpart Link
RTDP	revised thermal design procedure
RT_{NDT}	nil-ductility reference transition temperature
RTNSS	regulatory treatment of nonsafety systems
RTP	rated thermal power
RT_{PTS}	pressurized thermal shock reference temperature
RV	reactor vessel
RVSP	reactor vessel surveillance capsule program
RWS	raw water system
RXS	reactor system
s	second
S&PC	steam and power conversion
SAMG	severe accident management guidance
SAR	safety analysis report
SAS	secondary alarm station
SASSI	system for analysis of soil structure interaction
SAT	systematic approach to training
SBAA	Southern Balancing Authority Area
SBO	station blackout
SC	steel concrete composite
SCBA	self-contained breathing apparatus
SCDPRT	South Carolina Department of Parks, Recreation and Tourism
SCE&G	South Carolina Electric and Gas Company
SCEMD	South Carolina Emergency Management Division
S-COL	subsequent combined license
SCP	Safeguards Contingency Plan
SCSN	South Carolina State Network
SCT	Southern Company Transmission
SE	safety evaluation
SECY	Secretary of the Commission, Office of the Nuclear Regulatory Commission
SER	safety evaluation report

SFP	spent fuel pool
SFS	spent fuel pool cooling system
SG	steam generator
SGI	safeguards information
SGTR	steam generator tube rupture
SMA	seismic margin analysis
SNC	Southern Nuclear Operating Company
SNM	special nuclear material
SOT	station orientation training
SP	Setpoint Program
SPDS	safety parameter display system
SR	surveillance requirement
SREC	standard radiological effluent control
SRM	Staff Requirements Memorandum
SRO	senior reactor operator
SRP	standard review plan
SRSS	square root sum of squares
SSAR	Site Safety Analysis Report
SSCs	structures, systems, and components
SSE	safe shutdown earthquake
SSEP	safety, security and/or emergency preparedness
SSI	soil structure interaction
SS-ITAAC	site-specific inspections, tests, analyses and acceptance criteria
STAC	short-term availability control
STD	Standard
STS	Standard Technical Specification
SUNSI	sensitive unclassified non-safeguard information
SUP	Supplement
Sv	Sievert
SWMS	solid waste management system
SWS	service water system
T&QP	Training and Qualification Plan
TCS	turbine building closed cooling water system
TDMA	Time Division Multiple Access
TEDE	total effective dose equivalent
TG	turbine-generator
TGS	turbine generator system
TLD	thermoluminescent dosimeter
TMI	Three Mile Island
TNT	trinitrotoluene
TR	technical report
TRS	test response spectrum
TS	Technical Specification
TSC	Technical Support Center
TSO	transmission system operator
TSTF	Technical Specification Task Force
TVA	Tennessee Valley Authority
UAT	unit auxiliary transformer
UBC	Uniform Building Code

UFL	upper flammability limit
UFM	ultrasonic flow meter
UHS	ultimate heat sink
UPS	uninterruptible power supply
USACE	U.S. Army Corps of Engineers
USE	upper shelf energy
USGS	United States Geological Society
UT	ultrasonic
V	volt
V&V	verification and validation
VAR	Variance
VBS	nuclear island non-radioactive ventilation system
Vdc	volts direct current
VEGP	Vogtle Electric Generating Plant
VES	main control room emergency habitability system
VFS	containment air filtration system
VHRA	very high radiation area
VOIP	Voice Over Internet Protocol
VPN	Virtual Private Network
WCAP	Westinghouse Commercial Atomic Power
WCS	Waste Control Specialist
WEC	Westinghouse Electric Company
WLS	liquid radioactive waste system
WLS	liquid radwaste system
WWRB	waste water retention basin
WWS	waste water system
YFS	yard fire water system
ZRS	offsite retail power system

1.0 INTRODUCTION AND INTERFACES

This chapter of the final safety evaluation report (FSER) is organized as follows:

- Section 1.1 provides an overview of the entire combined license (COL) application;
- Section 1.2 provides the regulatory basis for the COL licensing process;
- Section 1.3 provides an overview of the COL application principal review matters and where the staff's review of the 11 parts of the COL application is documented;
- Section 1.4 documents the staff's review of Chapter 1 of the final safety analysis report (FSAR); and
- Section 1.5 documents regulatory findings that are in addition to those directly related to the staff's review of the FSAR.

1.1 Summary of Application

In a letter dated March 28, 2008, the Southern Nuclear Operating Company (SNC), acting on behalf of itself and Georgia Power Company, Oglethorpe Power Corporation, Municipal Electric Authority of Georgia, and the City of Dalton, Georgia, an incorporated municipality in the State of Georgia acting by and through its Board of Water, Light and Sinking Fund Commissioners (Dalton Utilities), submitted its application to the U.S. Nuclear Regulatory Commission (NRC or the Commission) for COLs for two AP1000 advanced passive pressurized-water reactors (PWRs) pursuant to the requirements of Sections 103 and 185(b) of the Atomic Energy Act, Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications and Approvals for Nuclear Power Plants," and the associated material licenses under 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," 10 CFR Part 40, "Domestic Licensing of Source Material," and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material." These reactors would be identified as Vogtle Electric Generating Plant (VEGP) Units 3 and 4, and would be located on the existing VEGP site in Burke County, Georgia.

Unless otherwise noted, this FSER (also referred to as the SER or Advanced SER in later sections of this document) is based on Submittal 8 (Revision 5 of the FSAR) of VEGP's COL application, which was submitted via letter (ADAMS Accession Number ML11180A086) dated June 24, 2011.

As indicated in the applicant's June 24, 2011, Submittal 8, the application incorporates by reference 10 CFR Part 52, Appendix D, "Design Certification Rule for the AP1000 Design," and the Westinghouse Electric Corporation's (Westinghouse's) application for amendment to portions of the Design Control Document (DCD) Revision 19. The application also incorporates by reference the VEGP Early Site Permit (ESP) Application, Revision 5, dated December 23, 2008, as approved by the NRC in the Vogtle Early Site Permit and Limited Work Authorization (ESP-004), dated August 26, 2009, including three amendments that were subsequently issued (on May 21, 2010, June 25, 2010 and July 9, 2010) to the ESP Permit. In addition, in a letter dated October 2, 2009, SNC requested a second limited work authorization (LWA) as part of the COL application in accordance with 10 CFR 50.10(d), "Request for limited work authorization." The LWA request involves installing reinforcing steel, sumps and drain

lines and other embedded items in the NI foundation base slab, and placement of concrete for the Nuclear Island (NI) foundation base slab.

The AP1000 nuclear reactor design is a PWR with a power rating of 3400 megawatts thermal (MWt) and an electrical output of at least 1000 megawatts electric (MWe). The AP1000 design uses safety systems that rely on passive means, such as gravity, natural circulation, condensation and evaporation, and stored energy for accident prevention and mitigation.

In developing the FSER for VEGP Units 3 and 4, the staff reviewed the AP1000 DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to a particular review topic. Because of its reliance on both the AP1000 DCD and the DCD FSER, the staff did not issue the VEGP FSER chapter until the AP1000 design certification amendment (DCA) FSER was issued. This allowed the staff to review the AP1000 DCA FSER and identify any issues that could affect the review of the VEGP COL application.

There is an AP1000 DCA FSER chapter that has been issued that does not have a corresponding VEGP COL FSER chapter. Specifically, AP1000 DCA FSER Chapter 23, "Design Changes Proposed in Accordance with ISG-11," which has been issued, does not have a corresponding VEGP COL SER chapter. Chapter 23 describes the staff's evaluation and findings for the information Westinghouse submitted after the submittal of DCD Revision 17, in order to address one or more of the criteria identified in Interim Staff Guidance (ISG), DC/COL-ISG-11, "Interim Staff Guidance Finalizing Licensing-basis Information." This information was subsequently incorporated into AP1000 DCD Revision 18. In the case where the information that is evaluated in AP1000 DCA FSER Chapter 23 affected the COL application, this issue was evaluated in the appropriate VEGP COL FSER chapter. Specifically, STD COL 5.2-3, associated with unidentified reactor coolant system leakage inside containment, was created as a result of changes evaluated in AP1000 DCA FSER Chapter 23. The staff's evaluation of the information in the VEGP COL application that addresses this COL information item is found in Chapter 5 of this FSER.

The VEGP Units 3 and 4 COL application is organized as follows:

- **Part 1 General and Administrative Information**

Part 1 provides an introduction to the application and includes certain corporate information regarding SNC pursuant to 10 CFR 50.33(a) – (d).

- **Part 2 Final Safety Analysis Report**

Part 2 includes information pursuant to the requirements of 10 CFR 52.79 and, in general, adheres to the content and format guidance provided in Regulatory Guide (RG) 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

- **Part 3 Environmental Report**

Part 3 includes environmental information pursuant to the requirements of 10 CFR 52.80 and 10 CFR 51.50(c).

- **Part 4 Technical Specifications**

Part 4 addresses how the AP1000 Generic Technical Specifications (GTS) and Bases are incorporated by reference into the VEGP Units 3 and 4 Plant-Specific Technical Specifications (PTS) and Bases. Specifically, Section A addresses completion of bracketed information. Section B provides a complete copy of the VEGP Units 3 and 4 PTS and Bases.

- **Part 5 Emergency Plan**

Part 5 incorporates the VEGP onsite emergency plan (included in Part 5 of the referenced VEGP ESP application), including supporting information (e.g., letters of agreements with offsite supporting governmental agencies and organizations). The offsite State and local emergency plans and evacuation time estimates (ETEs) for the VEGP plume exposure pathway were included in the ESP application.

- **Part 6 Limited Work Authorization**

On October 2, 2009, SNC and its four co-applicants submitted a request for a second limited work authorization (LWA) as part of its COL application. The requested activities under this LWA include:

> Installation of reinforcing steel, sumps, and drain lines and other embedded items in the nuclear island (NI) foundation base slab, placement of concrete for the NI foundation base slab.

In addition, SNC provided supplemental environmental information pursuant to the requirements of 10 CFR 51.49, "Environmental report—limited work authorization."

- **Part 7 Departures Report**

Part 7 includes information regarding "departures" and "exemptions." SNC identified six departures related to: (1) administrative departure for organization and numbering for the FSAR sections; (2) potable water system (PWS) filtration; and (3) the relocation of emergency response facilities. SNC also identified one exemption from 10 CFR Part 52, Appendix D, Section IV.A.2.a, related to COL application organization and numbering. In a letter dated October 15, 2010, the applicant proposed to include a departure (Departure 4) from DCD Section 8.3.2.2 clarifying the current limiting feature of voltage regulating transformers. The AP1000 DCD states that, for applicants who choose to use the sprayed-on waterproofing membrane system for foundations, the waterproofing material will consist of 100-percent solid materials based on polymer-modified asphalt or polyurea. However, the applicant proposed a Tier 2 departure (Departure 6). Specifically, the applicant stated that the material chosen for VEGP Units 3 and 4 ESP application site safety analysis report (SSAR) is an elastomeric membrane material utilizing Methyl Methacrylate resins as the base material. The applicant provided a departure from the AP1000 DCD to address the design information regarding the mudmat. The AP1000 DCD states that the lower and upper mudmat are a minimum 6 inches thick of unreinforced concrete. However, the lower and upper mudmats chosen for the VEGP ESP SSAR consist of a 6-inch layer of non-reinforced concrete. In a letter dated November 23, 2010, the applicant requested an exemption from the requirements of 10 CFR 70.22(b); 10 CFR 70.32(c) and in turn, 10 CFR 74.31, "Nuclear material control and accounting for special nuclear material of low strategic significance"; 10 CFR 74.41, "Nuclear

material control and accounting for special nuclear material of moderate strategic significance"; and 10 CFR 74.51. "Nuclear material control and accounting for strategic special nuclear material." The applicant requested the exemption so that the exceptions allowed in these regulations for nuclear reactors licensed under 10 CFR Part 50, "Domestic licensing of production and utilization facilities," will also be applied to those licensed under 10 CFR Part 52.

Part 7 also includes 6 variances from the VEGP ESP SSAR.

- **Part 8 Security Plan**

Part 8 addresses the VEGP Units 3 and 4 Safeguards/Security Plan, which consists of the Physical Security Plan, the Training and Qualification Plan, and the Safeguards Contingency Plan. The Security Plan is submitted to the NRC as a separate licensing document in order to fulfill the requirements of 10 CFR 52.79(a)(35) and 10 CFR 52.79(a)(36). The Plan is categorized as Security Safeguards Information and is withheld from public disclosure pursuant to 10 CFR 73.21, "Protection of safeguards information: performance requirements."

- **Part 9 Withheld Information**

Part 9 identifies sensitive information that is withheld from public disclosure under 10 CFR 2.390, "Public inspections, exemptions, requests for withholding." The information in this part includes sensitive unclassified non-safeguards information. The information in this section includes figures from Part 2 of the application that meet the sensitive unclassified nonsafeguards information (SUNSI) guidance for withholding from the public. In addition, this part of the application includes the following information:

- The withheld portion of the Mitigative Strategies Description and Plans for loss of large areas of the plant due to explosions or fire, as required by 10 CFR 52.80(d), and

- VEGP Units 3 and 4 Cyber Security Plan, as required by 10 CFR 73.54, "Protection of Digital Computer and Communication Systems and Networks."

- **Part 10 Proposed Combined License Conditions (Including ITAAC)**

Part 10 addresses VEGP Units 3 and 4 proposed license conditions including inspections, tests, analyses, and acceptance criteria (ITAAC) information in accordance with 10 CFR 52.80. A table of the proposed license conditions is provided in Part 10 of Section 1.3 of this SER.

The contents of the environmental protection plan (and associated license conditions) are not evaluated in this SER. Part 10 of the application incorporates by reference the AP1000 DCD Tier 1 information, including ITAAC. In addition, the application includes site-specific ITAAC (e.g., emergency planning and electrical).

- **Part 11 Enclosures**

Part 11 includes six enclosures submitted by the applicant in support of the VEGP Units 3 and 4. Specifically, these enclosures include:

- Enclosure 11A describes the SNC Nuclear Development Quality Assurance Manual (NDQAM). The NDQAM is the top-level policy document that establishes the quality

assurance (QA) policy and assigns major functional responsibilities for nuclear development activities conducted by or for SNC.

- Enclosure 11B includes mitigative strategies description and plans for loss of large areas of the plant due to explosions or fire, as required by 10 CFR 52.80(d). The SUNSI version of this enclosure is provided in Part 9 of the application.

- Enclosure 11C includes the cyber security plan. The SUNSI version of the cyber security plan is provided in Part 9 of the application.

- Enclosure 11D describes the VEGP Special Nuclear Material (SNM) Material Control and Accounting (MC&A) Program.

- Enclosure 11E describes the VEGP new fuel shipping plan.

- Enclosure 11F describes the supplemental information in support of 10 CFR Part 70 SNM application.

SNC organized and annotated its COL application to clearly identify: a) sections that incorporate by reference the AP1000 DCD; b) sections that are standard for COL applicants in the AP1000 design center; and c) sections that are site-specific and thus only apply to SNC/VEGP Units 3 and 4. The following notations have been used by the applicant for the departures from and/or supplements to the referenced DCD included in this COL application:

- STD – standard (STD) information that is identical in each COL referencing the AP1000

- VEGP – plant-specific information that is specific to this application

- DEP – departure (DEP) from the DCD

- COL – COL information item identified in the DCD

- SUP – information that supplements (SUP) information in the DCD

- CDI – design information replacing CDI included in the DCD but not addressed within the scope of the DCD review

- ESP – information addressed in the VEGP ESP

- VAR – information related to a variance (VAR) from the VEGP ESP

1.2 Regulatory Basis

1.2.1 Applicable Regulations

10 CFR Part 52, Subpart C, "Combined Licenses," sets out the requirements and procedures applicable to Commission issuance of a COL for nuclear power facilities. The following are of particular significance:

- 10 CFR 52.79, "Contents of applications; technical information in final safety analysis report," identifies the technical information for the FSAR.
- 10 CFR 52.79(d) provides additional requirements for a COL referencing a standard certified design.
- 10 CFR 52.80, "Contents of applications; additional technical information," provides additional technical information outside of the FSAR (ITAAC and the environmental report).
- 10 CFR 52.81, "Standards for review of applications," provides standards for reviewing the application.
- 10 CFR 52.83, "Finality of referenced NRC approvals; partial initial decision on site suitability," provides for the finality of referenced NRC approvals (i.e., standard design certification (DC)).
- 10 CFR 52.85, "Administrative review of applications; hearings," provides requirements for administrative reviews and hearing.
- 10 CFR 52.87, "Referral to the Advisory Committee on Reactor Safeguards (ACRS)," provides for referral to the ACRS.

The NRC staff reviewed this application according to the standards set out in

- 10 CFR Part 20, "Standards for Protection Against Radiation"
- 10 CFR Part 30
- 10 CFR Part 40
- 10 CFR Part 50
- 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions"
- 10 CFR Part 52
- 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants"
- 10 CFR Part 55, "Operators' Licenses"

- 10 CFR Part 70
- 10 CFR Part 73, “Physical Protection of Plants and Materials”
- 10 CFR Part 74, “Material Control and Accounting of Special Nuclear Material”
- 10 CFR Part 100, “Reactor Site Criteria”
- 10 CFR Part 140, “Financial Protection Requirements and Indemnity Agreements“

The staff evaluated the application against the acceptance criteria provided in the following:

- NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)”
- NUREG-1555, “Standard Review Plans for Environmental Reviews for Nuclear Power Plants”
- NUREG-1577, “Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance”

In addition, the staff considered the format and content guidance in RG 1.206[5] for the COL application.

1.2.2 Finality of Referenced NRC Approvals

In accordance with 10 CFR 52.83, if the application for a COL references a DC rule, the scope and nature of matters resolved in the DC for the application and any COL issued are governed by 10 CFR 52.63, “Finality of standard design certifications.” In addition, if the application for a COL references an ESP, the scope and nature of matters resolved in the ESP for the application and any COL issued are governed by 10 CFR 52.39, “Finality of early site permit determinations.”

The VEGP COL application references the VEGP ESP Site Safety Analysis Report, Revision 5. The ESP and LWA (ESP-004) were issued by the NRC on August 26, 2009.

Based on the finality afforded to referenced certified designs and ESPs, the scope of this COL application review, as it relates to the referenced certified design and ESP, is limited to items that fall outside the scope of the certified design (e.g., COL information items, design information replacing conceptual design information (CDI), and programmatic elements that are the responsibility of the COL) or the ESP.

The certified AP1000 design currently incorporated by reference in 10 CFR Part 52, Appendix D, is based on the AP1000 DCD as amended through Amendment 15. This COL application also incorporates by reference the AP1000 DCA application. The results of the NRC

[5] 10 CFR Part 52, Appendix D, Section IV.A.2.a, requires the COL application to include a plant-specific DCD that describes the same type of information and uses the same organization and numbering as the generic DCD. The generic DCD used RG 1.70, “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition),” Revision 3 as a guide for the format and content. RG 1.206 was issued after the initial certification of the AP1000; thus, there are anticipated differences between the VEGP 3 and 4 COL application and the guidance of RG 1.206.

staff's technical evaluation of the AP1000 DCA application are documented in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements. Since the AP1000 DCA is not yet certified, the applicant has not incorporated the 10 CFR Part 52 – codified version of the DCA into its application. The incorporation of the AP1000 DCA into the VEGP COL application is **Confirmatory Item 1-1**.

Resolution of Standard Content Confirmatory Item 1-1

Confirmatory Item 1-1 involves a commitment by the applicant to make changes to the VEGP COL application to incorporate by reference the certified AP1000 design as documented in 10 CFR Part 52, Appendix D following the pending DCA. In a letter dated June 24, 2011, the applicant provided submittal number 8 related to the VEGP COL application. In this letter, the applicant noted that it was incorporating by reference AP1000 DCD, Revision 19. In a February 24, 2011, *Federal Register* (76 FR 10269), the NRC issued a notice of proposed rulemaking to codify the AP1000, as amended, in 10 CFR Part 52, Appendix D. As stated in the *Federal Register* notice, the basis for the proposed rulemaking is AP1000 DCD, Revision 18, which was submitted by Westinghouse on December 1, 2010. Subsequent to the issuance of AP1000 DCD, Revision 18, on June 13, 2011, Westinghouse provided AP1000 DCD, Revision 19, to the NRC. The staff has evaluated whether any changes in AP1000 DCD, Revision 19 (relative to Revision 18), should be incorporated as part of the DCA, and the staff's safety evaluation associated with Revision 19 was issued on August 5, 2011. If the Commission incorporates any of these changes into the DCA, then the codified version of the AP1000 DCD would be based on Revision 19.

This FSER is based on the applicant's submittal 8, which incorporates by reference AP1000 DCD Revision 19. As noted in VEGP COL FSAR Section 1.1, Appendix D to 10 CFR Part 52 is incorporated by reference into the VEGP COL application. Prior to issuing the VEGP COLs, the staff must verify that the certified version of the AP1000 DCD is incorporated by reference in the VEGP COL application. Although FSAR Section 1.1 does not specify AP1000 DCD Revision 19 as the basis for 10 CFR Part 52 Appendix D, this FSER assumes that the changes in Revision 19 will be incorporated and approved in the rulemaking. In that event, if the VEGP COLs are issued (assuming all other necessary findings can be made), AP1000 DCD Revision 19 will be incorporated into the COLs. However, the staff recognizes that if changes are required to either the AP1000 DCA FSER or to the VEGP COL FSER as a result of the AP1000 DCA rulemaking, supplements to these FSERs as appropriate will be prepared, and it may be necessary to re-verify that the certified design is properly incorporated. Based on this understanding, and based on the VEGP application dated June 24, 2011, which incorporates by reference AP1000 DCD, Revision 19, Confirmatory Item 1-1 is now closed.

While the reference version of the AP1000 design has been docketed but not certified, 10 CFR 52.55(c) allows an applicant, at its own risk, to incorporate by reference a design that is not certified. If the DCA rulemaking results in certification of the amended design, that will demonstrate compliance with 10 CFR 52.81 for the information incorporated by reference from the AP1000 DCD into the COL application. However, until 10 CFR Part 52, Appendix D is revised by rulemaking to incorporate the AP1000 DCA application, the provisions of 10 CFR 52.63 do not apply to this supplemental information.

The contents of the AP1000 COL application are specified by 10 CFR 52.79(a), which requires the submission of information within the FSAR that describes the facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems,

and components (SSCs) of the facility as a whole. For a COL application that references a DC, 10 CFR 52.79(d) requires the DCD to be included or incorporated by reference into the FSAR. A COL application that references a certified design must also include the information and analysis required to be submitted within the scope of the COL application, but which is outside the scope of the DCD. This set of information addresses plant- and site-specific information and includes all COL action or information items; design information replacing CDI; and programmatic information that was not reviewed and approved in connection with the DC rulemaking.

During its evaluation of the COL application, the staff confirmed that the complete set of information required to be addressed in the COL application was addressed in the DC or referenced VEGP ESP, the DC or ESP as supplemented by the COL application, or completely in the COL application. Following this confirmation, the staff's review of the COL application is limited to the COL-specific review items.

1.2.3 Overview of the Design Centered Review Approach

The design centered review approach (DCRA) is described in Regulatory Issue Summary (RIS) 2006-06, "New Reactor Standardization Needed to Support the Design Centered Licensing Review Approach." The DCRA is endorsed by the Commission's Staff Requirements Memorandum (SRM) SECY-06-0187, "Semiannual Update of the Status of New Reactor Licensing Activities and Future Planning for New Reactors," dated November 16, 2006. The DCRA, which is the Commission's policy intended to promote standardization of COL applications, is beyond the scope of information included in the DC. This policy directs the staff to perform one technical review for each standard issue outside the scope of the DC, and use this decision to support decisions on multiple COL applications. In this context, "standard" refers to essentially identical information. In some cases the staff has expanded the use of this standard approach to other areas with essentially identical information for regulatory purposes. For example, the quality assurance plan for the AP1000 COL applicants is essentially identical with the exception of title names being different. Other areas where this approach was used include cyber security, technical specifications, and loss of large area fire reviews and may include information provided by the applicant(s) to resolve plant-specific issues.

The first COL application submitted for NRC staff review is designated in a design center as the reference COL (R-COL) application, and the subsequent applications in the design center are designated as subsequent COL (S-COL) applications. The Bellefonte Nuclear Plant (BLN) Units 3 and 4 COL application was originally designated as the R-COL application for the AP1000 design center, and the staff issued an SER with open items that documented its review of both standard and site-specific information (for all chapters except Sections 3.7, 3.8, 13.6, 13.7, and 13.8 and Appendix 19A). In a letter dated April 28, 2009, the NuStart Energy Development, LLC, consortium informed the NRC that it had changed the R-COL designation for the AP1000 design center from BLN Units 3 and 4 to the VEGP Units 3 and 4. To effect this transition, SNC responded to all of the open items in the staff's BLN SER that related to standard content on behalf of the AP1000 design center and consistent with its new position as the R-COL for the AP1000 design center. Thus, this SER documents the staff's review of both standard and site-specific information and is the first complete SER for a COL application in the AP1000 design center.

To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

Where there were differences between the information provided by the VEGP applicant and that provided by the BLN applicant regarding details in the application for the standard content material, the staff evaluated the differences and determined whether the standard content material of the BLN SER was still applicable to the VEGP application. These evaluations are in the SERs that reference the standard content.

This standard content material is identified in this SER by use of italicized, double-indented formatting. This SER also documents the staff's findings with respect to closure of all open items related to standard content, and will be used as the R-COL reference for other AP1000 S-COL application reviews. Finally, this SER documents the staff's findings with respect to site-specific issues, related only to the VEGP site.

1.3 Principal Review Matters

The staff's evaluations related to the COL application review are addressed as follows:

- **Part 1 General and Administrative Information**

The staff's evaluation of the corporate information regarding SNC pursuant to 10 CFR 50.33, "Contents of applications; general information," is provided in Section 1.5.1 of this SER.

- **Part 2 Final Safety Analysis Report**

The staff's evaluation of information in the VEGP COL FSAR is provided in the corresponding sections of this SER.

- **Part 3 Environmental Report**

The staff's evaluation of environmental information addressed in the Environmental Report pursuant to the requirements of 10 CFR 51.50(c) is provided in the Environmental Impact Statement (EIS); for the VEGP COL application, pursuant to the requirements of 10 CFR 51.92, "Supplement to the final environmental impact statement," this entails a supplement to the EIS prepared for the VEGP ESP.

- **Part 4 Technical Specifications**

Chapter 16 of this SER includes the staff's evaluation of the VEGP Units 3 and 4 plant Technical Specifications (PTS) and Bases (specifically completion of bracketed text).

- **Part 5 Emergency Plan**

Chapter 13 of this SER includes the staff's evaluation of the VEGP onsite Emergency Plan, including related ITAAC, and the offsite State and local emergency plans.

- **Part 6 LWA Request**

On October 2, 2009, SNC and its four co-applicants submitted a request for a second LWA as part of its COL application. The requested activities under this LWA are evaluated by the staff in the corresponding sections of this SER (pursuant to 10 CFR 50.10) and in the supplemental EIS (pursuant to 10 CFR 51.49, 10 CFR 51.76, and 10 CFR 51.92).

- **Part 7 Departures Report**

The staff's evaluation of the departures, exemptions and variances in Part 7 of the VEGP COL application is provided in the applicable chapter of this SER. The table below provides a description of the departure, exemption or variance and where the evaluation is addressed in this SER.

Departure Number	Description	Location of Evaluation in this Report
VEGP DEP 1.1-1	Administrative departure for organization and numbering of the FSAR sections	1.5.4
VEGP DEP 2.5-1	Lower and upper mudmat	2.5.4
VEGP DEP 3.4-1	Waterproofing Membrane Material	3.4.1, 3.8.5
STD DEP 8.3-1	Class 1E voltage regulating transformer current limiting features	8.3.2
VEGP DEP 9.2-1	PWS filtration	9.2.1
VEGP DEP 18.8-1	Emergency response facility locations	12.5, 13.3, and 18.8

Exemption Number	Description	Location of Evaluation in this Report
	Exemption from 10 CFR 52.93(a)(1)[6]	1.5.4
	COL Application Organization and Numbering (10 CFR Part 52, Appendix D)	1.5.4
	Exemption from the requirements of 10 CFR 70.22(b), 10 CFR 70.32(c), 10 CFR 74.31, 10 CFR 74.41, and 10 CFR 74.51	1.5.4

[6] Part 7 of the VEGP COL application does not include an exemption request related to the requirements found in 10 CFR 52.93(a)(1). As discussed in Section 1.5.4 of this report, the staff determined that an exemption from this regulation is necessary.

ESP Variance Number	Description	Location of Evaluation in this Report
VEGP ESP VAR 1.6-1	Variance from VEGP ESP SSAR Section 1.6, "Material Incorporated by Reference"	1.4.4
VEGP ESP VAR 1.6-2	Variance from VEGP ESP SSAR Section 3.8.5, "Foundations"	3.8.5
VEGP ESP VAR 1.6-3	Variance from VEGP ESP SSAR Chapter 15, "Accident Analysis"	15
VEGP ESP VAR 1.2-1	Variance from VEGP ESP SSAR Section 1.2, "General Site Description," Section 13.3, "Emergency Planning," and VEGP ESP Part 5, "Emergency Plan"	13.3
VEGP ESP VAR 2.2-1	Variance from VEGP ESP SSAR Section 2.2.3.2, "Hazardous Chemicals," and VEGP ESP SSAR Table 2.3-6, "Potential Hazards"	2.2
VEGP ESP VAR 2.3-1	Variance from VEGP ESP SSAR Section 2.3.1.5, "Meteorology"	2.3

- **Part 8 Security Plan**

The staff's evaluation of the Safeguards and Security Plans is documented separately from this SER, and is withheld from the public in accordance with 10 CFR 73.21. A non-sensitive summary of the staff's evaluation of those plans is provided in Section 13.6 of this SER.

- **Part 9 Withheld Information**

The staff's evaluation of the withheld information occurs in the context of the specific subject being reviewed and is documented accordingly. In a letter dated August 6, 2010, the applicant proposed to include plans related to cyber security regulations. The staff's evaluation of the cyber security related plans is included in SER Section 13.8. In a letter dated November 12, 2010, the applicant provided information regarding the Mitigative Strategies Description and Plans for loss of large areas of the plant due to explosions or fire, as required by 10 CFR 52.80(d). A summary of the staff's evaluation of the Mitigative Strategies Description and Plans for loss of large areas of the plant due to explosions is provided in Appendix 19A of this SER. The staff's complete evaluation is documented separately from this SER and is withheld from the public in accordance with 10 CFR 2.390.

- **Part 10 Proposed Combined License Conditions (Including ITAAC)**

The staff's evaluation of the proposed COL conditions (including ITAAC) is provided in the applicable chapter of this SER. The table below provides a description of the proposed license conditions and where the evaluation is addressed in this SER. The staff has identified certain license conditions and ITAAC that it will recommend the Commission impose if a COL is issued to the applicant. Appendix A.1 (of Appendix A) to this SER lists those license conditions. Each license condition is sequentially numbered in individual chapters of this SER. The staff has

provided an explanation of each license condition in the applicable section of the SER. These license conditions are based on the provisions of 10 CFR 52.97, "Issuance of combined license." This SER highlights the applicant's proposed ITAAC and the staff's review and acceptance of them. Appendix A.2 (of Appendix A) lists those ITAAC.

Proposed Combined License Condition	Location of Evaluation in this Report
ITAAC	14.3 and throughout this SER
COL information items that cannot be resolved prior to issuance of a COL	The proposed license conditions are evaluated throughout this SER.
Implementation requirements related to portions of operational programs identified in VEGP COL FSAR Table 13.4-201 on or before the associated milestones in Table 13.4-201	The operational programs are evaluated throughout this SER.
Requirements for a fully developed set of site-specific emergency action levels (EALs) to be submitted to the NRC	13.3
Requirements associated with revisions to the physical security plan	13.6
Requirements associated with submittal schedules to the NRC related to the operation programs listed in VEGP COL FSAR Table 13.4-201	The operational programs are evaluated throughout this SER.
First-Plant-Only and first-Three-Plant-only Testing requirements	14.2
Reporting requirements related to any changes made to the Initial Startup Test Program described in Chapter 14 of the VEGP COL FSAR	14.2
Power-ascension testing requirements	14.2
License conditions associated with granting 10 CFR Part 30, 40, and 70 licenses governing the possession and use of applicable source, byproduct and special nuclear material.[7]	1.5.5
License condition associated with Special Nuclear Material Physical Protection Plan Chang.[8]	1.5.5
License condition associated with implementation and maintenance of mitigative strategies for responding to a loss of large areas of the plant due to explosions or fire.[4]	19A
Inclusion of the Environmental Protection Plan	Final Supplemental Environmental Impact Statement

[3] Part 10 of the VEGP COL application includes a proposed license condition associated with special nuclear material physical protection plan. The staff discusses this license condition as well as additional license conditions that are associated with granting of 10 CFR Part 30, 40, and 70 licenses in Section 1.5.5 of this report.

[8] The VEGP COL application does not include the proposed license condition. The staff discusses this license condition in this SER as indicated in column "Location of Evaluation in this Report."

- **Part 11 Enclosures**

The SNC NDQAM (Enclosure 11A) is the top-level policy document that establishes the QA policy and assigns major functional responsibilities for nuclear development activities conducted by or for SNC. The staff's review of the NDQAM is documented in Chapter 17 of this SER. The staff's review of Enclosure 11B of the VEGP COL application regarding mitigative strategies description and plans for loss of large areas of the plant due to explosions is provided in Appendix 19A of this SER. The staff's complete evaluation is documented separately from this SER and is withheld as non-public in accordance with 10 CFR 2.390. Enclosure 11C of the application includes the cyber security plan and the staff's evaluation of this plan is in Section 13.8 of this SER. Enclosure 11D of the application includes the SNM, MC&A program description. Enclosure 11E of the application includes the new fuel shipping plan, and Enclosure 11F of the application includes supplemental information in support of the 10 CFR Part 70 license. Enclosures 11D, 11E, and 11F of the application are evaluated in Section 1.5.5 of this SER.

Organization of SER

The staff's SER is structured as follows:

- The SER adheres to the "finality" afforded to COL applications that incorporate by reference a standard certified design and the ESP. As such, this SER does not repeat any technical evaluation of material incorporated by reference; rather, it points to the corresponding review findings of NUREG-1793 and its supplements and NUREG-1923, "Safety Evaluation Report for Early Site Permit (ESP) at the Vogtle Electric Generating Plant (VEGP) ESP Site." However, the referenced AP1000 DCD, the VEGP ESP SSAR and the VEGP COL FSAR are considered in the staff's safety evaluation to the extent necessary to ensure that the expected scope of information to be included in a COL application is addressed adequately in the DCD or ESP SSAR or COL FSAR, or in all the documents.

- For sections that were completely incorporated by reference without any supplements or departures, the SER simply points to the AP1000 DCD and/or VEGP ESP SSAR and related NUREG-1793 and its supplements and/or NUREG-1923, and confirms that all the relevant review items were addressed in the AP1000 DCD/or VEGP ESP SSAR and the staff's evaluation was documented in NUREG-1793 and its supplements and/or NUREG-1923.

- For subject matter within the scope of the COL application that supplements or departs from the DCD, this SER generally follows a six section organization as follows:

  – "Introduction" section provides a brief overview of the specific subject matter

  – "Summary of Application" section identifies whether portions of the review have received finality and clearly identifies the scope of review for the COL

  – "Regulatory Basis" section identifies the regulatory criteria for the information addressed by the COL application

– "Technical Evaluation" section focuses on the information addressed by the COL application

– "Post Combined License Activities" section identifies the proposed license conditions, ITAAC or FSAR information commitments that are post-COL activities

– "Conclusion" section summarizes how the technical evaluation resulted in a reasonable assurance determination by the staff that the relevant acceptance criteria have been met

1.4 Staff Review of VEGP COL FSAR Chapter 1

1.4.1 Introduction

There are two types of information provided in Chapter 1 of the VEGP COL FSAR:

- General information that enables the reviewer or reader to obtain a basic understanding of the overall facility without having to refer to the subsequent chapters. A review of the remainder of the application can then be completed with a better perspective and recognition of the relative safety significance of each individual item in the overall plant description.

- Specific information relating to qualifications of the applicant, construction impacts and regulatory considerations that applies throughout the balance of the application (e.g., conformance with the acceptance criteria in NUREG-0800).

This section of the SER will identify the information incorporated by reference, summarize all of the new information provided, and document the staff's evaluation of the sections addressing regulatory considerations.

1.4.2 Summary of Application

The information related to COL/SUP items included in Chapter 1 of the VEGP COL FSAR encompasses the statements of fact or information recommended by RG 1.206. No staff technical evaluation was necessary where the statements were strictly background information. However, where technical evaluation of these COL/SUPs was necessary, the evaluation is not in this SER section, but in subsequent sections as referenced below.

Section 1.1 Introduction

Section 1.1 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.1, "Introduction," of the AP1000 DCD, Revision 19 with the following supplements.

Section 1.1 of the VEGP COL FSAR also incorporates by reference the VEGP ESP SSAR with variances and/or supplements as noted. VEGP COL FSAR Table 1.6-202, "Cross Reference of SSAR Sections Incorporated by Reference into FSAR Sections," provides information regarding incorporation of SSAR information into the FSAR. In a letter dated November 11, 2010, the applicant added a discussion of incorporation of the proprietary information and safeguards information referenced in the AP1000 DCD.

- VEGP COL 1.1-1

The applicant provided the anticipated schedule for construction and operation of VEGP Units 3 and 4 in VEGP COL FSAR Table 1.1-203. VEGP COL 1.1-1 is related to COL Information Item 1.1-1 in AP1000 DCD Table 1.8-2. The applicant committed to provide a site-specific construction plan and startup schedule after issuance of the COL.

Related to this is VEGP DEP 1.1-1, "Administrative departure for organization and numbering of the FSAR sections," discussed in FSAR Section 1.8 and Part 7 of the COL application. The staff's evaluation of this departure is included in Section 1.5.4 of this SER.

- VEGP COL 2.1-1

The applicant provided additional information in VEGP COL 2.1-1 to address COL Information Item 2.1-1 (COL Action Item 2.1.1-1). Specifically, VEGP Units 3 and 4 are to be located on a 3,169-acre coastal plain bluff on the southwest side of the Savannah River in eastern Burke County, Georgia. An expanded discussion of VEGP COL 2.1-1 is included in VEGP COL FSAR Section 2.1.

- STD SUP 1.1-1

The applicant specified the incorporation of Revision 19 of the Westinghouse AP1000 DCD in all sections of the VEGP COL FSAR. Additionally, the applicant incorporated by reference Nuclear Energy Institute (NEI) technical reports as identified in Table 1.6-201 of the VEGP COL FSAR.

- VEGP SUP 1.1-2

The applicant clarified that the FSAR was being submitted to NRC by SNC under Section 103 of the Atomic Energy Act to construct and operate two nuclear power plants under the provisions of 10 CFR Part 52, Subpart C.

- STD SUP 1.1-3

The applicant provided additional information to describe annotations used in the left hand column of the VEGP COL FSAR to identify departures, supplementary information, COL items, and CDI.

- STD SUP 1.1-4

The applicant provided additional information to indicate how proprietary, personal or sensitive information withheld from public disclosure pursuant to 10 CFR 2.390 and RIS 2005-026, "Control of Sensitive Unclassified Nonsafeguards Information Related to Nuclear Power Reactors," is identified in the VEGP COL FSAR. Proprietary material was provided in Part 9 of the COL application.

- VEGP SUP 1.1-5

The applicant provided additional information to identify acronyms and system designations used in the VEGP COL FSAR that are in addition to those identified in the AP1000 DCD.

- STD SUP 1.1-6

The applicant identified that, while the VEGP COL FSAR generally follows the AP1000 DCD organization and numbering, there were some organization and numbering differences that were adopted, where necessary, to include additional material, such as additional content identified in RG 1.206.

- VEGP SUP 1.1-8

The applicant provided additional information to identify acronyms and system designations used in the VEGP COL FSAR that are in addition to those identified in the AP1000 DCD and are associated with ESP issues.

Section 1.2 General Plant Description

Section 1.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.2, "General Plant Description," of the AP1000 DCD, Revision 19 and Section 1.2 of the VEGP ESP SSAR, Revision 5 with the following departure and supplements:

- VEGP DEP 18.8-1

The applicant stated that each Operations Support Center (OSC) is being moved from the location identified on AP1000 DCD Figure 1.2-8 to its respective Units 3 and 4 Control Support Area (shown on Figure 1.2-201), vacated by relocating the unit Technical Support Center (TSC) to a common site TSC in a new Communication Support Center (CSC). This departure is addressed in SER Section 13.3.

- VEGP COL 2.1-1; VEGP COL 3.3-1; and VEGP COL 3.5-1

The applicant provided additional information on the site plan for VEGP Units 3 and 4 summarizing the principal structures and facilities, parking areas, roads, and transmission lines. The location and orientation of the power block complex are also described. These COL information items are expanded in other sections of the VEGP COL FSAR.[9]

Section 1.3 Comparisons with Similar Facility Designs

Section 1.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.3, "Comparisons with Similar Facility Designs," of the AP1000 DCD, Revision 19 with no supplements.

Section 1.4 Identification of Agents And Contractors

Section 1.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.4, "Identification of Agents and Contractors," of the AP1000 DCD, Revision 19 and Section 1.4 of the VEGP ESP SSAR, Revision 5 with the following supplements:

- VEGP SUP 1.4-1

[9] Table 1.8-202 of the VEGP COL FSAR provides a COL information item index of occurrences in the VEGP COL FSAR.

The applicant provided additional information to identify SNC as the non-owner, operator, and contractor of VEGP Units 3 and 4. SNC is a wholly owned subsidiary of Southern Company.

- VEGP SUP 1.4-2

The applicant provided additional information to clarify the identification of additional participants. The applicant: 1) identifies the nuclear steam system supply (NSSS) vendor, architect engineer, and constructor; 2) describes their technical qualifications; and 3) describes the division of responsibility among them.

- VEGP SUP 1.4-3

The applicant provided additional information related to specialized consulting firms that assisted in preparing the COL application for VEGP.

Section 1.5 Requirements for Further Technical Information

Section 1.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.5, "Requirements for Further Technical Information," of the AP1000 DCD, Revision 19 with no departures or supplements. This section of the DCD provides information related to testing conducted during the AP600 conceptual design program to provide input into the plant design and to demonstrate the feasibility of unique design features. The DCD also describes the analyses performed to show that the AP600 and AP1000 exhibit a similar range of conditions such that the AP600 tests are sufficient to support the AP1000 safety analysis.

Section 1.5 of the VEGP COL FSAR also incorporates by reference Section 1.5, "Requirements for Further Technical Information," of the VEGP ESP SSAR, Revision 5 with no variances or supplements.

Section 1.6 Material Referenced

Section 1.6 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.6, "Material Referenced," of the AP1000 DCD, Revision 19 with the following supplements:

- STD SUP 1.6-1

The applicant provided additional information to identify the technical documents incorporated by reference in the VEGP COL FSAR in addition to those technical documents incorporated by reference in the AP1000 DCD.

- VEGP SUP 1.6-2

The applicant provided additional information to provide a cross reference of VEGP ESP SSAR sections incorporated by reference into VEGP COL FSAR sections.

- VEGP ESP VAR 1.2-1

VEGP ESP SSAR Section 1.2 is incorporated by reference into VEGP COL FSAR Section 1.1.1 with the exception of Figures 1-4 and 1-5. Part 7 of the VEGP COL application requests a variance for VEGP ESP SSAR Section 1.2. VEGP ESP SSAR Section 13.3 is incorporated by

reference into VEGP COL FSAR Section 13.3, with the exception of Figure 13.3-2. Part 7 of the VEGP COL application requests a variance for these VEGP ESP SSAR sections and is addressed in SER Section 13.3.

- VEGP ESP VAR 1.6-1

VEGP ESP SSAR Section 1.6 is not incorporated by reference in the VEGP COL FSAR. Part 7 of the VEGP COL application requests a variance for this VEGP ESP SSAR section and is addressed in SER Section 1.4.4.

- VEGP ESP VAR 1.6-2

VEGP ESP SSAR Section 3.8.5 is incorporated by reference into VEGP COL FSAR Section 3.8.5.1 with the exception of the first paragraph. This paragraph includes a reference to Revision 15 of the AP1000 DCD. Additionally, the first sentence of the second paragraph in VEGP ESP SSAR Section 3.8.5.1.1 is not incorporated by reference. Part 7 of the VEGP COL application requests a variance for this VEGP ESP SSAR section and is addressed in SER Section 3.8.5.

- VEGP ESP VAR 1.6-3

VEGP ESP SSAR Chapter 15 is not incorporated by reference into the VEGP COL FSAR. This chapter of the VEGP ESP SSAR provides accident release information that has been superseded by the referenced AP1000 DCD. Part 7 of the VEGP COL application requests a variance for this VEGP ESP SSAR section and is addressed in SER Chapter 15.

- VEGP ESP VAR 2.2-1

VEGP ESP SSAR Section 2.2 is incorporated by reference into VEGP COL FSAR Section 2.2 with the exception of the last paragraph of VEGP ESP SSAR Section 2.2.3.2.3 and VEGP ESP SSAR Table 2.2-6. This information has been superseded by information addressed in Sections 2.2 and 6.4. Part 7 of the VEGP COL application requests a variance for this VEGP ESP section and table and is addressed in SER Section 2.2.

- VEGP ESP VAR 2.3-1

VEGP ESP SSAR Section 2.3 is incorporated by reference into VEGP COL FSAR Section 2.3 with the exception that the third from last and second from last paragraphs of VEGP ESP SSAR Section 2.3.1.5 are replaced by information described in the replacement paragraph, which is shown in Section 2.3.1.5. Part 7 of the VEGP COL application requests a variance for this VEGP ESP SSAR section and is addressed in SER Section 2.3.

Section 1.7 Drawings and Other Detailed Information

Section 1.7 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.7, "Drawings and Other Detailed Information," of the AP1000 DCD, Revision 19, and Section 1.4 of the VEGP ESP SSAR, Revision 5 with the following supplements:

- VEGP SUP 1.7-1

The applicant identified the site-specific system drawings. These are the circulating water system, raw water system, offsite power system one line diagram, and switchyard general arrangement.

Section 1.8 Interfaces for Standard Design

Section 1.8 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.8, "Interfaces for Standard Design," of the AP1000 DCD, Revision 19 with the following supplements:

- VEGP SUP 1.8-1

The applicant identified three departures in VEGP COL FSAR Table 1.8-201, "Summary of FSAR Departures from the DCD." The departures are:

- VEGP DEP 1.1-1, related to numbering and organization of the VEGP COL FSAR sections to be consistent with RG 1.206 and NUREG-0800

- VEGP DEP 9.2-1, related to PWS filtration

- VEGP DEP 18.8-1, related to the location of the TSC and OSCs

In a letter dated October 15, 2010, the applicant proposed the Tier 2 departure related to a proposed revision to AP1000 DCD Section 8.3.2.2 (Class 1E voltage regulating transformer current limiting features).

As part of VEGP SUP 1.8-1, the applicant added to Section 1.8 that variances from the referenced VEGP ESP SSAR are identified in VEGP COL FSAR Table 1.6-202.

- VEGP SUP 1.8-2

The applicant provided a list of the COL information items in the AP1000 DCD. In VEGP COL FSAR Table 1.8-202, SNC provides the sections of the application addressing these issues. The table further identifies the AP1000 COL items as an "applicant" item, a "holder" item or both. An applicant item is completely addressed in the application. SNC's definition of a COL holder item is an item that cannot be resolved prior to issuance of the COL. These items are regulatory commitments of the COL holder and will be completed as specified in the appropriate section of the referenced DCD and their completion is the subject of a COL license condition presented in Part 10 of this COL application.

- VEGP SUP 1.8-3

The applicant provided a list in VEGP COL FSAR Table 1.8-203 of the ESP COL action items and the corresponding VEGP COL FSAR section(s) that address these COL action items.

- VEGP SUP 1.8-4

The applicant provided in VEGP COL FSAR Section 2.0 demonstrations that the VEGP Units 3 and 4 site characteristics, design parameters, and site interface values fall within the site-related parameters for which the AP1000 was designed.

- VEGP SUP 1.8-5

The applicant provided in VEGP COL FSAR Table 1.8-204 a list of the ESP permit conditions (PCs) and the corresponding locations that address these PCs.

- VEGP SUP 1.8-6

The applicant addressed the interface items for the AP1000 in Table 1.8-205.

Section 1.9 Compliance with Regulatory Criteria

Section 1.9 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 1.9, "Compliance with Regulatory Criteria," of the AP1000 DCD, Revision 19 with the following supplements:

- STD COL 1.9-1

The applicant provided additional information in STD COL 1.9-1 (corresponding to COL Information Item 1.9-1) related to RGs cited in the VEGP COL FSAR. Table 1.9-201 identifies the RG revision and provides VEGP COL FSAR cross-references. In addition, Appendix 1AA, "Conformance with Regulatory Guides," was developed by the applicant to supplement the detailed discussion presented in Appendix 1A, "Conformance with Regulatory Guides," of the referenced AP1000 DCD. Specifically, Appendix 1AA delineates conformance of design aspects as stated in the DCD and conformance with programmatic and/or operational issues as presented in the VEGP COL FSAR. In certain RGs design aspects were beyond the scope of the DCD and are also presented in the VEGP COL FSAR.

- VEGP COL 1.9-1

The applicant provided additional information in VEGP COL 1.9-1 (corresponding to COL Information Item 1.9-1) related to how Division 4 of the RGs applies to the Environmental Report and the topics addressed in the Environmental Report. In addition, the applicant provided additional information related how to certain Division 1 of the RGs apply to the VEGP ESP SSAR.

- STD COL 1.9-2

The applicant provided additional information in STD COL 1.9-2 (corresponding to the first un-numbered COL information item identified at the end of AP1000 DCD Table 1.8-2) related to operational experience. VEGP COL FSAR Table 1.9-204 provides a list of Bulletins and Generic Letters (GLs), the appropriate VEGP COL FSAR cross-references and whether the subject matter was addressed in the AP1000 DCD.

- STD COL 1.9-3

The applicant provided additional information in STD COL 1.9-3 (related to the second un-numbered COL information item identified at the end of AP1000 DCD Table 1.8-2) related to review of unresolved safety issues and generic safety issues (GSIs). Specifically, VEGP COL FSAR Table 1.9-203 lists Three Mile Island (TMI) Action Plan items, Task Action Plan items,

New Generic Issues, Human Factors issues, and Chernobyl Issues and states how they were considered in the AP1000 DCD and COL application. In addition, the applicant provided discussion on four new generic issues: Issue 186 related to heavy load drops; Issue 189 related to susceptibility of certain containments to early failure from hydrogen combustion; Issue 191 related to PWR sump performance; and Issue 196 related to the use of Boral in long-term dry storage casks for spent reactor fuel.

- STD SUP 1.9-1

The applicant provided additional information related to conformance with NUREG-0800. Specifically VEGP COL FSAR Table 1.9-202 delineates conformance with NUREG-0800 for design aspects as stated in the AP1000 DCD and conformance for subjects beyond the scope of the DCD as presented in the VEGP COL FSAR.

- VEGP SUP 1.9-2

The applicant clarified that the severe accident mitigation design alternatives evaluation for the AP1000 in Appendix 1B to the DCD is not incorporated into the VEGP COL FSAR, but is addressed in the VEGP ESP Environmental Report.

- STD SUP 1.9-3

The applicant provided information related to station blackout (SBO) procedures and training for operators to include actions necessary to restore offsite power after 72 hours by addressing alternating current (ac) power restoration and severe weather guidance in accordance with NUMARC-87-00.

Section 1.10 Nuclear Power Plants to Be Operated On Multi-Unit Sites

The applicant provided an assessment of the potential impacts of construction of one unit on SSCs important to safety for an operating unit, in accordance with 10 CFR 52.79(a)(31). This section of the VEGP COL FSAR provides an assessment of potential construction activity hazards, SSCs important to safety for the operating unit and related limiting conditions for operation (LCOs) for the operating unit, potentially impacted SSCs and LCOs and applicable managerial and administrative controls to be used to provide assurance that the LCOs for operating units are not exceeded as a result of construction activities at the multi-unit sites.

- STD SUP 1.10-1

The applicant identified this as a new section in the VEGP COL application that was not part of the referenced AP1000 DCD.

- VEGP SUP 1.10-1

The applicant identified that the power blocks for VEGP Units 3 and 4 have a minimum separation of at least 800 feet between plant centerlines. In the standard portion of the application there is a discussion that the primary consideration in setting this separation distance is the space needed to support plant construction via the use of a heavy-lift crane.

License Conditions

- Part 10, License Condition 1, ITAAC

The applicant proposed that the ITAAC identified in the tables in Appendix B of Part 10 of the VEGP COL application be incorporated into the COL.

1.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the introductory information in VEGP COL FSAR Chapter 1 are given in Section 1.0 of NUREG-0800.

The applicable regulatory requirements for the introductory information are as follows:

- 10 CFR 50.43(e), as it relates to requirements for approval of applications for a DC, COL, manufacturing license, or operating license that propose nuclear reactor designs that differ significantly from LWR designs that were licensed before 1997, or use simplified, inherent, passive, or other innovative means to accomplish their safety functions.

- 10 CFR 52.77 and 10 CFR 52.79, as they relate to general introductory matters.

- 10 CFR 52.79(a)(17), as it relates to compliance with technically relevant positions of the TMI requirements.

- 10 CFR 52.79(a)(20), as it relates to proposed technical resolutions of those unresolved safety issues and medium- and high priority GSIs that are identified in the version of NUREG-0933, “Resolution of Generic Safety Issues (Formerly entitled ‘A Prioritization of Generic Safety Issues’),” current on the date up to 6 months before the docket date of the application and, which are technically relevant to the design.

- 10 CFR 52.79(a)(31), regarding nuclear power plants to be operated on multi-unit sites, as it relates to an evaluation of the potential hazards to the SSCs important to safety of operating units resulting from construction activities, as well as a description of the managerial and administrative controls to be used to provide assurance that the LCOs are not exceeded as a result of construction activities at the multi-unit sites.

- 10 CFR 52.79(a)(37), as it relates to the information necessary to demonstrate how operating experience insights have been incorporated into the plant design.

- 10 CFR 52.79(a)(41), as it relates to an evaluation of the application against the applicable NRC review guidance in effect 6 months before the docket date of the application.

- 10 CFR 52.79(d)(2), requires that for a COL referencing a standard DC, the FSAR demonstrate that the interface requirements established for the design under 10 CFR 52.47 have been met.

- 10 CFR 52.97(a)(1)(iv), regarding technical and financial qualifications.

The related acceptance criteria from NUREG-0800, Chapter 1 are as follows:

- For regulatory considerations, acceptance is based on addressing the regulatory requirements as discussed in FSAR Chapter 1 or in the referenced FSAR section. The NUREG-0800 acceptance criteria associated with the referenced section will be reviewed in the context of that review.

- For performance of new safety features, the information is sufficient to provide reasonable assurance that: (1) these new safety features will perform as predicted in the applicant's FSAR; (2) the effects of system interactions are acceptable; and (3) the applicant provides sufficient data to validate analytical codes. The design qualification testing requirements may be met with either separate effects or integral system tests; prototype tests; or a combination of tests, analyses, and operating experience.

For conformance with regulatory criteria, RG 1.206 states an applicant should perform a similar evaluation for conformance with RGs that were in effect six months prior to the submittal of the COL application.

1.4.4 Technical Evaluation

The NRC staff reviewed Section 1 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[10] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to this introduction. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements (regarding the AP1000 design) and in NUREG-1923 and NUREG-1872, "Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site," (regarding the VEGP ESP).

The staff reviewed the information in the VEGP COL FSAR:

VEGP COL FSAR Sections 1.1, 1.2, 1.3, and 1.7

There are no specific NUREG-0800 acceptance criteria related to the general information presented in Sections 1.1, 1.2, 1.3, and 1.7, and no specific regulatory findings. The information provides the reader with a basic overview of the nuclear power plant and the construct of the VEGP COL FSAR, itself.

[10] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a DC or ESP.

Sections 1.1, 1.2, 1.3, and 1.7 of the referenced VEGP ESP SSAR are incorporated by reference. Some sections include variances and/or supplements and the variances and the supplemental information are evaluated in respective SER sections.

In the VEGP COL FSAR, VEGP COL 1.1-1 states that a site-specific construction plan and startup schedule will be provided to the NRC after issuance of the COL. This is identified as Commitment Number 1.4-1.

In a letter dated November 11, 2010, the applicant added a discussion of incorporation of the proprietary information and safeguards information referenced in the AP1000 DCD. This information is included to meet the requirements of 10 CFR Part 52, Appendix D, Section IV.A.3, which indicates the applicant must "include, in the plant specific DCD, the proprietary information and safeguards information referenced in the AP1000 DCD" and, therefore, is acceptable. The incorporation of the above information into a future revision of the VEGP COL FSAR is **Confirmatory Item 1.4-1**.

Resolution of Standard Content Confirmatory Item 1.4-1

Confirmatory Item 1.4-1 is an applicant commitment to revise FSAR Section 1.1 to include a discussion of incorporation of the proprietary information and safeguards information referenced in the AP1000 DCD. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 1.4-1 is now closed.

VEGP COL FSAR Section 1.4

- VEGP SUP 1.4-1, VEGP SUP 1.4-2, VEGP SUP 1.4-3

This evaluation is limited to SNC's technical qualification to hold a 10 CFR Part 52 license in accordance with 10 CFR 52.97(a)(1)(iv). The financial qualifications that are also a requirement of 10 CFR 52.97(a)(1)(iv) are evaluated in Section 1.5.1 of this SER.

The applicant identified SNC as the non-owner and operator of VEGP Units 3 and 4. The owner licensees are as follows: Georgia Power Company, Oglethorpe Power Corporation, Municipal Electric Authority of Georgia, and the City of Dalton, Georgia, an incorporated municipality in the State of Georgia acting by and through its Board of Water, Light and Sinking Fund Commissioners (Dalton Utilities). SNC is a wholly-owned subsidiary of Southern Company.

In Section 1.4 of the application, SNC provides justification for why it believes it is qualified to hold a 10 CFR Part 52 license. VEGP COL FSAR Section 1.4 states that SNC was formed for the purpose of operating nuclear facilities owned by other Southern Company subsidiaries. SNC operates the Edwin I. Hatch Nuclear Plant, Units 1 and 2, the VEGP Units 1 and 2, and the Joseph M. Farley Nuclear Plant, Units 1 and 2. The combined electric generation of the three plants is in excess of 5,900 MWe. Because SNC holds 10 CFR Part 50 licenses for nuclear power plants and has demonstrated its ability to build and operate these plants, the staff finds that SNC is qualified to hold a 10 CFR Part 52 license. This includes SNC's demonstrated ability to choose and manage oversight of NSSS vendors, architect engineers and constructors of nuclear related work. The staff notes that Section 17.5 of the VEGP COL FSAR discusses the QA program to be implemented at the receipt of the COL. This QA program includes requirements that will be implemented by SNC's NSSS vendor, architect engineer, and constructor. The staff's evaluation of Section 17.5 of the VEGP COL FSAR is in Section 17.5 of this SER. Based on SNC's experience with nuclear power plants and the staff's evaluation of

SNC's QA program, the staff finds that SNC is technically qualified to hold a 10 CFR Part 52 license in accordance with 10 CFR 52.97(a)(1)(iv).

VEGP COL FSAR Section 1.5

10 CFR 50.43(e) requires additional testing or analysis for applications for a DC or COL that propose nuclear reactor designs that differ significantly from LWR designs that were licensed before 1997, or use simplified, inherent, passive, or other innovative means to accomplish their safety functions. This requirement was addressed in the AP1000 DCD. The COL application does not include any additional design features that require additional testing.

VEGP COL FSAR Section 1.6

There are no specific NUREG-0800 acceptance criteria related to the information presented in Section 1.6, (for STD SUP 1.6-1 and VEGP SUP 1.6-2) and no specific regulatory findings.

- VEGP ESP VAR 1.6-1

Section 1.6 of the VEGP ESP SSAR references Revision 15 of the AP1000 DCD as related to the limited work authorization activities approved in the ESP LWA. In this respect, Revision 15 has been superseded by Revision 19 of the AP1000 DCD, which is incorporated by reference into the VEGP COL FSAR. Revision 19 of the AP1000 DCD includes the most updated information, and the results of the staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements. Therefore, the variance is acceptable.

VEGP COL FSAR Section 1.8

- VEGP SUP 1.8-1

As discussed in SER Section 1.4.2, the applicant identified three departures in Table 1.8-201 from the referenced AP1000 DCD and six variances from the VEGP ESP SSAR. In a letter dated October 15, 2010, the applicant proposed the Tier 2 departure related to a proposed revision to AP1000 DCD Section 8.3.2.2 (Class 1E voltage regulating transformer current limiting features). Section 1.3 of this SER provides a cross reference to where these departures and variances are discussed in this SER.

- VEGP SUP 1.8-2

In Sections 1.3 and 1.4.4 of the BLN SER, the staff identified a standard content **Open Item 1-2** related to the decision regarding which of the BLN COL FSAR commitments, if any, should become a license condition. On January 21, 2010, the NRC issued ISG-15, "Final Interim Staff Guidance on the Post-Combined License Commitments," ESP/DC/COL-ISG-15. This guidance discusses options regarding completion of COL items that cannot be completed until after issuance of the COL. The VEGP applicant identified that certain COL information items cannot be resolved prior to the issuance of a COL. The applicant has identified proposed License Condition 2 in Part 10 of the COL application to ensure these COL items will be completed by the identified implementation milestones through completion of the action identified. The determination that these COL information items cannot be resolved prior to issuance of a COL is discussed in the relevant SER section related to the topic. In addition, using the guidance of ISG-15, the staff has identified certain FSAR commitments in individual sections of this SER

and these FSAR commitments are listed in Appendix A.3 of this SER. The staff considers **Open Item 1-2** is resolved.

- VEGP SUP 1.8-3

As discussed in SER Section 1.4.2, Table 1.8-203 identified the VEGP ESP COL action items and corresponding FSAR section(s) that addresses these COL action items. A cross reference to where these ESP COL action items are discussed in this SER is provided below.

ESP COL Item	Description	Location of Evaluation in this Report
2.2-1	Hydrazine Hazard from Onsite Storage Tanks	2.2.3
2.2-2	Other Chemicals Hazards from Onsite Storage Tanks	2.2.3
2.3-1	Ultimate Heat Sink Design	2.3.1
2.4-1	Chelating Agents	2.4.13
13.6-1	Access Control Measures to Address Existing Spur	13.6

- VEGP SUP 1.8-4

As discussed in SER Section 1.4.2, the applicant provided in VEGP COL FSAR Section 2.0 demonstrations that the VEGP Units 3 and 4 site characteristics, design parameters, and site interface values fall within the site-related parameters for which the AP1000 was designed. The VEGP SER Section 2.0 demonstrates that the characteristics of the site fall within the site parameters specified in the DCD.

- VEGP SUP 1.8-5

As discussed in SER Section 1.4.2, Table 1.8-204 identified the ESP permit conditions (PCs) and corresponding location that addresses these COL action items. PCs 1, 2 through 8 and 9 are evaluated in SER Sections 2.5, 13.3, and 2.0, respectively.

- VEGP SUP 1.8-6

AP1000 DCD Table 1.8-1 presents interface items for the AP1000. This section of the DCD identifies certain interfaces with the standard design that have to be addressed in accordance with 10 CFR 52.47(a)(1)(vii).[11] As required by 10 CFR 52.79(d)(2), the COL application must demonstrate how these interface items have been met. In the VEGP COL FSAR, the applicant initially did not explicitly identify how these interface items have been met. In response to RAI 1-2, the applicant provided a revised VEGP COL FSAR Table 1.8-205, which explicitly identifies the FSAR location of information addressing the interface items identified in Section 1.8 of the AP1000 DCD. The staff review of the identified FSAR locations confirmed that interface items are adequately addressed in the VEGP COL FSAR. The technical

[11] Following the update to 10 CFR Part 52 (72 FR 49517), this provision has changed to 10 CFR 52.47(a)(25).

discussions related to specific interface requirements are addressed in related sections of this SER (e.g., SER Sections 8.2.4 and 11.3.2).

VEGP COL FSAR Section 1.9

In this section of the application, the applicant demonstrates conformance with RGs and NUREG-0800 and addresses unresolved and GSIs, TMI action items, and operating experience.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and to use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 1.4-2) and one open item (Open Item 1.4-2) related to the standard content in the BLN SER. The resolutions of these items are addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 1.4.4 of the BLN SER:

> *AP1000 COL Information Item*
>
> - *STD COL 1.9-1*
>
> *Regarding RGs, the applicant provides in BLN COL FSAR Table 1.9-201 a cross-reference between the RG and where it is discussed in the application, and Appendix 1AA, "Conformance with Regulatory Guides," to supplement the detailed discussion presented in Appendix 1A, "Conformance with Regulatory Guides," of the referenced DCD. The technical discussions related to this appendix are addressed in the related technical sections of the BLN COL FSAR. In addition, BLN COL FSAR Table 1.9-201 provides a listing of all RGs, the specific revision, and provides BLN COL FSAR and DCD cross-references.*
>
> *The staff issued three RAIs associated with how the RG information in Table 1.9-201 and Appendix 1AA of the BLN COL FSAR is presented. In*

addition, there were two specific RAIs associated with how an individual RG is discussed in Table 1.9-201 and Appendix 1AA. A description of the RAIs and their responses follows.

RAI 1-5

In RAI 1-5, the staff noted that BLN COL FSAR Appendix 1AA lists the later version of the RG when compared with DCD Table 1.9-1 but in some cases does not discuss compliance with the later version. In other cases, exceptions to the RG were identified but not justified.

RAI 1-7

In RAI 1-7, the staff noted that not all RGs listed in Appendix 1AA provided a cross-reference to where they were discussed in accordance with the guidance in Section 1 of NUREG-0800.

RAI 1-11

In RAI 1-11, the staff noted that the information that TVA provided in response to RAIs 1-5 and 1-7 conflicted with information that TVA provided in response to another RAI. TVA was requested to reconcile these differences.

RAIs 1-1 and 1-10

These RAIs are associated with specific RGs and RAI 1-1 and RAI 1-10 are evaluated in Chapters 13 and 12, of this SER, respectively.

In TVA's response to RAIs 1-5 and 1-7, TVA committed to make changes to BLN COL FSAR Table 1.9-201 and Appendix 1AA to:

- *Add an additional statement to Appendix 1AA that specifically addresses the later version of the RG.*

- *Revise BLN COL FSAR Sections 1.9.1.1, 1.9.1.2, 1.9.1.3, and 1.9.1.4, to reflect that one method of identifying and justifying an alternative to an RG is the use of previous revisions of the RG for design aspects as stated in the DCD in order to preserve the finality of the certified design.*

- *Revise BLN COL FSAR Table 1.9-201 to address the RG listed in Appendix 1AA, thereby providing a more complete cross reference of where each RG is discussed in the COL application.*

In response to RAI 1-11, TVA committed to revising BLN COL FSAR Table 1.9-201 and Appendix 1AA to ensure that they are consistent with commitments made in other RAI responses.

The staff's evaluation of the RGs is addressed in Chapters 2 through 19 of this SER as needed. At a minimum the NRC staff's FSER sections will discuss any RG that involves an exception.

The staff finds TVA's responses to RAIs 1-5 and 1-7 acceptable. However, the staff notes that BLN COL FSAR Table 1.9-201 and Appendix 1AA will most likely need additional changes based on the staff's evaluation of the RGs in this SER and TVA's response to RAI 1-11. The NRC staff is still evaluating TVA's response to RAI 1-11 and has not yet made a determination of whether the response is acceptable. This is Open Item 1.4-2. The updating of BLN COL FSAR Table 1.9-201 to reflect changes committed to by TVA in response to RAI 1-11 and the updating of this information to reflect TVA's commitments in other RAI responses is Confirmatory Item 1.4-2.

Evaluation of Site-Specific Information Related to Standard Content (Responses to RAIs 1-5 and 1-7)

In a letter dated September 18, 2008, the applicant stated that as part of the COL application changes described in the BLN response to RAI 1-5, the confirmation statements for some of the regulatory guidance (RG 1.29; RG 1.76; RG 1.78, "Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release," Revision 1; and RG 1.112, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors," Revision 1) addressed in the VEGP ESP SSAR are modified. The staff has already reviewed the RG conformance discussion included in the VEGP ESP SSAR and found it acceptable. The applicant inadvertently omitted RG 1.28, "Quality Assurance Program Criteria (Design and Construction)," Revision 4 in Appendix 1 AA of the VEGP COL FSAR. SNC endorsed the Tennessee Valley Authority (TVA) RAI 1-5 response that includes application changes for RG 1.28 into future revisions of the VEGP COL application. The staff verified that the VEGP COL FSAR was updated to reflect the above. The staff considers RAI 1-5 closed for VEGP.

In a letter dated October 1, 2008, the applicant stated that as part of the COL application changes (VEGP COL FSAR Table 1.9-201) described in the BLN response to RAI 1-7, the response partially applies to the VEGP Units 3 and 4 application. This is because the VEGP COL FSAR references the VEGP ESP SSAR for discussion of selected RGs in VEGP COL FSAR Table 1.9-201. The staff has already reviewed the RG conformance discussion included in the VEGP ESP SSAR and found it acceptable in NUREG-1923. The staff verified that the VEGP COL FSAR was updated to reflect the above information. The staff considers RAI 1-7 closed for VEGP.

Resolution of Standard Content Confirmatory Item 1.4-2

The NRC staff verified that VEGP COL FSAR Table 1.9-201 was updated to provide an acceptable cross reference of where each RG is discussed in the COL application. As a result, Confirmatory Item 1.4-2 is resolved for VEGP.

Resolution of Standard Content Open Item 1.4-2

In a letter dated September 21, 2009, the VEGP applicant provided clarification to a previously submitted response dated January 27, 2009 from the BLN applicant. Specifically, the applicant proposed to revise the discussion in the "General comment" portion related to preserving the finality of the certified design in VEGP COL FSAR Sections 1.9.1.1, 1.9.1.2, 1.9.1.3, 1.9.1.4 and Appendix 1AA Note (b); to clarify in VEGP COL FSAR Section 17.5 the "DCD scope" and the "remaining scope" discussion for QA-related RGs (including RG 1.28; RG 1.30, "Quality

Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment (Safety Guide 30)"; RG 1.33, "Quality Assurance Program Requirements (Operation)," Revision 2; RG 1.38, "Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants," Revision 2; RG 1.39, "Housekeeping Requirements for Water-Cooled Nuclear Power Plants," Revision 2; RG 1.94, "Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants," Revision 1; and RG 1.116, "Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems"). In addition, the applicant proposed to revise the VEGP COL FSAR, Appendix 1AA Note (c) to clarify the purpose of a "General" entry under the column labeled "Section Criteria" discussion. It is stated that a "Criteria Section" entry of "General" indicates a scope for the conformance statement of "all regulatory guide positions related to programmatic and/or operational aspects." Thus an associated conformance statement of "Conforms" indicates that the applicant "complies with all regulatory guide positions related to programmatic and/or operational aspects." The proposed clarifications clearly provide the scope of conformance to the RGs and, therefore, they are acceptable. The staff verified that the VEGP COL FSAR was updated to reflect the above. The staff considers Open Item 1.4-2 resolved for VEGP.

- VEGP COL 1.9-1

The staff has already reviewed the RG conformance discussion included in the VEGP ESP SSAR and found it acceptable in NUREG-1923. Therefore, no further evaluation is needed for VEGP COL 1.9-1.

The following portion of this technical evaluation section is reproduced from Section 1.4.4 of the BLN SER:

- *STD SUP 1.9-1*

Regarding conformance with regulatory review criteria as required by 10 CFR 52.79(a)(41), BLN COL FSAR Table 1.9-202 provides the applicant's review of conformance with the acceptance criteria of NUREG-0800. The technical discussions related to the specific acceptance criteria of NUREG-0800 are addressed in the related sections of the BLN COL FSAR and addressed in Chapters 2 through 19 of this SER as needed.

Site-specific Discussion for STD SUP 1.9-1

The technical discussions related to the specific acceptance criteria of NUREG-0800 are addressed in the related sections of the VEGP COL FSAR and addressed in Chapters 2 through 19 of this SER as needed.

- *STD COL 1.9-3*

Regarding consideration of new and generic safety issues as required by 10 CFR 52.79(a)(17) and 10 CFR 52.79(a)(20), BLN COL FSAR Table 1.9-203, provides a listing of the TMI Action Plan items, Task Action Plan items, New Generic Issues, Human Factors issues, and Chernobyl Issues and states how they were considered in the DCD and COL application. The technical

discussions related to the specific safety issues are addressed in the related sections of the BLN COL FSAR.

In addition, the applicant provided discussion of four new generic issues: Issue 186 related to heavy load drops; Issue 189 related to susceptibility of certain containments to early failure from hydrogen combustion; Issue 191 related to PWR sump performance; and Issue 196 related to the use of Boral in long-term dry storage casks for spent reactor fuel.

The applicant identified that neither Issue 189 nor Issue 196 is applicable to the design or application and that therefore neither is addressed in the BLN COL FSAR. Issue 186 states that there are not any planned heavy load lifts outside those described in the DCD; nonetheless, special procedures to address heavy loads are discussed in Subsection 9.1.5.3. Related to Issue 191, the applicant provided a reference to the protective coatings program and containment cleanliness program in Subsections 6.1.2.1.6 and 6.3.8.1 of the BLN COL FSAR, respectively.

Issue 186 and Issue 196 are evaluated in Chapter 9 of this SER. Issues 189 and 191 are evaluated in Chapter 6 of this SER.

- STD SUP 1.9-3

This COL supplemental item is addressed as VEGP SUP 8.1-2 in SER Section 8.1.

- VEGP SUP 1.9-2

The applicant clarified that the severe accident mitigation design alternatives evaluation for the AP1000 in Appendix 1B to the DCD is not incorporated into the VEGP COL FSAR but is addressed in the VEGP ESP Environmental Report. The staff has already reviewed this discussion included in the VEGP ESP and found it acceptable in NUREG-1872. Therefore, no further evaluation is needed for VEGP SUP 1.9-2.

The following portion of this technical evaluation section is reproduced from Section 1.4.4 of the BLN SER:

- *STD COL 1.9-2 (related to the first un-numbered COL information item identified at the end of DCD Table 1.8-2)*

Regarding demonstration of operating experience from Bulletins and GLs, as required by 10 CFR 52.79(a)(37), BLN COL FSAR Table 1.9-204 provides a list of Bulletins and GLs, the appropriate BLN COL FSAR cross-references, and whether the subject matter was addressed in the DCD. The technical discussions related to the specific safety issues are addressed in the related sections of the BLN COL FSAR and are addressed in Chapters 2 through 19 of this SER as needed.

The evaluation of GSI 163, “Multiple Steam Generator Tube Leakage,” is described below because otherwise its evaluation would be spread across several SER chapters.

GSI 163 identified a safety concern associated with the potential multiple steam generator (SG) tube leaks triggered by a main steam line break outside containment that cannot be isolated. The issue was evaluated as part of the AP1000 DCD review and was resolved for the AP1000 design. The evaluation was documented in NUREG-1793, Chapter 20. The evaluation states in part the following:

> The staff agrees that the issue should be closed for the AP1000 design. Issue 163 concerns the possibility that a multiple steam generator tube rupture (SGTR), resulting from a main steam line break and degraded SG tubes, could result in core damage due to depletion of the reactor coolant and safety injection fluid in the refueling water storage tank. For the AP1000 design, an SGTR is mitigated using the passive core cooling system, initially through the passive residual heat removal heat exchanger, and the core makeup tanks (CMTs). After the CMTs drain to the low level to actuate the automatic depressurization system, the reactor coolant depressurization would result in gravity injection from the in containment refueling water storage tank (IRWST), and eventually from the containment recirculation. The scenario that the safety injection from the refueling water storage tank, which is outside the containment in the existing plants, will be depleted to result in core damage is not likely for the AP1000 design because the IRWST and containment recirculation will continue to provide core cooling.
>
> Since the resolution of Issue 163 is an ongoing NRC effort, any future requirements for the resolution of this issue will be required of the COL applicant, if applicable to the AP1000 design.

Subsequent to the original issuance of NUREG-1793, GSI 163 was closed via a July 16, 2009, memorandum. In the safety evaluation accompanying the closure of the issue, the following is stated:

> the staff concludes that the technical specification requirements relating to SG tube integrity provide reasonable assurance that all tubes will exhibit acceptable structural margins against burst or rupture during normal operation and DBAs (including MSLB [main steam line break]), and that leakage from one or multiple tubes under DBAs will be limited to very small amounts, consistent with the applicable regulations for offsite and control room dose.

Therefore, in addition to the unique design features of the AP1000 cited in NUREG-1793 and its supplements as a basis for closure of the issue, the staff notes that for PWR designs in general the issue is resolved based on the technical specification requirements. The staff discusses these technical specification requirements in Section 5.4, “Component and Subsystem Design,” of this SER. Based on the evaluation in NUREG-1793 and its supplements, and based on the staff’s evaluation of the SG tube surveillance program in Section 5.4 of this SER, the staff considers GSI 163 resolved for VEGP.

VEGP COL FSAR Section 1.10

In this section of the application, the applicant provides an assessment of the potential hazards due to construction of one unit on SSCs important to safety for an operating unit, in accordance with 10 CFR 52.79(a)(31).

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was two open items (Open Items 1.4-3 and 1.4-4) related to the standard content in the BLN SER. The resolutions of these items are addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 1.4.4 of the BLN SER:

- *STD SUP 1.10-1*

The NRC staff reviewed the information in BLN COL FSAR Table 1.10-201, identifying the potential hazards from construction activities, BLN COL FSAR Table 1.10-202 that cross-references the construction hazard with the impacted SSCs, and BLN COL FSAR Table 1.10-203, identifying the specific managerial and administrative controls to preclude or mitigate the construction hazard. There is the potential that review of other areas of the application could impact the hazards and management programs identified in the Bellefonte application. For example, site runoff from construction of Unit 4, if not properly controlled, could impact the operation of Unit 3. Site runoff is evaluated in Section 2.4 of this report. The staff has not yet completed its review of this application against the requirements of 10 CFR 52.79(a)(31). This is part of Open Item 1.4-3.

In the application, TVA stated that controls within Section 1.10 of the FSAR are not required unless there is an operating unit on the site. To clarify this FSAR commitment, the staff requests TVA to revise the application to positively state these programs will be in place when there is an operating unit on the site. This is Open Item 1.4-4.

Resolution of Standard Content Open Item 1.4-4

In a letter dated July 29, 2009, the applicant proposed to revise VEGP COL FSAR Section 1.10.3 to positively state that these programs will be in place when there is an operating

unit on the site. The staff verified that the VEGP COL FSAR was appropriately updated to include the above. As a result, Open Item 1.4-4 is resolved.

- VEGP SUP 1.10-1

The supplemental information states that the power blocks for VEGP 3 and 4 have a minimum separation of at least 800 feet between plant centerlines and notes that new units SSCs important to safety are described in the VEGP COL FSAR Chapter 3, and the LCOs for VEGP 3 and 4 are identified in Part 4 of the COL application. VEGP Units 1 and 2 SSCs important safety are described in Chapter 3 of the updated FSAR. In the standard portion of VEGP COL FSAR Section 1.10, there is a discussion that the primary consideration in setting the 800-foot separation distance is the space needed to support plant construction via the use of a heavy-lift crane.

The site-specific supplemental information is provided to supplement the standard information above and provides with specificity the location of the SSCs and LCOs required by 10 CFR 52.79(a)(31). The staff's review of this SUP item is included in resolution of Open Item 1.4-3.

Resolution of Standard Content Open Item 1.4-3

A new draft ISG-22 has been issued to assist the staff with the evaluation of COL applicants' compliance with the requirements of 10 CFR 52.79(a)(31). The above draft ISG document was made available to the public including the applicant and was discussed at a public meeting on August 26, 2010.

The regulation at 10 CFR 52.79(a)(31) requires, in part, that applicants for a COL intending to construct and operate new nuclear power plants on multi-unit sites provide an evaluation of the potential hazards to the SSCs important to safety for operating units resulting from construction activities on the new units. The requirement in 10 CFR 52.79(a)(31) can be viewed as having two subparts:

1. The COL applicant must evaluate the potential hazards from constructing new plants on SSCs important to safety for existing operating plants that are located at the site.

2. The COL applicant must evaluate the potential hazards from constructing new plants on SSCs important to safety for newly constructed plants that begin operation at the site.

The interim guidance recommends that the applicant provide a construction impact evaluation plan that includes:

- A discussion of the construction activity identification process and the impact evaluation criteria used to identify and evaluate the construction activities that may pose potential hazards to the SSCs important to safety for operating unit(s).

- A table of those construction activities and the potential hazards that are identified using that construction impact evaluation plan, the SSCs important to safety for the operating unit potentially impacted by the construction activity, and expected mitigation method.

- Identification of the managerial and administrative controls, such as proposed license conditions that may involve construction schedule constraints or other restrictions on construction activities, that are credited to preclude and/or mitigate the impacts of potential construction hazards to the SSCs important to safety for the operating unit(s).

- A discussion of the process for communications and interactions planned and credited between the construction organization and the operations organization to ensure appropriate coordination and authorization of construction activities and implementation of the prevention or mitigation activities as necessary.

- A memorandum of understanding or agreement (MOU or MOA) between the COL applicant and the operating unit(s) licensee as a mechanism for communications, interactions, and coordination to manage the impact of the construction activities.

- An implementation schedule corresponding to construction tasks or milestones to ensure the plan is reviewed on a recurring basis and maintained current as construction progresses.

The staff reviewed the VEGP COL FSAR Section 1.10, which provides information to address compliance with 10 CFR 52.79(a)(31). In order to complete the staff's review, in RAI 1.5-2, the staff requested that the applicant provide a construction impact evaluation plan that includes:

- A discussion of the process for communications and interactions planned and credited between the construction organization and the operations organization to ensure appropriate coordination and authorization of construction activities and implementation of the prevention or mitigation activities as necessary.

- A memorandum of understanding or agreement (MOU or MOA) between the COL applicant and the operating unit(s) licensee as a mechanism for communications, interactions, and coordination to manage the impact of the construction activities.

- An implementation schedule corresponding to construction tasks or milestones to ensure the plan is reviewed on a recurring basis and maintained current as construction progresses.

In addition, the applicant was requested to identify the managerial and administrative controls (VEGP COL FSAR Table 1.10-203) that are credited to preclude and/or mitigate the impacts of potential construction hazards to the SSCs important to safety for the operating units (VEGP Units 1 and 2).

In a letter dated November 2, 2010, the applicant stated:

- VEGP COL FSAR Sections 1.10.2 and 13AA will be revised to include the discussion of the process for communications and interactions planned and credited between the construction organization and the operations organization.

- The COL applicant and the operating unit(s) licensee are the same entity; thus, no MOU or MOA is considered necessary.

- VEGP COL FSAR Sections 1.10.3 and 13AA will be revised to include the discussion of the implementation schedule corresponding to construction tasks or milestones.

- VEGP COL FSAR will be revised to indicate that managerial and administrative controls are developed and implemented as work progresses on site. These controls are intended to preclude and/or mitigate the impacts of potential construction hazards to the SSCs important to safety for the operating units.

The proposed changes to the VEGP COL FSAR meet the draft guidance of ISG-22 and, therefore, meet the requirements of 10 CFR 50.79(a)(31). The incorporation of the above proposed changes into a future revision of the VEGP COL FSAR is **Confirmatory Item 1.4-2**.

Resolution of Standard Content Confirmatory Item 1.4-2

Confirmatory Item 1.4-2 is an applicant commitment to revise FSAR Sections 1.10.2 and 1.10.3 and Appendix 13A to address guidance included in ISG-22. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 1.4-2 is now closed.

License Conditions

- Part 10, License Condition 1, ITAAC

The applicant proposed that the ITAAC identified in the tables in Appendix B of Part 10 of the VEGP COL application be incorporated into the COL. The proposed license condition also states that after the Commission has made the finding required by 10 CFR 52.103(g), "Operation under a combined license," the ITAAC do not constitute regulatory requirements; except for specific ITAAC, which are subject to a hearing under 10 CFR 52.103(a), their expiration will occur upon final Commission action in such proceeding.

The ITAAC identified in tables in Appendix B of Part 10 of the VEGP COL application are evaluated throughout this SER. The remaining text of the proposed license condition is already covered by regulatory requirements of 10 CFR 52.103(h). Therefore, there is no need for a license condition.

1.4.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the following FSAR commitment is identified as the responsibility of the licensee:

- Commitment (1.4-1) - A site-specific construction plan and startup schedule will be provided after issuance of the COL.

1.4.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to principal review matters, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923 and NUREG-1872.

1.5 Additional Regulatory Considerations

1.5.1 10 CFR 52.97(a)(1)(iv) Applicant Financial Qualifications and Evaluation of Financial Qualification in accordance with 10 CFR 50.33

BACKGROUND:

SNC has been authorized by the VEGP Units 1 and 2 owner, Georgia Power Company, (which acts as agent for the other VEGP Units 1 and 2 owners) to apply for two COLs for VEGP Units 3 and 4. SNC submits this application individually, and for the proposed owner licensees that will be named on the VEGP Units 3 and 4 licenses, along with the proposed percentage ownership interest:

- (45.7 percent) Georgia Power Company (GPC)
- (30.0 percent) Oglethorpe Power Corporation (OPC)
- (22.7 percent) Municipal Electric Authority of Georgia (MEAG)
- (01.6 percent) The City of Dalton, Georgia (Dalton) - [an incorporated municipality in the State of Georgia acting by and through its Board of Water, Light and Sinking Fund Commissioners (Dalton Utilities)]

SNC is the applicant for the COL for VEGP Units 3 and 4, and will construct and operate these new units on behalf of the VEGP Unit 3 and 4 owners. However, SNC will not have any ownership interest in VEGP Units 3 and 4. GPC, as a proposed owner of VEGP Units 3 and 4, has entered into an agreement with the other owners to decide on the ownership percentages of VEGP Units 3 and 4 in the near future.

SNC has entered into agreements with GPC (and GPC with the other owners) to provide SNC the authority to apply for and hold the COLs as an operator licensee and, therefore, to operate the facilities on the owners' behalf. SNC will enter into similar agreements to construct the facilities. As such, SNC is granted the authority, on behalf of the owners, to manage all aspects of plant construction and operation, including but not limited to, management of the construction of the units, control of the exclusion area, security, and emergency planning.[12]

REGULATORY EVALUATION:

SNC's request for the NRC to issue two COLs under Section 103 of the Atomic Energy Act of 1954, as amended, for construction and operation is subject to, among other things, the requirements of the Atomic Energy Act of 1954, as amended; 10 CFR Part 52, Subpart C; 10 CFR Part 50; and 10 CFR Part 140. This safety evaluation reviews the following issues: financial qualifications, decommissioning funding assurance, foreign ownership, and nuclear insurance and indemnity. SNC has chosen to pursue this application under 10 CFR Part 52.

FINANCIAL QUALIFICATIONS:

[12] Additionally, SNC has implemented a 10 CFR Part 50, Appendix B QA program applicable to both construction and operation as part of its obligations.

Pursuant to 10 CFR 52.77, the application must include all of the information required by 10 CFR 50.33.

Construction:

Pursuant to 10 CFR 50.33(f)(1), "the applicant shall submit information that demonstrates that the applicant possesses or has reasonable assurance of obtaining the funds necessary to cover estimated construction costs and related fuel cycle costs. The applicant shall submit estimates of the total construction costs of the facility and related fuel cycle costs, and shall indicate the source(s) of funds to cover these costs."

Construction Cost Estimate:

Under 10 CFR Part 50, Appendix C, Section I.A.1:

> Each applicant's estimate of the total cost of the proposed facility should be broken down as follows and be accompanied by a statement describing the bases from which the estimate is derived:
>
> (a) Total nuclear production plant costs; and
> (b) Transmission, distribution, and general plant costs; and
> (c) Nuclear fuel inventory cost for first core.
>
> If the fuel is to be acquired by lease or other arrangement than purchase, the application should so state. The items to be included in these categories should be the same as those defined in the applicable electric plant and nuclear fuel inventory accounts prescribed by the Federal Energy Regulatory Commission [FERC] or an explanation given as to any departure there from.

In accordance with 10 CFR 50.33(f) and 10 CFR Part 50, Appendix C, SNC has estimated the construction costs for the two units of the proposed VEGP Units 3 and 4 facility, which are provided in Part 1 of the VEGP COL application. The costs are based upon a construction period for the project beginning in November 2011 and ending with Unit 3 commercial operation in April 2016, and Unit 4 commercial operation in April 2017. Other than the cost of financing, each of the owners will share in the costs of the facility in accordance with its ownership interest. Each owner will arrange for its financing and bear those costs individually.

According to SNC, the total cost of VEGP Units 3 and 4 consists of Engineering, Procurement and Construction (EPC) costs, owners' costs, and financing costs. The EPC costs were based on detailed cost estimates performed by Shaw and Westinghouse for the standard AP1000 design and the site-specific design referenced in the VEGP COL application. The EPC cost estimate looked in detail at equipment cost, commodities cost, and labor costs. Owners' costs were estimated by SNC. Those costs include cost of site development, licensing, owners' oversight activities, preparations of the plant operations staff, and other costs not covered by the EPC contract. The costs associated with financing were estimated by GPC.

Escalation of commodity prices or labor rates could increase the actual installed cost of the facility. The estimate is based on proprietary negotiations between SNC and GPC and a consortium comprising Westinghouse Electric Company, LLC, and Stone & Webster, Inc. Although no EPC contract for the facility has been executed at the time of the submission of the

VEGP COL application, the total nuclear production plant costs reflect a reasonable estimate based on the contract negotiations. As the contract currently provides one price for both units, the table is structured in this manner.

Total nuclear production plant costs also include the general plant costs that owners will pay for activities outside the scope of the EPC contract, expressed in 2008 dollars. These costs include licensing, GPC and SNC organization, contract oversight, including QA and quality control (QC) oversight, site preparation, permits, plant buildings, and other miscellaneous costs.

The NRC staff reviews studies from independent sources and collects projected construction cost estimates from all COL applications, as they are submitted, for comparison and reasonableness.[13] According to these sources, the cost of constructing a plant comparable to VEGP Units 3 and 4 is approximately $3,221/kilowatt electric (kWe) to $5,072/kWe (Massachusetts Institute of Technology [MIT] Study) installed.[14] As stated earlier, the applicants' overnight cost estimate can be calculated based on information in Part 1 of the VEGP COL application.

The applicant's overnight cost estimate is above the range derived from the studies developed from independent sources, and is also greater than construction cost estimates reviewed to date for comparable plants. Accordingly, the NRC staff finds the applicant's overnight cost estimate to be reasonable.

Sources of Construction Funds:

Pursuant to 10 CFR Part 50, Appendix C, Section I.A.2:

> The application should include a brief statement of the applicant's general financial plan for financing the cost of the facility, identifying the source or sources upon which the applicant relies for the necessary construction funds, e.g., internal sources such as undistributed earnings and depreciation accruals, or external sources such as borrowings.

GPC's Source of Construction Funds

According to the applicant, GPC obtained approval of the facility from the Georgia Public Service Commission (GPSC) certifying the cost to construct. (The GPSC approved the building of VEGP Units 3 and 4 on Tuesday, March 17, 2009, by a vote of 4 to 1).

The sources of construction funds for GPC's portion of this facility will be a mixture of internally generated cash and external funding. The external funding will come from a mix of capital (debt, preferred, and equity). GPC plans to finance the construction of VEGP Units 3 and 4 utilizing a mixture of general obligation corporate debt and equity (i.e., GPC does not currently plan to incur project-specific financing for the units) that will maintain its overall capital structure,

[13] The staff's consideration of the cost information submitted by the applicant focuses on the estimated production plant cost and on the estimated cost of fuel, since the NRC clearly has oversight of the plant and fuel, and unreasonably low plant construction and fuel cost estimates may have a nexus to a possible reduction in safety. The NRC does not have regulatory authority over transmission and distribution assets, which do not raise radiological safety issues. Thus, any such cost estimate provided is deemed to be true and accurate under 10 CFR 50.9, "Completeness and accuracy of information," and no further assessment of that estimate is performed.

[14] Update to the MIT 2003 Future of Nuclear Power, 2009.

taking into consideration financial market conditions during construction, and the financial requirements of its other investment in new sources of generation.

Southern Company is the parent firm of GPC, Alabama Power Company, Gulf Power Company, Mississippi Power Company, Southern Power, and SNC as well as certain service and special purpose subsidiaries. GPC's common stock is held solely by Southern Company. Southern Company is investor owned, and had 102,903 common stockholders at year end 2007.

As of 2007, GPC has a net utility investment of more than $13.8 billion, of which approximately $5.2 billion is invested in generating facilities including 156 generating units (38 fossil steam, 75 hydroelectric, 4 nuclear, 2 combined cycle, and 37 combustion turbine units). GPC has a total owned generating capacity of approximately 16,102 MWe and a total generating capacity of approximately 20,000 MWe; 71 percent of the energy supplied from owned units is from coal, 18 percent from nuclear, 3 percent from hydroelectric, and less than 8 percent from natural gas and oil. GPC currently has co-ownership of Edwin I. Hatch Nuclear Plant, Units 1 and 2 and VEGP Units 1 and 2 along with OPC, MEAG, and the City of Dalton.

The applicant states that GPC is subject to the jurisdiction of two rate regulatory authorities, the GPSC and the FERC. The output of VEGP 3 and 4 is expected to be sold to GPC retail customers; accordingly, GPC will include its proportionate share of the aforementioned costs as capital expenditure before the GPSC and will earn a return on prudently incurred costs from its customers.

OPC's Source of Construction Funds

The sources of construction funds for OPC's portion of this facility will be primarily external funding. OPC is an eligible borrower under the Rural Electrification Act and is seeking loan funds pursuant to the loan programs of the Rural Utilities Service. To the extent funds are not available from these loan programs, OPC will issue debt in the capital markets as necessary to finance its share of the cost of construction. In addition, OPC will issue tax-exempt financing for any portion of VEGP Units 3 and 4 that qualifies (such as sewage and solid waste disposal facilities).

OPC is owned by 38 retail electric distribution cooperative members (Members). OPC and the Members were each formed pursuant to the Georgia Electric Membership Corporation Act. OPC's principal business is providing wholesale electric power to the Members. As with cooperatives generally, OPC operates on a not-for-profit basis. OPC is the largest electric cooperative in the United States in terms of assets, kilowatt-hour sales and, through the Members, consumers served.

The Members are local consumer-owned distribution cooperatives providing retail electric service on a not-for-profit basis. In general, the customer base of the Members consists of residential, commercial and industrial consumers within specific geographic areas. The Members serve approximately 4.1 million people.

OPC has interests in 24 generating units. These units provide OPC with a total of 4,744 MWe of nameplate capacity, consisting of 1,501 MWe of coal-fired capacity, 1,185 MWe of nuclear-fueled capacity, 632 MWe of pumped storage hydroelectric capacity, 1,411 MWe of gas-fired capacity (206 MWe of which is capable of running on oil) and 15 MWe of oil-fired combustion turbine capacity. OPC purchases approximately 300 MWe of power pursuant to a long-term power purchase agreement.

MEAG's Source of Construction Funds

MEAG will participate in the ownership of the proposed additional VEGP Units 3 and 4 only to the extent that it first procures binding power sales contracts with those Participants electing to participate in the new project. MEAG will issue revenue bonds, supported by the power sales contracts with the Participants as well as any power purchase agreement between MEAG and a third party, to fund the construction costs relating to its ownership interest. MEAG currently provides bulk electric power to 48 cities and one county in the State of Georgia (also referred to as the Participants). Under each such power sales contract, MEAG will agree to provide the Participant, and the Participant shall agree to take from MEAG, a specified percentage of the output and services thereof and to be responsible for a specified percentage of the related costs. The Participant's payment obligations under such power sales contracts are general obligations to the payment of which its full faith and credit are pledged. MEAG's remedies under such power sales contracts will include specific performance to compel the Participants to assess and collect an annual ad valorem tax sufficient to meet its obligations thereunder.

MEAG has the statutory authority to issue revenue bonds to pay for the costs associated with its ownership interest in the additional units. Such revenue bonds, and the power sales contracts as collateral for the payment of such bonds, will be validated in Georgia prior to issuance of the bonds. The bond proceeds will be the source of MEAG's payments of its share of the construction costs related to the additional units.

The MEAG was created by the State of Georgia for the purpose of owning and operating electric generation and transmission facilities to supply bulk electric power to political subdivisions of Georgia, which owned and operated electric distribution systems as of March 18, 1975. MEAG's power resources include ownership interests in 10 electric generating units, all of which have been placed in service, as well as power and energy obtained by MEAG through purchases from and exchanges with other bulk electric suppliers. MEAG also owns transmission facilities, which together with those of other utilities form a statewide integrated transmission system. MEAG's ownership interests in those 10 generating units represent 2,069 MWe of nominally rated generating capacity.

Dalton's Sources of Construction Funds

The sources of construction funds for the portion funded by the City of Dalton, Georgia (Dalton) for VEGP Units 3 and 4 will be from a combination of internally generated funds, investment funds restricted for renewals and extensions, and a possible future debt financing. Currently, Dalton has total assets of $890 million with $71 million of outstanding bond debt.

Dalton is a municipal corporation organized under the laws of the State of Georgia. Dalton constructs and operates its public utilities through the Board of Water, Light and Sinking Fund Commissioners of the City of Dalton, Georgia, which was established in 1913 by an act of the Georgia legislature for the purpose of constructing and operating the public utilities for Dalton. Electric, natural gas, water, sewer, and information technology services are provided to customers of Dalton utilities within Dalton and certain other surrounding areas.

Dalton serves approximately 45,000 customers with the majority of its operating revenues coming from the carpet industry that is headquartered in northwest Georgia. It owns interests in electric generation facilities, the Georgia Integrated Transmission System, electric distribution,

natural gas transmission and distribution, water and sewerage systems, and a retail/wholesale broadband system.

Dalton has utility plant investment approaching $1 billion, of which $350 million is invested in electric generating, transmission and distribution facilities. Dalton owns 118 MWe of electric generation through its joint ownership of Plants Scherer and Wansley, Edwin I. Hatch Nuclear Plant, and VEGP Units 1 and 2 (with GPC, OPC, and MEAG). According to SNC, the balance of Dalton's generating stack is provided by the Southeastern Power Administration and through a wholesale power contract with Southern Power Company. Annual operating revenues exceed $171 million with annual investment income of approximately $9.5 million.

In consideration of the foregoing, the NRC staff finds that GPC, OPC, MEAG, and Dalton have demonstrated they possess or have reasonable assurance of obtaining the funds necessary to cover estimated construction costs and related fuel cycle costs. Therefore, the NRC staff finds that GPC, OPC, MEAG, and Dalton are financially qualified to provide funds to SNC. Therefore, the NRC staff finds that SNC is financially qualified to construct the facilities.

Financial Statements

Pursuant to 10 CFR Part 50, Appendix C, Section I.A.3:

> The application should also include the applicant's latest published annual financial report, together with any current interim financial statements that are pertinent. If an annual financial report is not published, the balance sheet and operating statement covering the latest complete accounting year together with all pertinent notes thereto and certification by a public accountant should be furnished.

GPC's Financial Statements

GPC's reports and filings to the GPSC and the United States Securities and Exchange Commission may be found at http://www.psc.state.ga.us/ and at http://investor.southerncompany.com/sec.cfm, respectively. In accordance with 10 CFR Part 50, Appendix C, Southern Company's 2007 10-K Reports may also be found at http://investor.southerncompany.com/sec.cfm.

GPC submitted, pursuant to 10 CFR Part 50, Appendix C, Section I.A.3, annual financial statements. The NRC staff did not identify anything in GPC's financial statements that warranted further inquiry.

OPC's Financial Statements

OPC's reports to the United States Securities and Exchange Commission may be found at www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0000788816&owner=include&count=40.

OPC submitted, pursuant to 10 CFR Part 50, Appendix C, Section I.A.3, annual financial statements. The NRC staff did not identify anything in OPC's financial statements that warranted further inquiry.

MEAG's Financial Statements

MEAG's 2008 annual audit is expected to be available in early to mid-April 2009. MEAG's latest available financial statements may be found at http://www.meagpower.org/NewsPublications/AnnualReports/tabid/82/Default.aspx and http://www.meagpower.org/NewsPublications/AnnualReports/tabid/84/Default.aspx.

MEAG submitted, pursuant to 10 CFR Part 50, Appendix C, Section I.A.3, annual financial statements. The NRC staff did not identify anything in MEAG's financial statements that warranted further inquiry.

Dalton's Financial Statements

Dalton's latest available 2007 financial statements for the Board of Water, Light and Sinking Fund Commissioners were provided in Appendix 1C, of the VEGP COL application.

Dalton submitted, pursuant to 10 CFR Part 50, Appendix C, Section I.A.3, annual financial statements. The NRC staff did not identify anything in Dalton's financial statements that warranted further inquiry.

Operating License

Pursuant to 10 CFR 50.33(f)(3):

> If the application is for a combined license under subpart C of part 52 of this chapter, the applicant shall submit the information described in paragraphs (f)(1) and (f)(2) of this section.

10 CFR 50.33(f) provides that each application shall state:

> [e]xcept for an electric utility applicant for a license to operate a utilization facility of the type described in [10 CFR] § 50.21(b) or § 50.22, information sufficient to demonstrate to the Commission the financial qualification[s] of the applicant to carry out, in accordance with the regulations in this chapter, the activities for which the permit or license is sought.

10 CFR 50.2, "Definitions," states, in part, that an electric utility is:

> Any entity that generates or distributes electricity and which recovers the cost of this electricity, either directly or indirectly, through rates established by the entity itself or by a separate regulatory authority.

GPC

According to SNC, GPC meets the definition of an "electric utility" as that term is defined in 10 CFR 50.2 in that GPC recovers the cost of electricity through rates established by the GPSC. Therefore, the NRC staff concludes that GPC is exempt from financial qualification review for the operating license pursuant to 10 CFR 50.33(f).

OPC

According to SNC, OPC meets the definition of an "electric utility" as that term is defined in 10 CFR 50.2 in that OPC recovers the cost of electricity through rates set by OPC itself. Therefore, the NRC staff concludes that OPC is exempt from financial qualification review for the operating license pursuant to 10 CFR 50.33(f).

MEAG

According to SNC, MEAG meets the definition of an "electric utility" as that term is defined in 10 CFR 50.2 in that MEAG recovers the cost of electricity through rates set by MEAG itself. Therefore, the NRC staff concludes that MEAG is exempt from financial qualification review for the operating license pursuant to 10 CFR 50.33(f).

Dalton

According to SNC, the City of Dalton, Georgia (Dalton) is a municipal corporation organized and existing under the laws of the State of Georgia. Dalton constructs and operates its public utilities through the Board of Water, Light and Sinking Fund Commissioners of the City of Dalton, Georgia ("Dalton Utilities"), which was established in 1913 by an act of the Georgia legislature for the purpose of constructing and operating the public utilities for Dalton. Electric, natural gas, water, sewer, and information technology services are provided to customers of Dalton Utilities within Dalton and certain other surrounding areas. Dalton Utilities sells to its retail customers, the residents of the City of Dalton, at rates set by its board of water and light. Thus, Dalton Utilities meets the definition of an "electric utility" as that term is defined in 10 CFR 50.2 in that the cost of electricity is recovered through rates. Therefore, the NRC staff concludes that Dalton Utilities is exempt from financial qualification review for the operating license pursuant to 10 CFR 50.33(f).

SNC Operating License, Operator, non-Owner

SNC was established as a company within the Southern Company for the purpose of consolidating personnel within the Southern Electric System engaged in nuclear-related activities into a single, integrated organization. Accordingly, SNC will be the constructor and licensed operator for VEGP Units 3 and 4. Agreements will be entered into for SNC with GPC to exercise this authority. SNC will be the exclusive entity authorized to construct and operate VEGP Units 3 and 4.

Related to construction, the following corporate and contractual relationships have been established. GPC, as agent for the owners of the new units, will enter into an EPC agreement with a consortium comprising of Westinghouse Electric Company, LLC and Stone & Webster, Inc. ("the Consortium") for the construction of the units. The owners will make payment to the Consortium through GPC, as agent, for the costs under the EPC contract. SNC will administer the EPC contract on behalf of the owners.

GPC has contracted to reimburse SNC for all other funds necessary for the construction of the units. According to SNC responsibility for reimbursement of these costs will be absolute. The other owners (OPC, MEAG, and Dalton) have contracted to reimburse GPC for their proportionate shares of these costs.

GPC is subject to the jurisdiction of two rate regulatory authorities, the GPSC and the FERC. The output of VEGP Units 3 and 4 is expected to be sold to GPC retail customers; accordingly, GPC will include its proportionate share of the aforementioned costs as a capital expenditure

before the GPSC and will earn a return on prudently incurred costs from its customers. According to the application, the other plant owners will recover their costs through rates and charges to their customers.

Related to operations, the following corporate and contractual relationships have been established. SNC will not have any ownership interest in the new units, the nuclear facilities, nor the fuel. On behalf of the owners, SNC will be authorized to exercise overall responsibility for plant operations, including exclusive responsibility for safety decisions. By contract, GPC and SNC will establish cost responsibility and allocation for the units. The costs experienced directly by SNC in the operation of VEGP Units 3 and 4 will be reimbursed by GPC pursuant to the operating agreement. Other expenses of SNC that are not direct charges to a specific plant will be allocated to GPC and others for whom such expenses are incurred, as appropriate. According to SNC, responsibility for reimbursement by GPC of these costs will be absolute. GPC will, in turn, be reimbursed by the other plant owners for their proportionate shares of these costs pursuant to existing agreements.

Because the plant owners are entitled to the entire electric generation from VEGP Units 3 and 4, and do not purchase electric generation from SNC, the costs will not be "rates" subject to regulatory review and approval except as items of costs to the plant owners.

GPC will recover its proportionate share of prudently incurred costs of operation of the units in rates charged to customers as authorized by the GPSC. According to the application, the other plant owners will recover their costs through rates and charges to their customers.

With SNC as the licensed plant operator, GPC has contracted to provide all funds necessary for the safe operation, construction, maintenance, repair, decontamination and decommissioning incurred or accrued by SNC. Thus, the various contractual obligations, and retention of full ownership interest by the plant owners as well as the owners' entitlement to all electrical output from the plant, assure that the same level of financial qualification for the operating licensee will exist for VEGP 3 and 4 as for VEGP Units 1 and 2.

The plant owners will retain authority to direct, through their agent, GPC, that the plant be shut down in an orderly fashion by SNC (and in accordance with SNC's safety judgment) rather than make specific capital modifications or other major expenditures.

This retained authority ultimately will limit SNC's spending authority, but will not encumber SNC's ability to make operational safety decisions and will have no impact on safe operation of the plant.

Based on the foregoing discussion the NRC staff finds that SNC is financially qualified to hold the licenses to the extent proposed.

DECOMMISSIONING FUNDING ASSURANCE:

Regulatory Requirements:

Pursuant to the requirements of 10 CFR 50.33(k)(1), an applicant for a COL for a production or utilization facility will state information in the form of a report, as described in 10 CFR 50.75, "Reporting and recordkeeping for decommissioning planning," indicating how reasonable assurance will be provided that sufficient funds will be available to decommission the facility.

Under 10 CFR 50.75, the report must include a certification that the applicant will provide financial assurance for decommissioning using one or more of the methods allowed under the regulation at 10 CFR 50.75(e) no later than 30 days after the Commission publishes notice in the *Federal Register* (FR) under 10 CFR 52.103(a). In addition, the amount of the financial assurance may be more, but not less, than the amount stated in the table in 10 CFR 50.75(c)(1), as adjusted under 10 CFR 50.75(c)(2). Under 10 CFR 50.75(b)(4), "a combined license applicant need not obtain a financial instrument appropriate to the method to be used or submit a copy of the instrument to the Commission." (Once the COL is granted, the holder of a COL must submit an instrument as provided in 10 CFR 50.75(e)(3).)

Decommissioning Funding Estimate:

SNC has calculated the decommissioning funding assurance amount escalated to 2006 dollars, pursuant to the methodology set out in 10 CFR 50.75(c), using available regional labor and energy escalation factors from the Bureau of Labor Statistics, and escalation factors for waste burial from NUREG-1307, "Report on Waste Burial Charges: Changes in Decommissioning Waste Disposal Costs at Low-Level Waste Burial Facilities," Revision 12, which is the most currently available revision at the time the application was submitted. The 1986 (year) boiling-water reactor (BWR) base decommissioning amount is premised on the best available estimate of the thermal rating of the new reactors of 3400 MWt per unit. SNC has calculated the decommissioning funding assurance amount assuming disposal of low-level radioactive waste (LLRW) using waste vendors. As of December 31, 2010, this calculation results in a decommissioning funding assurance amount of $466,987,774 per unit.

The calculation of the decommissioning funding assurance amount assuming the use of waste vendors is set forth in Appendix 1D, Part 1 of the VEGP COL application. SNC will provide assurance of this amount through the owners, in proportion to their respective ownership shares.

The NRC staff calculated the minimum funding acceptable under 10 CFR 50.75(c), and found the applicants' amounts to be acceptable.

Decommissioning Funding Mechanism:

SNC has provided a certification that financial assurance for decommissioning will be provided in accordance with 10 CFR 50.75(b). SNC states that the owners will deposit funds for the decommissioning of VEGP Units 3 and 4 using the external sinking fund as described in 10 CFR 50.75(e)(1)(ii). In accordance with 10 CFR 50.75(e)(3), SNC, after issuance of the licenses, will submit a report for each unit, no later than 30 days after the NRC publishes notice in the FR under 10 CFR 52.103(a), including a certification that financial assurance for decommissioning is provided in the amount specified in SNC's most recent updated certification, including a copy of the financial instrument to be used.

Therefore, at this time, the NRC staff finds that the applicant, SNC, as agent for GPC, OPC, MEAG, and Dalton, has complied with applicable decommissioning funding assurance requirements.

ANTITRUST REVIEW:

The Energy Policy Act of 2005 (EPAct) removed the antitrust review authority in Section 105.c of the Atomic Energy Act of 1954, as amended, regarding license applications for production or

utilization facilities submitted under Sections 103 or 104.b of the Atomic Energy Act of 1954 after the date of enactment of the EPAct. Accordingly, the NRC is not authorized to conduct an antitrust review in connection with this COL application.

FOREIGN OWNERSHIP, CONTROL, or DOMINATION:

Section 103 of the Atomic Energy Act of 1954 prohibits the Commission from issuing a license for a nuclear power plant under Section 103 to:

> an alien or any corporation or other entity if the Commission knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation or a foreign government.

GPC Foreign Ownership, Control, or Domination

GPC is a Georgia corporation with its principal office in Atlanta, Georgia. GPC is a wholly owned subsidiary of Southern Company, a Delaware corporation with its principal office also in Atlanta, Georgia. According to the application, Southern Company is not owned, controlled, or dominated by an alien, foreign corporation, or foreign government. The names and business addresses of GPC's directors and principal officers, all of whom are citizens of the United States, were listed in the application.

According to the application, GPC is not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

The NRC staff does not know or have reason to believe otherwise.

OPC Foreign Ownership, Control, or Domination

OPC is a Georgia corporation with its principal office in Tucker, Georgia, a suburb of Atlanta, Georgia. The names and business addresses of OPC's directors and principal officers, all of whom are citizens of the United States, were listed in the application.

According to the application, OPC is not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

The NRC staff does not know or have reason to believe otherwise.

MEAG Foreign Ownership, Control, or Domination

MEAG is a public corporation and an instrumentality of the State of Georgia, a body corporate and politic, created by the General Assembly of the State of Georgia in its 1975 Session (Official Code of Georgia Annotated, Title 46, Chapter 3, Article 3). The names and business addresses of MEAG's directors and principal officers, all of whom are citizens of the United States, were listed in the application.

According to the application, MEAG is not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

The NRC staff does not know or have reason to believe otherwise.

Dalton Foreign Ownership, Control, or Domination

Dalton is a municipality within the State of Georgia. Acting by and through its Board of Water, Light and Sinking Fund Commissioners, doing business as Dalton Utilities, Dalton owns electric generation capacity, transmission capacity and a distribution system. Dalton is a duly incorporated municipality under the laws of the State of Georgia.

Dalton is a duly incorporated municipality under the laws of the State of Georgia. Dalton acts by and through its Board of Water, Light and Sinking Fund Commissioners, which does business as Dalton Utilities. Dalton Utilities is not owned, controlled, or dominated by an alien, foreign corporation, or foreign government.

The names and business addresses of the City of Dalton's governing body (Mayor and Councilmen); the Board of Water, Light and Sinking Fund Commissioners of the City of Dalton; and Dalton Utilities' principal officers (President/Chief Executive Officer, Secretary and Chief Financial Officer), all of whom are citizens of the United States, were listed in the application.

According to the application, Dalton is not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

The NRC staff does not know or have reason to believe otherwise.

SNC Foreign Ownership, Control, or Domination

SNC is a wholly owned subsidiary of Southern Company and is engaged in the operation of nuclear power plants on behalf of the Southern Electric System. SNC is a corporation organized and existing under the laws of the State of Delaware. SNC was formed for the purpose of operating nuclear facilities owned by other subsidiaries of Southern Company. Traditional electrical operating companies that are subsidiaries of Southern Company are GPC, Alabama Power Company, Gulf Power Company and Mississippi Power Company. SNC currently licensed to operate the Edwin I. Hatch Nuclear Plant, Units 1 and 2; and VEGP Units 1 and 2, for GPC, OPC, MEAG, and the City of Dalton (i.e., Dalton Utilities), (the owners). SNC also operates the Joseph M. Farley Nuclear Plant, Units 1 and 2, for Alabama Power Company. The combined electric generation of the three facilities is in excess of 6,000 MWe.

SNC is a Delaware corporation that is headquartered in Birmingham, Alabama. SNC is a wholly-owned subsidiary of Southern Company, a Delaware corporation, with its principal office in Atlanta, Georgia. According to the application, neither SNC, nor its parent, Southern Company, is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government. The names and business addresses of SNC's directors and principal officers, all of whom are citizens of the United States, were listed in the application.

The NRC staff does not know or have reason to believe otherwise.

NUCLEAR INSURANCE and INDEMNITY:

The provisions of the Price-Anderson Act (Section 170 of the Atomic Energy Act of 1954) and the Commission's regulations at 10 CFR Part 140 require that the current indemnity agreement with respect to GPC, OPC, MEAG and Dalton's current facilities reflect that GPC, OPC, MEAG and Dalton will be the licensees for VEGP Units 3 and 4 after the proposed licenses are issued.

GPC, OPC, MEAG and Dalton will be required to maintain the financial protection required by 10 CFR Part 140 and the property insurance required by 10 CFR 50.54(w), "Conditions of licenses." Upon issuance of the licenses, the NRC staff will issue to GPC, OPC, MEAG and Dalton an amended indemnity agreement to include VEGP Units 3 and 4. This is SER Commitment 1.5-1.

CONCLUSION:

Based on the foregoing, the NRC staff finds reasonable assurance that SNC, GPC, OPC, MEAG and Dalton are financially qualified to engage in the proposed activities regarding VEGP Units 3 and 4, and that there are no problematic decommissioning funding assurance issues, foreign ownership issues, and nuclear insurance and indemnity issues.

1.5.2 Nuclear Waste Policy Act

Section 302(b) of the Nuclear Waste Policy Act of 1982, as amended, states, "The Commission, as it deems necessary or appropriate, may require as a precondition to the issuance or renewal of a license under Section 103 or 104 of the Atomic Energy Act of 1954 [42 U.S.C. 2133, 2134] that the applicant for such license shall have entered into an agreement with the Secretary for the disposal of high-level radioactive waste and spent nuclear fuel that may result from the use of such license."

In a letter dated December 16, 2008, SNC stated that on November 5, 2008, it signed contracts with the Department of Energy (DOE) establishing the terms and conditions applicable to the DOE's responsibility for disposal of spent nuclear fuel and high-level radioactive waste generated at the proposed VEGP Units 3 and 4. The DOE contract numbers that are referenced in SNC's letter are DE-CR01-09RW09005 for VEGP Unit 3 and DE-CR01-09RW09006 for VEGP Unit 4. Because SNC has entered into contracts with the DOE for the disposal of high-level radioactive waste and spent nuclear fuel for VEGP Units 3 and 4, the staff considers that the applicable requirements of Section 302(b) of the Nuclear Waste Policy Act of 1982 are met.

1.5.3 Consultation with Department of Homeland Security and Notifications

1.5.3.1 *Consultation with Department of Homeland Security*

In accordance with Section 657 of the *Energy Policy Act of 2005*, the NRC consulted with the Department of Homeland Security.

1.5.3.2 *Notifications*

As required by Section 182c. of the Atomic Energy Act of 1954, as amended and 10 CFR 50.43(a), on March 2, 2011, the NRC notified the U.S. Department of Agriculture Rural Utilities Service, the U.S. Securities and Exchange Commission, the FERC, and the GPSC of the VEGP application. In accordance with Section 182c., the staff also published a notice of the application in the *Federal Register* on March 3, 10, 17, and 24, 2011 (76 FR 11822, 13241, 14699, and 16645).

Based on the staff's completion of notifications to regulatory agencies and the public notices described above, the staff concludes that, for the purpose of issuing COLs for VEGP Units 3 and 4, any required notifications to other agencies or bodies have been duly made.

1.5.4 Evaluation of Departures and Exemption Associated with Numbering in the Application and Exemption Associated with Special Nuclear Material (SNM) Material Control and Accounting (MC&A) Program

Evaluation of Departures and Exemption Associated with Numbering in the Application

In VEGP DEP 1.1-1, the applicant renumbered the VEGP COL FSAR sections to include content consistent with RG 1.206 and NUREG-0800. The applicant identified the affected FSAR sections in Part 7 of the COL application. The departure and the exemption associated with the numbering scheme of the FSAR are closely related. The departure provided in Part 7 of the COL application provides the specific sections of the VEGP COL FSAR that deviate from the DCD numbering scheme.

Pursuant to 10 CFR 52.7, "Specific Exemptions," and 10 CFR 52.93, "Exemptions and Variances," the applicant requested an exemption from 10 CFR Part 52, Appendix D, Section IV.A.2.a, to include "a plant specific DCD containing the same type of information and using the same organization and numbering as the generic DCD for the AP1000 design…." In Part 7, "Departures and Exemptions," of the VEGP COL application, the applicant states that the exemption will not result in any significant departures from the expected organization and numbering of a typical FSAR, and the information is readily identifiable to facilitate an NRC review. The applicant states that the subject deviations are considered to be purely administrative to support a logical construction of the document. Further, the revised organization and numbering generally follows the guidance provided in RG 1.206 and NUREG-0800.

Pursuant to 10 CFR 52.7, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 52. 10 CFR 52.7 further states that the Commission's consideration will be governed by 10 CFR 50.12, "Specific exemptions," which states that an exemption may be granted when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) special circumstances are present. Special circumstances are present whenever, according to 10 CFR 50.12(a)(2)(ii), "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."

Before considering whether this numbering exemption should be granted, the staff needed to address a threshold question regarding the review standard applicable to the request. Under 10 CFR 52.93(a)(1), if a request for an exemption is from any part of a design certification rule, then the Commission may grant the exemption if the exemption complies with the appropriate change provision in the referenced design certification rule, or if there is no applicable change provision, if the exemption complies with 10 CFR 52.63. Here, there is no applicable change provision in the referenced design certification rule, so according to 10 CFR 52.93(a)(1), the exemption must meet 10 CFR 52.63. However, the standards of the appropriate provision of 10 CFR 52.63 applicable to requests for exemptions from a design certification rule in 10 CFR 52.63(b)(1), by their terms, also do not apply to this change. Specifically, 10 CFR 52.63(b)(1) applies to changes to "certification information," and not administrative or procedural design certification rule provisions such as this one under consideration. In the

Statements of Consideration for 10 CFR 52.63, the Commission stated that it used the "phrase 'certification information' in order to distinguish the rule language in the DCRs from the design certification information (e.g., Tier 1 and Tier 2) that is incorporated by reference in the DCRs." 72 Fed. Reg. 49,444. The exemption requested from the AP1000 DCD numbering scheme is an exemption from rule language, not Tier 1 or Tier 2 information; therefore, 10 CFR 52.63 should not be used to analyze this exemption.

Because there is not an applicable change provision in the referenced design certification, and because 10 CFR 52.63(b)(1) does not apply to this exemption, the exemption cannot comply with the plain language of 10 CFR 52.93(a)(1). In this situation, the language of 10 CFR 52.93(a)(1) does not appear to serve the underlying purpose of the regulation as described by the Commission in the Statements of Consideration to the rule, in which the Commission stated that only changes to certification information must meet 10 CFR 52.63. Instead, this exemption should have fallen under 10 CFR 52.93(a)(2), and, thus, be analyzed under the requirements in 10 CFR 52.7. Therefore, the staff finds that, pursuant to 10 CFR 52.7, an exemption to 10 CFR 52.93(a)(1) should be granted. This exemption is warranted because it meets the requirements in 10 CFR 50.12. First, because this is an administrative change regarding what exemption regulation applies, the exemption to 10 CFR 52.93(a)(1) is authorized by law, will not present an undue risk to public health or safety, and is consistent with the common defense and security. Additionally, application of the regulation in this case is not necessary to achieve the underlying purpose of the rule. The underlying purpose of the rule is to maintain the safety benefits of standardization by requiring any exemption from certification information to meet the requirements in 10 CFR 52.63(b)(1). This underlying purpose does not apply to this exemption, because the form and organization of the application does not affect the safety benefits of standardization of the certification information. Therefore, for the purpose of determining the standards applicable to the exemption related to VEGP DEP 1.1-1, the staff finds an exemption to 10 CFR 52.93(a)(1) to be acceptable for the review of the exemption related to VEGP DEP 1.1-1.

Pursuant to the exemption described above, the NRC staff has reviewed the exemption related to VEGP DEP 1.1-1 to determine whether it meets the requirements in 10 CFR 52.7. This exemption would allow the applicant to provide an FSAR with numbering and topics more closely related to NUREG-0800 and RG 1.206., and the staff finds that this administrative change of minor renumbering will not present an undue risk to the public health and safety and is consistent with the common defense and security. In addition, this exemption is consistent with the Atomic Energy Act and is authorized by law. Further, the application of the regulation in these particular circumstances is not necessary to achieve the underlying purpose of the rule. Therefore, the staff finds that the exemption to 10 CFR Part 52, Appendix D, Section IV.A.2.a is justified. Finally, for the same reasons the staff is granting the exemption request, the staff also finds the departure from the numbering scheme in the VEGP COL FSAR to be acceptable.

Exemption Associated with Special Nuclear Material (SNM) Material Control and Accounting (MC&A) Program

In a letter dated November 23, 2010, the applicant requested an exemption from the requirements of 10 CFR 70.22(b), 10 CFR 70.32(c) and, in turn, 10 CFR 74.31, 10 CFR 74.41, and 10 CFR 74.51. The provision of 10 CFR 70.22(b) requires an application for a license for SNM to include a full description of the applicant's program for MC&A of SNM under 10 CFR 74.31; 10 CFR 74.33, "Nuclear material control and accounting for uranium enrichment facilities authorized to produce special nuclear material of low strategic significance";

10 CFR 74.41; and 10 CFR 74.51[15]. 10 CFR 70.32(c) requires a license authorizing the use of SNM to include and be subjected to a condition requiring the licensee to maintain and follow an SNM MC&A program. However, 10 CFR 70.22(b), 10 CFR 70.32(c), 10 CFR 74.31, 10 CFR 74.41, and 10 CFR 74.51 include exceptions for nuclear reactors licensed under 10 CFR Part 50. The regulations applicable to the MC&A of SNM for nuclear reactors licensed under 10 CFR Part 50 are provided in 10 CFR Part 74, Subpart B, 10 CFR 74.11 through 10 CFR 74.19, excluding 10 CFR 74.17. The applicant stated that the purpose of this exemption request is to seek a similar exception for this COL under 10 CFR Part 52, such that the same regulations will be applied to the SNM MC&A program as nuclear reactors licensed under 10 CFR Part 50. In addition, the applicant stated that the exemption request is evaluated under 10 CFR 52.7, which incorporates the requirements of 10 CFR 50.12. As stated previously, that section allows the Commission to grant an exemption if: 1) the exemption is authorized by law; will not present an undue risk to the public health and safety; and is consistent with the common defense and security; and 2) special circumstances are present as specified in 10 CFR 50.12(a)(2). The criteria in 10 CFR 50.12 encompass the criteria for an exemption in 10 CFR 70.17(a) and 10 CFR 74.7, the specific exemption requirements for 10 CFR Part 70 and 10 CFR Part 74, respectively. Therefore, by demonstrating that the exemption criteria in 10 CFR 50.12 are satisfied, this request would also demonstrate that the exemption criteria in 10 CFR 52.7, 10 CFR 70.17(a), and 10 CFR 74.7 are satisfied.

The applicant stated that the subject exemption would allow nuclear reactors licensed under 10 CFR Part 52 to be explicitly excepted from the requirements of 10 CFR 70.22(b), 10 CFR 70.32(c), 10 CFR 74.31, 10 CFR 74.41, and 10 CFR 74.51. There is no technical or regulatory basis to treat nuclear reactors licensed under 10 CFR Part 52 differently than reactors licensed under 10 CFR Part 50 with respect to the MC&A provisions in 10 CFR Part 74. As indicated in the Statement of Considerations for 10 CFR 52.0(b) (72 Federal Register 49352, 49372, 49436 (August 28, 2007)), applicants and licensees under 10 CFR Part 52 are subject to all of the applicable requirements in 10 CFR Chapter I, whether or not those provisions explicitly mention a COL under 10 CFR Part 52. This regulation clearly indicates that plants licensed under 10 CFR Part 52 are to be treated no differently than plants licensed under 10 CFR Part 50 with respect to the substantive provisions in 10 CFR Chapter I (which includes 10 CFR Part 70 and 10 CFR Part 74). In particular, the exception for nuclear reactors licensed under 10 CFR Part 50, as in 10 CFR 70.22(b), 10 CFR 74.31, 10 CFR 74.41, or 10 CFR 74.51, should also be applied to reactors licensed under 10 CFR Part 52.

The staff agrees with the applicant's justification that nuclear reactors licensed under 10 CFR Part 52 should be treated the same as the reactors licensed under 10 CFR Part 50 regarding the MC&A for SNM.

Pursuant to 10 CFR 70.17(a), the Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

In addition, pursuant to 10 CFR 74.7, the Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security, and are otherwise in the public interest.

[15] While not including an explicit exception for 10 CFR Part 50 reactors, 10 CFR 74.33 applies only to uranium enrichment facilities and thus is not directly implicated in this exemption request.

Pursuant to 10 CFR 52.7, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 52. 10 CFR 52.7 further states that the Commission's consideration will be governed by 10 CFR 50.12, "Specific exemptions," which states that an exemption may be granted when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Special circumstances are present whenever, according to 10 CFR 50.12(a)(2)(ii), "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."

The NRC staff reviewed the subject exemption, which will allow the applicant to have a similar exception for the COL under 10 CFR Part 52, such that the same regulations will be applied to the SNM MC&A program as nuclear reactors licensed under 10 CFR Part 50, and determined that this requested exemption will not present an undue risk to the public health and safety and is otherwise in the public interest. In addition, this exemption is consistent with the Atomic Energy Act and is authorized by law. Therefore, granting this exemption will not adversely affect the common defense and security. Further, the application of the regulation in these particular circumstances is not necessary to achieve the underlying purpose of the rule. Since the exemption criteria in 10 CFR 50.12 are satisfied, the staff considers that this request also demonstrates that the exemption criteria in 10 CFR 52.7, 10 CFR 70.17(a), and 10 CFR 74.7 are satisfied. Therefore, the staff finds that the exemption from 10 CFR 70.22(b), 10 CFR 70.32(c) and, in turn, 10 CFR 74.31, 10 CFR 74.41, and 10 CFR 74.51, is justified.

1.5.5 Receipt, Possession, and Use of Source, Byproduct and Special Nuclear Material Authorized by 10 CFR Part 52 Combined Licenses

In SNC's letter dated May 22, 2009, and in Part 1, "General and Financial Information," of the VEGP COL application, SNC requested material licenses for receipt, possession and use of source, byproduct and SNM in accordance with Commission regulations in 10 CFR Parts 30, 40, and 70. The reviews conducted for compliance with the requirements of 10 CFR Part 52 to support the issuance of the COLs encompass those necessary to support granting 10 CFR Parts 30, 40, and 70 licenses. In this respect, the 10 CFR Part 52 COLs for VEGP will be consistent with the approach to 10 CFR Parts 30, 40, and 70 licensing followed for operating licenses for nuclear power plants licensed in accordance with 10 CFR Part 50. The staff considered the following standard license provisions for the VEGP COLs, as it relates to authorization pursuant to regulations in 10 CFR Parts 30, 40, and 70:[16]

> Subject to the conditions and requirements incorporated herein, the Commission hereby licenses SNC:
>
> (1) (i) pursuant to the Act and 10 CFR Part 70, to receive and possess at any time, special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, described in the final safety analysis report (FSAR), as supplemented and amended;

[16] These proposed standard license conditions that the staff considered were based on similar license conditions found in SECY-00-0092, "Combined License Review Process," dated April 20, 2000.

(ii) pursuant to the Act and 10 CFR Part 70, to use special nuclear material as reactor fuel, after the finding in Section 2.D(1) of this license has been made ((note: 2D(1) is a reference to the 10 CFR 52.103(g) finding), in accordance with the limitations for storage and amounts required for reactor operation, and described in the FSAR, as supplemented and amended;

(2) pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use, at any time, any byproduct, source, and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(3) pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use in amounts as required, any byproduct, source, or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(4) pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

The staff notes that VEGP COL FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations," provides milestones for the implementation of various operational programs. Important milestone dates for various operational programs that support issuance of the license and requirements relative to 10 CFR Parts 30, 40, and 70 include the following:

- Radiation Protection Program (including as low as is reasonably achievable [ALARA] principles) – prior to initial receipt of byproduct, source, or SNMs (excluding exempt quantities as described in 10 CFR 30.18, "Exempt quantities")

- Fire Protection Program – prior to initial receipt of byproduct, source, or SNMs (excluding exempt quantities as described in 10 CFR 30.18, "Exempt quantities")

- Security Program including physical security, safeguards contingency programs, training and qualification program – prior to receipt of fuel onsite (protected area)

- Non-licensed plant staff training program associated with receipt of the radioactive material – prior to initial receipt of byproduct, source, or SNMs (excluding exempt quantities as described in 10 CFR 30.18, "Exempt quantities")

In a letter dated November 23, 2010, the applicant proposed to revise the VEGP COL FSAR Table 13.4-201 to add information (milestones and requirements) related to the SNM MC&A program. In addition, in letters dated July 29, 2009, July 9, 2010, October 15, 2010, and November 23, 2010, the applicant identified the portions of the application that demonstrate compliance with the requirements of 10 CFR Parts 30, 40, 70, and 74. Also, in a letter dated November 23, 2010, the applicant requested an exemption from the requirements of 10 CFR 70.22(b), 10 CFR 70.32(c) and, in turn, 10 CFR 74.31, 10 CFR 74.41, and 10 CFR 74.51. This exemption request is addressed in Section 1.5.4 of this SER.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 1.5-1) related to the standard content in the BLN SER. The resolution of this item is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 1.5.6 of the BLN SER:

> *In addition to the evaluation of the implementation milestones noted above, the staff's evaluation of the radiation protection program that supports the issuance of the 10 CFR Parts 30, 40, and 70 licenses is addressed in Chapter 12 of this SER. Additional staff evaluations that support the issuance of the 10 CFR Part 70 license are addressed in Chapter 9 of this SER (i.e., new fuel storage, spent fuel storage, and fire protection programs) and in the staff's evaluation of TVA's security program. The staff finds that the information in the Bellefonte COL application to support granting of the 10 CFR Part 70 license mentioned as part of the license above is sufficient, pending resolution of the open items in this report related to new and spent fuel, fire protection program, security program, and the implementation of the fire protection and security programs. However, TVA needs to provide a discussion of which parts of its COL application other than the reference to the radiation protection program provide sufficient information to support compliance with the applicable portions of 10 CFR Part 30 and 40, prior to the 10 CFR 52.103(g) finding. This is Open Item 1.5-1.*

Resolution of Standard Content Open Item 1.5-1

In letters dated July 29, 2009, July 9, 2010, and October 15, 2010, the applicant provided additional information related to source, byproduct and SNM and its purposes, radiation safety personnel, personnel training, facilities and equipment, waste management, and the radiation safety program in general.

Subsequent to the issuance of the SER with open items for the BLN application, the staff performed an additional review associated with granting the 10 CFR Parts 30, 40 and 70 licenses. For the 10 CFR Part 70 license, the staff considered SNM associated with the fuel (including security requirements) and SNM associated with non-fuel material (i.e., fission chambers). The staff also considered emergency plan requirements associated with SNM (fuel and non-fuel material). Based on these reviews, standard content Open Item 1.5-1 is resolved. These reviews are described below.

Review of Parts 30 and 40 Materials

In a letter dated March 3, 2011, the applicant provided information regarding specific types of sources and byproduct material, the chemical or physical form, and the maximum amount at any time for the requested material licenses under 10 CFR Parts 30 and 40. The applicant also stated that SNM shall be in the form of reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the VEGP COL FSAR. Byproduct material and source material shall be in the form of sealed neutron sources for reactor startup and sealed sources for reactor instrumentation, radiation monitoring equipment, calibration, and fission detectors in amounts as required. The applicant also committed that no 10 CFR Part 40 specifically licensed source material, including natural uranium, depleted uranium and uranium hexafluoride will be received, possessed, or used during the period between issuance of the COL and the Commission's 10 CFR 52.103(g) finding for each of the VEGP Units 3 and 4. The applicant also stated that the quantity of any byproduct material with atomic numbers 1 through 93 would not exceed 100 millicuries for a single source and 5 Curies total. The maximum quantity for Americium-241 would not exceed 300 millicuries for single source and 500 millicuries total. Following the 10 CFR 52.103(g) finding for each of the VEGP Units 3 and 4, byproduct material, source material, and SNM in amounts as required, without restriction to chemical forms or physical form, would be used for the following:

- Sample analysis,
- Instrument and equipment calibration, and
- Associated with radioactive apparatus or components.

With respect to the requirements of 10 CFR Parts 30, 40, and 70 that are related to radiation protection (including administrative controls), the applicant provided information (in letters dated July 9, and November 23, 2010) on the purpose, storage and security of sources in VEGP COL FSAR Sections 12.2 and 12.5. Information related to the radiation protection program itself, including procedures for the use of these sources, is also described in VEGP COL FSAR Chapter 12. In addition, VEGP COL FSAR Section 13.4 states that the radiation protection program will be implemented according to the milestones listed in VEGP COL FSAR Table 13.4-201, Item 10. These milestones ensure that those portions of the program necessary to comply with the requirements of 10 CFR Parts 20, 30, 40, and 70, are implemented prior to the receipt of byproduct, source, SNM, or fuel, onsite.

The staff finds that the information provided by the applicant that describes the radiation protection measures (Chapter 12 of the VEGP COL FSAR) that will be implemented prior to receipt of byproduct, source or SNM, conforms to the applicable guidance in NUREG-1556, "Consolidated Guidance about Materials Licenses," and is, therefore, acceptable. The radiation protection program milestones included in the VEGP COL FSAR Table 13.4-201 are evaluated in Section 12.5 of this SER.

In a letter dated July 9, 2010, the applicant provided supplemental information relative to Item 14, Emergency Planning, in VEGP COL FSAR Table 13.4-201. In addition, the applicant proposed to revise the term 'portions applicable to SNM' to 'portions applicable to radioactive materials' for Item 14; Item 8, Fire Protection Program; Item 11, Non-Licensed Plant Staff Training Program; and Item 15, Physical Security Program. In addition, the applicant proposed to correct the references to regulatory citations of 10 CFR 30.32, "Application for specific licenses"; 10 CFR 40.31, "Application for specific licenses"; and 10 CFR 70.22, "Contents of applications." It also proposed to revise the "Requirements" column for Item 14 of the VEGP COL FSAR Table 13.4-201 to reference 10 CFR 30.32(i)(1), 10 CFR 40.31(j)(1), and 10 CFR 70.22(i)(1). It also proposed to revise Part 10 of the VEGP COL application, Proposed License Condition 3, "Operational Program Implementation," Section C, "Receipt of Materials," to include implementation of the portions of the emergency planning program applicable to SNM. In addition to the evaluation of the implementation milestones noted above, the staff's evaluation that supports the issuance of the 10 CFR Parts 30 and 40 licenses is addressed in Chapter 9 (the fire protection program).

The operational programs are specific programs that are required by regulations. VEGP COL FSAR Table 13.4-201 lists each operational program, the regulatory source for the program, the section of the FSAR in which the operational program is described, and the associated implementation milestone(s). The applicant proposed a license condition in Part 10, License Condition 3, Item C.3 of the VEGP COL application, which provides the milestones for implementing the portions of the non-licensed plant staff training program applicable to receipt of the radioactive material. However, Table 13.4-201 specifies implementation requirements (10 CFR 30.32(a), 10 CFR 40.31(a), and 10 CFR 70.22(a)) for the non-licensed plant staff training program associated with receipt of the radioactive material. Therefore, the staff determined that Item C.3 of proposed License Condition 3 is not needed because the implementation milestones for the non-licensed plant staff training program associated with receipt of radioactive material are governed by the applicable regulations.

The applicant proposed a license condition in Part 10 of the VEGP COL application to provide a schedule to support the NRC's inspection of operational programs, including the non-licensed plant staff training program applicable to receipt of the radioactive material. The proposed license condition is consistent with the policy established in SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," for operational programs and is acceptable.

In response to RAI 1.5-1, the applicant stated, in a letter dated October 15, 2010, that no byproduct material will be received, possessed, or used at AP1000 units of a physical form that is in unsealed form, on foils or plated sources, or sealed in glass, that exceeds the quantities in Schedule C of 10 CFR 30.72. Since the quantities do not exceed Schedule C, an emergency plan that meets the requirements of 10 CFR 30.32(i)(3) is not required. As such, the implementation of the emergency plan prior to the receipt of byproduct material will be removed from VEGP COL FSAR Table 13.4-201 and from Part 10 proposed License Condition 3, Item C.4. The request for a 10 CFR Part 40 license does not involve authorization to receive, possess, or use uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total. However, in a letter dated March 3, 2011, the applicant revised the request for a 10 CFR Part 40 license to state that no 10 CFR Part 40 specifically-licensed source material, including natural uranium, depleted uranium and uranium hexafluoride (UF_6), will be received, possessed, and used during the period between issuance of the COL and the Commission's 10 CFR 52.103(g) finding for each of the VEGP Units 3 and 4. Since the above

quantities are not exceeded, an emergency plan for responding to the radiological hazards of an accidental release of source material and to any associated chemical hazards related to the material is not required. As such, the implementation of the emergency plan prior to the receipt of source material will be removed from VEGP COL FSAR Table 13.4-201. This applicant's proposal meets the requirements of 10 CFR 30.32 and 10 CFR 40.31 and is, therefore, acceptable. The incorporation of changes into a future revision of the VEGP COL FSAR is **Confirmatory Item 1.5-1**.

Resolution of Standard Content Confirmatory Item 1.5-1

Confirmatory Item 1.5-1 is an applicant commitment to revise FSAR Table 13.4-201. The staff verified that the VEGP COL FSAR Table 13.4-201 was appropriately revised. As a result, Confirmatory Item 1.5-1 is now closed.

The applicant also proposed an FSAR commitment to address the limitations during the period prior to the implementation of the emergency plan. In a letter dated March 16, 2011, the applicant stated that it has no plans to process UF_6 at the plant site at any time following the Commission's 10 CFR 52.103(g) finding, and consequently does not expect the requested 10 CFR Part 40 license to include receipt, storage, or use of UF_6 at the plant site. However, using the guidance of DC/COL-ISG-15, "Post-Combined License Commitments", the staff has determined that the commitment is not sufficient and instead the staff is proposing to add a restriction in the license condition related to 10 CFR Parts 30 and 40 (See License Condition 1-1,c(ii).

Review of Part 70 Materials

The staff reviewed information related to nuclear fuel as SNM included in the VEGP COL application including the AP1000 DCD against 10 CFR Part 70 requirements. Specifically, the staff's review included:

- General information—financial qualification, site description, hydrology, geology, meteorology, the nearby population, and potential effects of natural phenomena (Part 1 of the application, FSAR Section 1.1 and Chapter 2, Section 4.1 and Table 4.1-1 of the AP1000 DCD against the requirements of 10 CFR 70.22(a)(1) through (a)(4));

- Organization and Administration—the responsibilities and associated resources for the receipt, possession, inspection, and storage of the SNM in the form of fresh fuel assemblies (Part 1 of the application, Quality Assurance Program included in Part 11 (Enclosure 11A) of the application, VEGP COL FSAR Section 13.1 for organization against the requirements of 10 CFR 70.22(a)(6) and (a)(8));

- Radiation Protection—Radiation protection program implementation, organization and personnel qualification, written procedures, ALARA, radiation survey and monitoring (AP1000 DCD Section 9.1 and Chapter 12 of VEGP COL FSAR against the requirements of 10 CFR 70.22(a)(6) through (a)(8));

- Nuclear Criticality Safety—use of area radiation monitors in lieu of criticality accident alarms (AP1000 DCD Sections 9.1.1.3 and 11.5.6 against the requirements of 10 CFR 70.22(a)(6) through (a)(8) and 10 CFR 50.68(b));

- Fire safety—fire protection program (VEGP COL FSAR Section 9.5.1 and Table 13.4-201 against the requirements of 10 CFR 70.22(a)(6) through (a)(8));

- Emergency Preparedness— emergency preparedness program for the VEGP site (VEGP COL FSAR Section 13.3 and Table 13.4-201 and the Emergency Plan against the requirements of 10 CFR 70.22(i));

- Environmental Protection—organization, procedures and controls that ensures that the environment is protected during the conduct of activities (i.e., receipt, possession, inspection, and storage of SNM) (VEGP COL FSAR Section 11.5 and AP1000 DCD Sections 9.1.1 and 11.5 against the requirements of 10 CFR 70.22(a)(7) and (a)(8)); and

- MC&A Program and Security (MC&A program included in the application against requirements of 10 CFR 70.22(b) and 10 CFR Part 74, and the Physical Security Plan (PSP) against the requirements of 10 CFR 73.67, "Licensee fixed site and in-transit requirements for the physical protection of special nuclear material of moderate and low strategic significance").

As indicated above, the applicant's compliance with several applicable 10 CFR Part 70 requirements regarding radiation protection, nuclear criticality safety, and environmental protection is already encompassed by the design information incorporated by reference from the AP1000 DCD and evaluated by the staff as part of the design certification proceeding. As explained further below, with respect to other applicable 10 CFR Part 70 requirements to be addressed by the COL applicant, the staff finds that the information provided regarding general information, organization and administration, radiation protection, nuclear criticality safety, fire safety, emergency preparedness, and environmental protection to support receipt, storage, and possession of SNM conforms to the applicable guidance in NUREG-1520 and NUREG-0800 and, therefore, is acceptable. First, however, the staff's review of information regarding the MC&A program (10 CFR 70.22(b) and 10 CFR Part 74) and the PSP (10 CFR 73.67) is provided below.

MC&A Program for SNM (Fuel)

In RAI 1.5-3, the staff requested the applicant to review the requirements of 10 CFR 70.22(b) for the program addressing the control and accounting of SNM and provide descriptions of how the applicable requirements for material accounting and controls under 10 CFR Part 74 will be met for the possession and storage of SNM during construction and prior to the operation of the nuclear power plant. In addition, the staff requested the applicant to provide a proposed license condition to clearly establish full implementation of the MC&A program meeting the applicable requirements of 10 CFR Part 74 prior to receipt of SNM, consistent and concurrent with the proposed license condition for implementing the applicable security (i.e., physical protection) requirements of 10 CFR Part 73.

In response to RAI 1.5-3, the applicant, in a letter dated November 23, 2010, stated that all non-irradiated SNM for the AP1000 units is identified as Category III, SNM of low strategic significance, as defined in 10 CFR 74.4, "Definitions." No SNM at an AP1000 nuclear facility will exceed an uranium-235 isotope enrichment of 10 percent. The quantity of SNM will be documented, controlled, and communicated to the NRC as required in 10 CFR 74.13, "Material status reports"; 10 CFR 74.15, "Nuclear material transaction reports"; and 10 CFR 74.19, "Recordkeeping."

In its response to RAI 1.5-3, the applicant also described the SNM MC&A program and stated that this program will be provided as an enclosure in the VEGP COL application, Part 11. The SNM MC&A program will be developed for control and accounting of SNM in accordance with the applicable requirements of 10 CFR Part 74, Subparts A and B. This program will be consistent with guidance of American National Standards Institute (ANSI) 15.8-2009, "Material Control Systems – Special Nuclear Material Control and Accounting Systems for Nuclear Power Plants." The SNM MC&A program will be implemented prior to receipt of SNM at the plant site and will remain in effect until the SNM is shipped from the plant site. The procedures constituting the SNM MC&A program will delineate the requirements, responsibilities, and methods of SNM control necessary to address the following programmatic elements:

1. Establish, maintain, and follow written MC&A procedures to account for SNM.

2. Maintain adequate records of the initial receipt or current inventory of SNM, including records of isotopic content, material received, material shipped, and material lost (material balance reports and physical inventory listing reports).

3. Develop adequate inventory procedures and maintain adequate perpetual inventory records.

4. Inventory SNM within the 12-month prescribed frequency.

5. Report SNM inventories on the applicable forms.

6. Establish an individual responsible for the control and accountability of SNM.

7. Report the loss of or inability to find SNM items in a timely manner.

8. Control access to SNM.

9. Control the shipping and transfer of SNM.

The applicant proposed to add a new FSAR Section 13.5.2.2.9, which will summarize the use of plant procedures to address MC&A of SNM. The applicant also stated that VEGP COL FSAR Table 13.4-201 will be revised to provide information related to implementation of the SNM MC&A program.

In order to address the applicable 10 CFR Part 74 MC&A requirements prior to power operation, the applicant proposed a license condition that will require implementation of a MC&A program prior to receipt of SNM on site. Implementation of the SNM MC&A program prior to SNM receipt will also address the SNM possession and storage requirements during construction and prior to operation of the nuclear power plant.

The applicant's MC&A program for SNM is consistent with ANSI 15.8 and meets reporting and recordkeeping requirements of 10 CFR 74.11, "Reports of loss or theft or attempted theft or unauthorized production of special nuclear material"; 10 CFR 74.13; 10 CFR 74.15; and 10 CFR 74.19. The documentation, submitted by the applicant, for a program addressing the control and accounting of SNM provided descriptions of how the applicable requirements for material accounting and controls under 10 CFR Part 74 are met and, therefore, is acceptable, subject to the proposed revision to the VEGP COL application and the VEGP COL FSAR (this

has been tracked as **Confirmatory Item 1.5-2**). In addition, the proposed license condition includes a provision to provide a schedule to support the NRC's inspection of the MC&A program for the SNM. This is consistent with the policy established in SECY-05-0197 and is thus acceptable.

Resolution of Standard Content Confirmatory Item 1.5-2

Confirmatory Item 1.5-2 is an applicant commitment to revise FSAR Sections 13.4, 13.5 and Parts 7 and 11 (Enclosure 11D) of its application to address the SNM MC&A program. The staff verified that the VEGP COL FSAR and Parts 7 and 11 (Enclosure 11D) of its application were appropriately revised. As a result, Confirmatory Item 1.5-2 is now closed.

Security Review for 10 CFR Part 70 Materials

In accordance with 10 CFR 73.55(a)(4), current applicants for an operating license under 10 CFR Part 50, or a COL under 10 CFR Part 52 who have submitted their applications to the Commission prior to the effective date of this rule must amend their applications to include security plans consistent with this section.

The Commission worded 10 CFR 73.55(a)(4) to require implementation of 10 CFR 73.55, "Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage," "before fuel is allowed onsite (protected area)." The Commission explained this provision as follows:

> This paragraph establishes when an applicant's physical protection program must be implemented. The receipt of special nuclear material (SNM) in the form of fuel assemblies onsite, (*i.e.*, within the licensee's protected area) is the event that subjects a licensee or applicant to the requirements of this rule, and it is the responsibility of the applicant or licensee to complete the preliminary and preparatory actions required to implement an effective physical protection program at the time SNM is received onsite (within the protected area). 74 FR 13926, 13960 (Mar. 27, 2009)

Further guidance is provided in the form of RGs to support implementation of this Rule. The following guidance is provided in RG 5.76, "Physical Protection Programs at Nuclear Power Reactors":

> Except for mixed-oxide (MOX) fuel assemblies, the Commission requirements of 10 CFR 73.67, "Licensee Fixed Site and In-Transit Requirements for the Physical Protection of Special Nuclear Material of Moderate and Low Strategic Significance," apply and must be met until fuel assemblies are received inside an operational protected area. Consistent with 10 CFR 73.55(a)(4), applicants for an operating license under the provisions of 10 CFR Part 50, or holders of a COL under the provisions of 10 CFR Part 52, shall implement the requirements of 10 CFR 73.55 before special nuclear material (SNM) in the form of fuel assemblies are allowed on site (in the protected area).

In a letter dated March 15, 2011, the NRC staff asked the applicant to provide its plan regarding the protection of new fuel as SNM at the VEGP Units 3 and 4 plant site prior to declaration of an operational protected area (PA) and implementation of the requirements of 10 CFR 73.55, as described in the SNM MC&A Program description. In addition, the staff also requested that the

applicant consider the applicability of the substantive provisions of interim compensatory orders (ICMO) that were issued to Category III Fuel Cycle Facilities to ensure adequate protection when SNM is on site prior to the activation of the PA. In response to the staff's questions, in a letter dated March 16, 2011, the applicant provided a physical protection plan in accordance with 10 CFR 73.67(f) and (g). This plan was included as an annex to the PSP. This plan includes transportation security provisions. The applicant also stated that once the PA is declared operational in accordance with 10 CFR 73.55(a)(4), the annex would no longer be required and could be removed in accordance with 10 CFR 50.54(p). Then, no separate transportation security provisions would be necessary for future new fuel shipments. The staff raised a question regarding the licensee's ability to receive new fuel and return new fuel rods/assemblies to the fuel manufacturer. In a letter dated May 6, 2011, the applicant proposed to revise its FSAR Section 13.5.2.2.8 to include the New Fuel Shipping Plan that addresses the applicable 10 CFR 73.67 requirements in the event that unirradiated new fuel assemblies or components are returned to the supplying fuel manufacturer(s) facility. The New Fuel Shipping Plan summarizes the procedures and the written agreement that the applicant will have in place prior to shipment of new fuel back to the fuel manufacturer, and this plan will be included in Part 11, Enclosures of its application. The staff finds this New Fuel Shipping Plan acceptable because it meets the applicable requirements of 10 CFR 73.67(g). The staff verified that the VEGP FSAR Section 13.5 and Part 11 (Enclosure 11E) are appropriately updated.

In the RAI response dated March 16, 2011, the applicant addressed the Order imposing fingerprinting and criminal history records check requirements for unescorted access to radioactive material or other property dated April 30, 2007. In accordance with Section 5.4 of the PSP annex, the applicant committed to utilizing the access authorization program as outlined in Section 14.1 of the PSP. The access authorization program in Section 14.1 is in accordance with 10 CFR 73.56, "Personnel Access Authorization Requirements for Nuclear Power Plants," based on implementing guidance as provided by RG 5.66, "Access Authorization Program for Nuclear Power Plants," Revision 1 and Section 652 of the Energy Policy Act of 2005 (EP Act).

The applicant conducted a critical target area analysis (CTA), and determined that a CTA would not exist. Because there is no CTA at the facility, there is no need to address security issues related to CTAs. In addition, the applicant has adequately addressed security issues related to; security response procedures, coordination with local law enforcement for response support, storage of hazardous materials on-site, review of emergency shutdown/cool down procedures, supplementing of the Emergency Actions Levels, site accountability and evacuation strategies, emergency communications, evaluation of computer and communications networks for vulnerabilities, capabilities to provide fire suppression, evaluation of the need for offsite medical support, emergency support, and access to Federal support, and limiting public access to sensitive plant information. However, the staff has determined that the commitment included in the RAI responses is not sufficient and instead the staff is proposing to add a license condition to ensure adequate protection prior to implementation of the requirements of 10 CFR 73.55. This license condition (1-5) will preclude changes to the security plan provisions related to these issues without prior NRC approval until such matters fall under the new reactor security requirements of 10 CFR 73.55.

The staff's review of the applicant's PSP for the protection of SNM of low strategic significance (LSS) includes information that has been marked as "Safeguards Information" by the applicant, pursuant to 10 CFR 73.21 and 73.22. The NRC staff reviewed the applicant's PSP for fixed site physical protection of SNM-LSS and chemicals of concern. The methods and procedures outlined in the PSP satisfy the performance objectives, systems capabilities, and reporting

requirements specified in 10 CFR 73.67. The PSP for the facility is acceptable and provides reasonable assurance that the requirements for the physical protection of SNM-LSS and chemicals of concern will be met. The staff also verified that the PSP is appropriately updated.

Non-Fuel SNM

In a letter dated June 22, 2011, the applicant provided information regarding the name, amount, and specifications (including the chemical and physical form and, where applicable, isotopic content) of the non-fuel SNM (Fission Chambers) the applicant proposes to use (10 CFR 70.22(a)(4)). The letter also provided information to confirm that the applicable design and programmatic elements provided in the licensing basis will satisfy the requirements in 10 CFR 70.22(a)(6) through (8) prior to receipt of non-fuel SNM.

10 CFR Part 70 Requirements – Other than MC&A (10 CFR 70.22(b) and 10 CFR Part 74) and Security (10 CFR 73.67) – for Fuel and Non-Fuel Material

As noted above, in addition to MC&A and security, the staff also examined the applicant's compliance with 10 CFR Part 70 requirements regarding general information, organization and administration, radiation protection, nuclear criticality safety, fire safety, emergency preparedness, and environmental protection to support receipt, storage, and possession of SNM.

The staff's analysis follows with respect to those other requirements not already resolved via the applicant's incorporation of the AP1000 DCD. For the reasons described in Section 1.4.4 of this FSER, the staff agrees that the applicant is technically qualified to engage in the proposed activities associated with this license, based on the applicant's ongoing experience in the safe operation of nuclear power plants, as presented in Section 1.4.1 of the VEGP COL FSAR. Likewise, the applicant's financial qualifications and ownership structure meet the requirements of 10 CFR 70.22 for the same reasons described above in Section 1.5.1. Similarly, the applicant has explained the anticipated amounts, types, and uses of 10 CFR Part 70 materials at the site are consistent with the provisions of 10 CFR 70.22. The VEGP COL FSAR and Part 1 of the application provide adequate description of the VEGP Units 3 and 4 facility and the proposed activities related to 10 CFR Parts 30, 40 and 70 material. In addition the VEGP COL FSAR provides information regarding regional hydrology, geology, meteorology, the nearby population, and potential effects of natural phenomena that could occur at the facility. The applicant has described the responsibilities and associated resources (see Part 1, "General and Administration Information," and Enclosure 11A, "Nuclear Development Quality Assurance Manual" of the application) for the receipt, possession, inspection, and storage of the 10 CFR Part 70 material (fuel and non-fuel). Therefore, it meets the requirements of 10 CFR 70.22(a)(1). Furthermore, as indicated in VEGP COL FSAR Table 13.4-201, applicable portions of the Radiation Protection Program will be implemented prior to initial receipt of byproduct, source, or SNMs. In accordance with VEGP COL FSAR Table 13.4-201, Item 10, Implementation Milestone #1, and the NRC-approved template, Nuclear Energy Institute (NEI) 07-03A, "Generic FSAR Template Guidance for Radiation Protection Program Description," which is incorporated by reference into VEGP COL FSAR Appendix 12AA (see SER Section 12.5), the appropriate radiation protection program elements associated with organization, facilities, instrumentation and equipment, procedures (e.g., procurement, receipt, inventory, labeling, leak testing, surveillance, control, transfer, disposal, storage, issuance, and use of radioactive sources), and training will be in place prior to initial receipt of byproduct, source, or special nuclear materials, thereby satisfying the requirements of 10 CFR 70.22(a)(4), (6), (7), and (8). VEGP COL FSAR Section 12.2 includes the requirements for written

procedures that address leak-testing of radioactive sources. The leak-test will be consistent with 10 CFR 20.1501, "General," survey and monitoring requirements for evaluating the quantities of radioactive material and the potential radiological hazard of the radioactive source.

The fission chambers will be disposed of consistent with the operating procedures that specify the processes to be followed to ship waste that complies with the waste acceptance criteria (WAC) of the disposal site, the waste classification and characteristics requirements of 10 CFR 61.55, "Waste classification," and 10 CFR 61.56, "Waste characteristics," and the requirements of third party waste processors as applicable. This process is identified in VEGP COL FSAR Section 11.4.6.1.

With respect to fire safety, prior to installation, the new fission chambers (along with the new fuel) will be stored in the Auxiliary Building fuel handling area, which is an area protected by the fire protection program and fire protection system, as discussed in the AP1000 DCD Section 9A.3.1.3.1.2. Temporary storage of these non-combustible sealed sources is not specifically addressed in the AP1000 fire protection analysis in DCD Appendix 9A; however, the approach to extinguishing fires and containing material releases associated with the fission chambers would be similar to, and bounded by, the approach considered for the fuel handling area in general. The fuel handling area has been evaluated and determined acceptable for the storage of SNM in a full core load of new fuel. The hazards imposed by the relatively small quantity of SNM associated with the fission chambers (less than 100 grams), is not expected to be a challenge to the existing fire protection analysis for the new fuel storage (see Section 9.5.1 of this SER). The VEGP COL FSAR Section 12.2 includes the requirements for written procedures that address leak testing of radioactive sources (byproduct, source, and devices that contain SNM, as appropriate). Further, the fission chambers that contain the non-fuel SNM are sealed sources that are tested periodically to confirm their leak-tightness. Therefore, it is expected that the capabilities of the fire protection program and the fire protection equipment servicing this area are sufficient to meet the requirements of 10 CFR 70.22(a)(7) and 10 CFR 70.22(a)(8).

Emergency Plan (SNM, Fuel and Non-Fuel)

The applicant will be storing the new fuel in the new fuel rack (stored dry) or in the spent fuel racks prior to loading into the reactor. The safety analysis included in AP1000 DCD Sections 9.1.1.3 and 9.1.2.3 provides safety analysis that indicates that: (1) the design of new fuel rack is such that K_{eff} remains less than or equal to 0.95 with full density unborated water and less than equal to 0.98 with optimum moderation and full reflection conditions; and (2) the design of spent fuel rack is such that K_{eff} remains less than or equal to 0.95 under design basis conditions. This criticality evaluation meets the requirements of 10 CFR 50.68(b). Therefore, a criticality accident alarm system to meet the requirements of 10 CFR 70.24, "Criticality accident requirements," is not required. As a result, an emergency plan (to receive and possess) pursuant to 10 CFR 70.22(i) is also not required. In addition, an emergency plan for the fission chambers (to receive and possess) pursuant to 10 CFR 70.22(i) is not required due to the small quantity of SNM (less than 100 grams) associated with the fission chambers.

Conclusion

Based on the above, the staff finds that the information regarding general information, organization and administration, radiation protection, nuclear criticality safety, fire safety, emergency preparedness, and environmental protection to support receipt, storage, and

possession of fuel and non-fuel SNM (Fission Chambers), conforms to the applicable guidance in NUREG-1520 and NUREG-0800 and, therefore, is acceptable.

For the reasons discussed above, the staff proposes to include the following license conditions for the VEGP COL, as they relate to authorization pursuant to regulations in 10 CFR Parts 30, 40, and 70:

- License Condition (1-1) - Subject to the conditions and requirements incorporated herein, the Commission hereby licenses SNC:

  (a) (i) Pursuant to the Act and 10 CFR Part 70, to receive and possess at any time, special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, described in the final safety analysis report (FSAR), as supplemented and amended;

  (ii) Pursuant to the Act and 10 CFR Part 70, to use special nuclear material as reactor fuel, after a Commission finding under 10 CFR 52.103(g) has been made, in accordance with the limitations for storage and amounts required for reactor operation, and described in the FSAR, as supplemented and amended.

  (b) (i) Pursuant to the Act and 10 CFR Parts 30, and 70, to receive, possess, and use, at any time, before a Commission finding under 10 CFR 52.103(g), such byproduct, and special nuclear material as: sealed neutron sources for reactor startup; sealed sources for reactor instrumentation and radiation monitoring equipment, calibration; and fission detectors in amounts as required;

  (ii) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use, after a Commission finding under 10 CFR 52.103(g), any byproduct, source, and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment, calibration, and as fission detectors in amounts as required;

  (c) (i) Pursuant to the Act and 10 CFR Parts 30, and 70, to receive, possess, and use, before a Commission finding under 10 CFR 52.103(g), in amounts not exceeding those specified in 10 CFR 30.72, any byproduct, or special nuclear material that is (1) in unsealed form; (2) on foils or plated surfaces, or (3) sealed in glass, for sample analysis or instrument calibration or other activities associated with radioactive apparatus or components;

  (ii) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use, after a Commission finding under 10 CFR 52.103(g), in amounts as required, any byproduct, source, or special nuclear material without restriction as to chemical or physical form, for sample analysis or instrument calibration or other activity associated with radioactive apparatus or components, but not uranium hexafluoride; and

(d) Pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

- License Condition (1-2) - Prior to initial receipt of special nuclear materials (SNM) onsite, the licensee shall implement the SNM Material Control and Accounting (MC&A) program. No later than 12 months after issuance of the COL, the licensee shall submit to the Director of Office of New Reactors (NRO) a schedule that supports planning for and conduct of NRC inspections of the SNM Material Control and Accounting program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the SNM Material Control and Accounting program has been fully implemented.

- License Condition (1-3) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspection of the non-licensed plant staff training program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the non-licensed plant staff training program has been fully implemented.

- License Condition (1-4) – Prior to initial receipt of SNM on site, the licensee shall implement the SNM physical protection program. No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspection of the SNM physical protection program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the SNM physical protection program has been fully implemented.

- License Condition (1-5) – The licensee shall not revise or modify the provisions of Sections 5.3, 5.4, 5.6, 5.9 and 5.10 of the Special Nuclear Material (SNM) Physical Protection Plan until the requirements of 10 CFR 73.55 are implemented.

2.0 SITE CHARACTERISTICS

Chapter 2, "Site Characteristics," of the Final Safety Analysis Report (FSAR) addresses the geological, seismological, hydrological, and meteorological characteristics of the site and vicinity, in conjunction with present and projected population distribution and land use, and site activities and controls.

2.0.1 Introduction

The site characteristics are reviewed by the Nuclear Regulatory Commission (NRC) staff to determine whether the applicant has accurately described the site characteristics and site parameters together with site-related design parameters and design characteristics in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, certifications, and approvals for nuclear power plants." The review is focused on the site characteristics and site-related design characteristics needed to enable the NRC staff to reach a conclusion on all safety matters related to siting of Vogtle Electric Generating Plant (VEGP) Units 3 and 4. Because this combined license (COL) application references a design certification (DC), this section focuses on the applicant's demonstration that the characteristics of the site fall within the site parameters specified in the DC rule or, if outside the site parameters, that the design satisfies the requirements imposed by the specific site characteristics and conforms to the design commitments and acceptance criteria described in the AP1000 Design Control Document (DCD).

2.0.2 Summary of Application

Section 2.0 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2 of the AP1000 DCD, Revision 19 and Section 1.3 of the VEGP Early Site Permit (ESP) application Site Safety Analysis Report (SSAR), Revision 5. The advanced safety evaluation (ASE) with confirmatory items for Section 2.0 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse revised the AP1000 Tier 1, Table 5.0-1 and Tier 2, Table 2-1 (which revised the VEGP COL FSAR Table 2.0-201). These revised AP1000 tables have been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Section 2.0, the applicant provided the following:

Supplemental Information

- VEGP Supplemental (SUP) 2.0-1

The applicant provided supplemental information in VEGP COL FSAR Section 2.0, "Site Characteristics," which describes the characteristics and site-related design parameters of VEGP Units 3 and 4. In a letter dated July 1, 2010, the applicant provided a proposed revision to VEGP COL FSAR Table 2.0-201 to reflect the proposed changes to the AP1000 Tier 1, Table 5.0-1 and Tier 2, Table 2-1.

- VEGP ESP Permit Condition (PC) 9

The applicant added, in VEGP COL FSAR Table 2.0-201 (sheet 6) and FSAR Table 2.0-202 (sheets 1 and 2), supplemental information to address the VEGP ESP PC 9 related to the accident analysis χ/Q values.

2.0.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements and in NUREG-1923, "Safety Evaluation Report for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant (VEGP) ESP Site."

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the site characteristics are given in Section 2.0 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants ((LWR Edition)."

The applicable regulatory requirements for site characteristics are as follows:

- 10 CFR 52.79(a)(1)(i) - (vi) provides the site-related contents of the application.

- 10 CFR 52.79(d)(1), as it relates to information sufficient to demonstrate that the characteristics of the site fall within the site parameters specified in the DC.

- 10 CFR Part 100, "Reactor site criteria," as it relates to the siting factors and criteria for determining an acceptable site.

The related acceptance criteria from Section 2.0 of NUREG-0800 are as follows:

- The acceptance criteria associated with specific site characteristics/parameters and site-related design characteristics/parameters are addressed in the related Chapter 2 or other referenced sections of NUREG-0800.

- Acceptance is based on the applicant's demonstration that the site characteristics and site-related design parameters specified in the ESP fall within the site parameters and design characteristics specified in the DC. If the actual site characteristics do not fall within the certified standard design site parameters, the COL applicant provides sufficient justification (e.g., by request for exemption or amendment from the DC, or request for a variance from the ESP) that the proposed facility is acceptable at the proposed site.

2.0.4 Technical Evaluation

The NRC staff reviewed Section 2.0 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[17] The NRC staff's review confirmed that the information in the application and

[17] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a DC and ESP.

incorporated by reference addresses the required information relating to site characteristics. The results of the NRC staff's technical evaluation of the information incorporated by reference related to site characteristics are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 2.0-1
- VEGP ESP PC 9

The NRC staff reviewed supplemental information VEGP SUP 2.0-1, and VEGP ESP PC 9 in VEGP COL FSAR Section 2.0, "Site Characteristics," describing the characteristics and site-related design parameters of VEGP Units 3 and 4. The DCD site parameters in DCD Table 2-1 are compared to the site-specific characteristics in VEGP COL FSAR Table 2.0-201. In addition, control room (CR) atmospheric dispersion factors for accident dose analysis are presented in VEGP COL FSAR Table 2.0-202.

The NRC staff reviewed and compared the site-specific characteristics included in VEGP COL FSAR Tables 2.0-201 and 2.0-202 against DCD Table 2-1. The staff's evaluation of the population distribution is addressed in Section 2.1 of this SER. The staff's evaluation of the site characteristics associated with air temperature, precipitation, wind speed, atmospheric dispersion values, and CR atmospheric dispersion values is addressed in Section 2.3 of this SER. The staff's evaluation of site characteristics associated with flood level, ground water level, and plant grade elevation is addressed in Section 2.4 of this SER. The staff's evaluation of seismic and soil site characteristics is addressed in Section 2.5 of this SER. The staff's evaluation of site characteristics associated with missiles is addressed in Section 3.5 of this SER.

The NRC staff reviewed and compared the site-specific characteristics included in FSAR Table 2.0-201 against the AP1000 DCD site parameters included in DCD Table 2-1. The staff's review confirmed that in every case, as shown in Table 2.0-201, the DCD value envelops the site-specific value. Detailed discussions of the staff's review are in the individual SER sections identified above. The updating of the VEGP COL FSAR to include the changes to FSAR Table 2-201 discussed in the applicant's letter dated July 1, 2010, is **Confirmatory Item 2.0-1**.

Resolution of VEGP Site-specific Confirmatory Item 2.0-1

Confirmatory Item 2.0-1 is an applicant commitment to revise its FSAR Table 2.0-201 to reflect the revised the AP1000 Tier 2, Table 2-1. The staff verified that the VEGP COL FSAR Table 2.0-1 was appropriately revised. As a result, Confirmatory Item 2.0-1 is now closed.

The applicant took a variance (VEGP ESP VAR 2.3-1) from the site characteristics (the maximum normal temperature and minimum normal temperature) specified in the VEGP ESP SSAR Table 1-1, "Site Characteristics, Design Parameters, and Site Parameters." This variance is addressed in SER Section 2.3.

2.0.5 Post Combined License Activities

There are no post-COL activities related to this section.

2.0.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to the site characteristics and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

As set forth above, the NRC staff reviewed the application to ensure that sufficient information was presented in VEGP SUP 2.0-1, and VEGP ESP PC 9 to demonstrate that the characteristics of the site fall within the site parameters specified in the DC. The applicant has demonstrated that the site characteristics fall within the DC site parameters and thus meet the requirements of 10 CFR 52.79(d)(1).

2.1 Geography and Demography

Section 2.1, "Geography and Demography" of the VEGP COL FSAR addresses site-specific information related to site location and description, exclusion area authority and control, and population distribution.

Section 2.1 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.1 of the AP1000 DCD, Revision 19 and Section 2.1 of the VEGP ESP SSAR, Revision 5, and adds VEGP COL 2.1-1 to address COL Information Item 2.1-1 (COL Action Items 2.1.1-1, 2.1.2-1 and 2.1.3-1). The applicant stated that VEGP COL 2.1-1 is addressed in Sections 1.1.1 and 1.2.2 of the VEGP COL FSAR and in Section 2.1 of the VEGP ESP SSAR. The information in VEGP COL FSAR Sections 1.1.1 and 1.2.2, related to VEGP COL 2.1-1, provides descriptive information regarding the site that does not need NRC review and approval. The staff found that the applicant appropriately supplied site-specific geography and demography by incorporating by reference VEGP ESP SSAR Section 2.1. The staff has already reviewed Section 2.1 of the VEGP ESP SSAR and found the information relating to site-specific geography and demography to be acceptable as documented in NUREG-1923. Therefore, the staff concludes that the information in VEGP ESP SSAR Section 2.1 and incorporated by reference in VEGP COL FSAR Section 2.1 is sufficient to satisfy the requirements of COL Information Item 2.1-1. Hence, the NRC staff considers COL Information Item 2.1-1 resolved.

The NRC staff reviewed Section 2.1 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to site-specific geography and demography. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.2 Nearby Industrial, Transportation, and Military Facilities

2.2.1 Locations and Routes

Section 2.2, "Nearby Industrial, Transportation, and Military Facilities" of the VEGP COL FSAR addresses site-specific information related to "Locations and Routes" of nearby industrial, transportation, and military facilities.

Section 2.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.2 of the AP1000 DCD, Revision 19, and VEGP ESP SSAR Section 2.2, Revision 5. Section 2.2 of the DCD is incorporated by reference with no supplements related to "Locations and Routes," and one departure related to DCD Section 2.2.1. The departure, VEGP DEP 1.1-1, applies to VEGP COL FSAR section numbering and is addressed by the NRC staff in Chapter 1 of this SER. Section 2.2 of the VEGP ESP SSAR includes Section 2.2.1, which is incorporated by reference with no variances or supplements. The staff found that the applicant appropriately supplied site-specific information related to locations and routes of nearby industrial, transportation, and military facilities by incorporating by reference VEGP ESP SSAR Section 2.2. The NRC staff documented its review of Section 2.2 of the VEGP ESP SSAR in NUREG-1923; it found the information relating to site-specific locations and routes of nearby industrial, transportation, and military facilities to be acceptable as documented in NUREG-1923. Therefore, the staff concludes that the information in VEGP ESP SSAR Section 2.2 and incorporated by reference in VEGP COL FSAR Section 2.2 is sufficient to satisfy the requirements of COL Information Item 2.2-1. Hence, the NRC staff considers the locations and routes of nearby industrial, transportation, and military facilities aspect of COL Information Item 2.2-1 resolved.

The NRC staff reviewed Section 2.2 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to site-specific locations and routes of nearby industrial, transportation, and military facilities. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.2.2 Descriptions

Section 2.2, "Nearby Industrial, Transportation, and Military Facilities" of the VEGP COL FSAR addresses site-specific information related to "Descriptions" of nearby industrial, transportation, and military facilities.

Section 2.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Subsection 2.2 of the DCD, Revision 19, and VEGP ESP SSAR Section 2.2, Revision 5. Section 2.2 of the DCD is incorporated by reference with no departures or supplements related to "Descriptions." Section 2.2 of the VEGP ESP SSAR includes Section 2.2.2, which is incorporated by reference with no variances or supplements. The staff found that the applicant appropriately supplied site-specific information related to the descriptions of nearby industrial, transportation, and military facilities by incorporating by reference VEGP ESP SSAR Section 2.2. The NRC staff documented its review of Section 2.2 of the VEGP ESP SSAR in NUREG-1923 where it found the information relating to site-specific descriptions of nearby industrial, transportation, and military facilities to be acceptable. Therefore, the staff concludes that the information in VEGP ESP SSAR Section 2.2 and incorporated by reference in VEGP COL FSAR Section 2.2 is

sufficient to satisfy the requirements of COL Information Item 2.2-1. Hence, the NRC staff considers the descriptions of nearby industrial, transportation, and military facilities of COL Information Item 2.2-1 resolved.

The NRC staff reviewed Section 2.2 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to site-specific descriptions of nearby industrial, transportation, and military facilities. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.2.3 Evaluation of Potential Accidents

2.2.3.1 *Introduction*

Section 2.2.3, "Evaluation of Potential Accidents" addresses the evaluation of potential accidents involving hazardous materials or activities onsite and in the vicinity of the proposed site to confirm that appropriate data and analytical models have been used.

2.2.3.2 *Summary of Application*

Section 2.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.2 of the AP1000 DCD, Revision 19, and Section 2.2 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.2, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 2.2-1

The applicant provided additional information in VEGP COL 2.2-1 to address COL Information Item 2.2-1 (COL Action Item 2.2-1) related to the evaluation of potential accidents involving hazardous materials. The applicant stated that VEGP COL 2.2-1 is addressed in VEGP COL FSAR Sections 2.2.3.2.3.1, 2.2.3.2.3.2, 2.2.3.3, 2.2.3.4, and Section 2.2 of the VEGP ESP SSAR.

This COL item states that the COL applicant referencing the AP1000 certified design will address the identification of site-specific potential hazards. Regulatory Guide (RG) 1.206, "Combined License Applications for Nuclear Power Plants (LWR [Light-Water Reactor] Edition)," states that onsite hazardous material inventories and related information not reviewed as a part of the ESP will be included in the COL application as appropriate.

The applicant also addressed impacts due to potential fires and radiological hazards as a part of COL Information Item 2.2-1.

- VEGP COL 6.4-1

The applicant provided additional information in VEGP COL 6.4-1 to address COL Information Item 6.4-1 (COL Action Item 6.4-1) related to the evaluation of potential accidents involving

hazardous materials that may impact the control room habitability. The applicant stated that VEGP COL 6.4-1 is addressed in VEGP COL FSAR Sections 2.2.3.2.3.1, 2.2.3.2.3.2, 2.2.3.3, 6.4.4, and 6.4.4.2.

This COL item states that COL applicants referencing the AP1000 certified design are responsible for addressing the amount and location of possible sources of hazardous chemicals in or near the plant.

- STD COL 6.4-1

The applicant provided additional information in Standard (STD) COL 6.4-1 to address COL Information Item 6.4-1 (COL Action Item 6.4-1) related to the evaluation of potential accidents involving hazardous materials that may impact the control room habitability. The applicant stated that STD COL 6.4-1 is addressed in VEGP COL FSAR Sections 2.2.3.2.3.1, 2.2.3.2.3.2, 2.2.3.3, 6.4.4, and 6.4.4.2.

In a letter dated June 17, 2010, the applicant provided additional information as STD COL 6.4-1 related to the onsite chemical hazards. Specifically, the applicant provided a proposed revision to VEGP FSAR Table 6.4-201 that provides a description of the onsite chemicals including an identification of which chemicals are expected to be standard to all AP1000 COLs. The FSAR table also provides a description using the VEGP COL 6.4-1 annotation for which chemicals are expected to be plant-specific. The staff's review of the standard AP1000 onsite chemicals found in VEGP's June 17, 2010, letter is found under STD COL 6.4-1 in Section 2.2.3.4 below.

ESP COL Information Items

- VEGP ESP COL 2.2-1

The applicant provided additional information in VEGP ESP COL 2.2-1 to address VEGP ESP COL Action Item 2.2-1 related to the hydrazine hazard from onsite storage tanks. The applicant stated that VEGP ESP COL 2.2-1 is addressed in VEGP COL FSAR Section 2.2.3.2.3.1.

NUREG-1923, Section 2.3.3.2.2 states that due to the impact on control room habitability, these calculations will be evaluated at the time of the COL application.

- VEGP ESP COL 2.2-2

The applicant provided additional information in VEGP ESP COL 2.2-2 to address VEGP ESP COL Action Item 2.2-2 related to the other site-specific chemicals from onsite storage tanks providing quantities and locations and evaluation of potential hazards. The applicant stated that VEGP ESP COL 2.2-2 is addressed in VEGP COL FSAR Section 2.2.3.2.3.2.

NUREG-1923, Section 2.3.3.2.2 states that potential toxic concentrations of these chemicals based on their volatility, toxicity, and quantity, including their impact on control room habitability, will be evaluated at the time of the COL application.

Supplemental Information

- VEGP SUP 2.2-1

The applicant provided supplemental information in VEGP SUP 2.2-1 by adding the following references:

> Murphy, K.G., and K.M. Campe, "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19," U.S. Atomic Energy Commission, 13th Air Cleaning Conference, 1974.
>
> U.S. Environmental Protection Agency, "ALOHA (Areal Location of Hazardous Atmospheres)," Version 5.4.1, February 2007.

Variances

- VEGP ESP VAR 2.2-1

This ESP variance item proposed changes to the VEGP ESP SSAR associated with the other chemical hazards from onsite storage tanks.

In VEGP COL FSAR Section 2.2.3.2.3.2, the applicant states that in some instances, alternative chemicals to those proposed by Westinghouse have been suggested.

2.2.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793, the FSER related to the DCD and its supplements, and in NUREG-1923.

The applicable regulatory requirements for the evaluation of potential accidents are:

- 10 CFR 52.79(a)(1)(iv), as it relates to the factors to be considered in the evaluation of sites, which require the location and description of industrial, military, or transportation facilities and routes, and the requirements of 10 CFR 52.79(a)(1)(vi), as they relate to compliance with 10 CFR Part 100.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the evaluation of potential accidents are provided in Section 2.2.3 of NUREG-0800.

The related SRP acceptance criteria are:

- Event Probability: The identification of design-basis events resulting from the presence of hazardous materials or activities in the vicinity of the plant or plants of specified type is acceptable if all postulated types of accidents are included for which the expected rate of occurrence of potential exposures resulting in radiological dose in excess of the 10 CFR 50.34(a)(1) limits, as it relates to the requirements of 10 CFR Part 100, is estimated to exceed the NRC staff's objective of an order of magnitude of 10^{-7} per year.

- Design-Basis Events: The effects of design-basis events have been adequately considered, in accordance with 10 CFR 100.20(b), if analyses of the effects of those accidents on the safety-related features of the plant or plants of a specified type have been performed and measures have been taken (e.g., hardening, fire protection) to mitigate the consequences of such events.

2.2.3.4 *Technical Evaluation*

The NRC staff reviewed Section 2.2 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information related to hazardous materials or activities. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

Hydrazine Hazard from Onsite Storage Tanks

The staff reviewed the information in the VEGP COL FSAR, with respect to the hydrazine hazard from onsite storage tanks.

AP1000 COL Information Items

- VEGP COL 2.2-1
- VEGP COL 6.4-1

ESP COL Information Item

- VEGP ESP COL 2.2-1

The NRC staff reviewed VEGP COL 2.2-1 (related to COL Information Item 2.2-1) and VEGP ESP COL 2.2-1 (related to ESP COL Action Item 2.2-1), which address the hydrazine hazard from onsite storage tanks.

VEGP COL 6.4-1 (related to COL Information Item 6.4-1) is addressed in Section 6.4 of this SER.

In resolution of VEGP ESP COL Action Item 2.2-1, the applicant added new information to VEGP ESP SSAR Section 2.2.3.2.3 with an evaluation of potential hazards for the impact on the new Units 3 and 4 due to an accidental hydrazine release from onsite storage tanks located at VEGP Unit 1. Impact on control room habitability for Units 3 and 4 due to an accidental release of hydrazine, not previously evaluated in the VEGP ESP SSAR, is evaluated and addressed in VEGP COL FSAR Section 2.2.3.2.3.1. The analyses include the following four evaluations as a part of the response to request for additional information (RAI) 6.4-3.

Toxicity of a Hydrazine Vapor Cloud

Toxicity of a vapor cloud from hydrazine release is determined for control room habitability. The concentration of hydrazine based on a release of 6644 gallons is calculated at the outside and inside the Unit 3 control room at a distance of 2200 feet (ft) from the hydrazine tank located at VEGP Unit 1 turbine building. In RAI 6.4-3, the staff requested that the applicant justify analysis methodology and the control room air exchange rate. In its response, dated March 5, 2010, the applicant provided changes to the control room air exchange rate and the associated chemical hazard analysis. The concentration inside the control room with air exchange rate of 0.95 per hour is calculated using the ALOHA model to be 7.76 parts per million (ppm), which is within the limiting immediate danger to life and health (IDLH) value of 50 ppm.

Flammability of a Hydrazine Vapor Cloud

Based on the lower flammability limit (LFL) of 4.7 percent and the upper flammability limit (UFL) of 99.9 percent for hydrazine, the distance calculated from the leak source to the LFL is 54 ft. Therefore, there is no potential flammable hydrazine vapor reaching the Unit 3 control room.

Explosive Hydrazine Vapor Cloud

Since the hydrazine vapor cloud does not reach the control room with any flammability, the NRC staff agrees that no explosion will occur at the control room due to a hydrazine vapor cloud.

Hydrazine Tank Explosion

The potential explosion due to confined vapor in the tank is evaluated by the Trinitrotoluene (TNT) equivalent of hydrazine vapor confined in the tank. The distance not exceeding peak incident pressure of 1 pounds per square inch (psi) due to explosion is determined using RG 1.91, “Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants,” Revision 1 methodology to be 311 ft, which is less than the distance from the hydrazine tank to the Unit 3 control room of 2200 ft.

The NRC staff performed independent confirmatory calculations for the evaluations discussed above and confirmed the applicant’s results and conclusions. Therefore, the staff considers the applicant’s analysis of hydrazine from onsite storage tanks pertaining to COL Action Item 2.2-1 reasonable and acceptable.

The applicant’s proposed changes to VEGP COL FSAR Section 2.2.3.2.3.1 will be tracked as **Confirmatory Item 2.2-1**.

Resolution of VEGP Site-specific Confirmatory Item 2.2-1

Confirmatory Item 2.2-1 is an applicant commitment to revise its FSAR Section 2.2.3.2.3.1. The staff verified that VEGP COL FSAR Section 2.2.3.2.3.1 was appropriately revised. As a result, Confirmatory Item 2.2-1 is now closed.

Other Chemical Hazards from Onsite Storage Tanks

The staff reviewed the information in the VEGP COL FSAR, with respect to the other chemical hazards from onsite storage tanks.

AP1000 COL Information Items

- VEGP COL 2.2-1
- VEGP COL 6.4-1
- STD COL 6.4-1

ESP COL Information Item

- VEGP ESP COL 2.2-2

Variances

- VEGP ESP VAR 2.2-1

The NRC staff reviewed VEGP COL 2.2-1 (related to COL Information Item 2.2-1), VEGP ESP COL 2.2-2 (related to ESP COL Action Item 2.2-2), and VEGP ESP VAR 2.2-1 (related to VEGP ESP VAR Item 2.2-1), which addresses the other chemical hazards from onsite storage tanks.

VEGP COL 6.4-1 (related to AP1000 COL Information Item 6.4-1) is addressed in Section 6.4 of this SER.

The applicant supplemented VEGP ESP SSAR Section 2.2.3.2.3 with new information pertaining to the evaluation of potential hazards for the impact on the new Units 3 and 4 due to other chemical hazards from onsite storage tanks in resolving VEGP ESP COL Action Item 2.2-2. VEGP COL FSAR Table 2.2-201 provides specific information about the chemicals described in VEGP ESP SSAR Table 2.2-6. The applicant stated that "Except as noted, these chemicals have been suggested by Westinghouse for use in the AP1000 and have been evaluated in conjunction with AP1000 standard design and found not to present a hazard to the control room operators or to safety-related systems, structures, or components."

The applicant replaced Table 2.2-201 with Table 6.4-201 in the VEGP COL FSAR giving the list of all chemicals, including standard chemicals suggested by the Westinghouse AP1000 DCD, as well as VEGP site-specific chemicals. In a letter dated June 17, 2010, the applicant provided a proposed revision to VEGP FSAR Table 6.4-201, which provides a description of the onsite chemicals including an identification of which chemicals are expected to be standard to all AP1000 COLs. The staff's review of the standard chemicals for all AP1000 plants is found under STD COL 6.4-1 below. The staff's site-specific evaluation of these chemicals appears under VEGP COL 6.4-1 below.

STD COL 6.4-1

On the basis of the staff's confirmatory analysis of the standard chemicals, the concentration of two chemicals, hydrazine and carbon dioxide, exceeded respective chemical IDLH concentration outside the control room. Therefore, these chemicals are being further evaluated as part of control room habitability systems in SER Section 6.4, along with the review of other chemicals listed in FSAR Table 6.4-201 in the applicant's June 17, 2010, letter.

The staff reviewed the applicant's Table 6.4-201 standard AP1000 chemicals stored onsite, and the applicant's screening out of chemicals that do not pose a threat to control room habitability.

Based on evaluation of the information presented in the VEGP COL FSAR, confirmatory analyses, and review of the response to the request for additional information (RAI 2.2.3-1), the staff evaluated whether any additional chemicals needed to be evaluated further in Section 6.4 along with the applicant's identified list of toxic chemicals for control room habitability. The staff concluded that the two standard AP1000 chemicals hydrazine and carbon dioxide exceeded IDLH concentration outside the control room; these are further evaluated in SER Section 6.4 for control room habitability.

The inclusion of the VEGP FSAR Table 6.4-201 standard chemicals in the applicant's letter dated June 17, 2010, in the next revision of the VEGP COL FSAR is **Confirmatory Item 2.2-2**.

Resolution of Standard Content Confirmatory Item 2.2-2

Confirmatory Item 2.2-2 is an applicant commitment to revise its FSAR Table 6.4-201. The staff verified that VEGP COL FSAR Table 6.4-201 was appropriately revised. As a result, Confirmatory Item 2.2-2 is now closed.

VEGP COL 6.4-1

The applicant has not addressed the site-specific impact of the chemicals on VEGP Units 3 and 4 control room habitability. As a result, RAI 2.2.3-1 was issued asking the applicant to provide the details for the other chemical hazards from onsite storage tanks in addressing the control room habitability impacts. On the basis of the review of the chemical inventory information and response provided by the applicant, and the staff's confirmatory analysis, the staff determined that the concentration of the site-specific chemicals Methoxypropylamine (MPA) and ammonium bisulfite exceeded the respective IDLH concentration outside the control room. Therefore, these two additional chemicals are being further evaluated as part of control room habitability systems in SER Section 6.4.

The staff reviewed the applicant provided (Table 6.4-201 found in the applicant's June 17, 2010 letter) site-specific chemicals stored onsite, and the applicant's screening out of chemicals that do not pose a threat to control room habitability. Based on evaluation of the information presented in the VEGP COL FSAR, confirmatory analyses, and review of the response to RAI 2.2.3-1, the staff considered whether any additional chemicals needed to be evaluated further in Section 6.4 along with the applicant's identified list of toxic chemicals for control room habitability. The staff concludes that two site-specific chemicals, MPA and Ammonium bisulfite, exceeded IDLH concentration limits outside the control room, and these are further evaluated in SER Section 6.4 for control room habitability.

The inclusion of the applicant's Table 6.4-201 standard chemicals in its letter dated June 17, 2010, in the next revision of the VEGP COL FSAR is **Confirmatory Item 2.2-2**.

Resolution of VEGP Site-specific Confirmatory Item 2.2-2

Confirmatory Item 2.2-2 is an applicant commitment to revise its FSAR Table 6.4-201. The staff verified that VEGP COL FSAR Table 6.4-201 was appropriately revised. As a result, Confirmatory Item 2.2-2 is now closed.

Fires

The staff reviewed the information in the VEGP COL FSAR, with respect to forest fires and fires due to an accident at an offsite industrial storage facility.

AP1000 COL Information Items

- VEGP COL 2.2-1
- VEGP COL 6.4-1

The NRC staff reviewed VEGP COL 2.2-1 (related to COL Information Item 2.2-1), which addressed fires.

VEGP COL 6.4-1 (related to COL Information Item 6.4-1) is addressed in SER Section 6.4.

The applicant presented additional information to VEGP ESP SSAR Section 2.2.3.3 pertaining to fires as part of VEGP COL 2.2-1.

The NRC staff reviewed the information provided by the applicant with respect to forest fires and industrial fires at offsite industrial storage facilities and finds the applicant's information acceptable, as it meets the guidance provided in NUREG/CR-1748, "Hazards to Nuclear Power Plants from Nearby Accidents Involving Hazardous Materials-A Preliminary Assessment."

Radiological Hazards

The staff reviewed the information in the VEGP COL FSAR, with respect to radiological hazards.

AP1000 COL Information Item

- VEGP COL 2.2-1

The NRC staff reviewed VEGP COL 2.2-1 (related to COL Information Item 2.2-1), which addresses radiological hazards.

The applicant presented additional information to VEGP ESP SSAR Section 2.2.3.4 pertaining to radiological hazards due to loss-of-coolant accident (LOCA) design-basis accident (DBA) in Unit 1 or 2 for uprated conditions using alternate source term methodology as part of VEGP COL 2.2-1.

The NRC staff reviewed the information provided by the applicant, and finds the applicant's information acceptable, as the radiological doses are comparable to the dose reported in AP1000 DCD Tier 2, Table 15.6.5-3 for a postulated LOCA. Radiological doses are further addressed in Section 6.4 and Section 15 of this SER.

Supplemental Information

- VEGP SUP 2.2-1

The applicant provided the following additional references in VEGP SUP 2.2-1.

> Murphy, K.G., and K.M. Campe, "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19," U.S. Atomic Energy Commission, 13th Air Cleaning Conference, 1974.
>
> U.S. Environmental Protection Agency, "ALOHA (Areal Location of Hazardous Atmospheres)," Version 5.4.1, February 2007.

The staff finds the addition of these references to be acceptable, as the methodology provided in these references is consistent with the NRC guidance in NUREG-0570, "Toxic Vapor Concentrations in the Control Room Following a Postulated Accidental Release."

2.2.3.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.2.3.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to evaluation of potential accidents, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

On the basis of confirmatory analysis, the staff determined that the concentration of two standard chemicals, hydrazine and carbon dioxide; and the concentration of the site-specific chemicals, MPA and ammonium bisulfite, exceeded the respective IDLH concentration outside the control room. Therefore, the two standard AP1000 chemicals, hydrazine and carbon dioxide, and two site-specific chemicals, MPA and ammonium bisulfite, are identified for further evaluation by the staff in SER Section 6.4 for control room habitability, along with the review and evaluation of other chemicals listed in Table 6.4-201.

As set forth above, the applicant has identified potential accidents related to the presence of hazardous materials or activities in the site vicinity that could affect a nuclear power plant or plants of the specified type that might be constructed on the proposed site, has appropriately determined those that should be considered as design-basis events, and has demonstrated that the plant is adequately protected and can be operated with an acceptable degree of safety with regard to the DBAs. The staff has reviewed the information provided in the VEGP ESP SSAR and the VEGP COL FSAR and, for the reasons given above, concludes that the applicant has established that the construction and operation of VEGP Units 3 and 4 on the proposed site location are acceptable to meet the requirements of 10 CFR 52.79(a)(1)(iv) and 10 CFR 52.79(a)(1)(vi) for compliance with respect to determining the acceptability of the site. This addresses VEGP COL 2.2-1. The applicant has provided sufficient information to satisfy the applicable requirements of 10 CFR Part 50, "Domestic licensing of production and utilization

facilities“; 10 CFR Part 52; and 10 CFR Part 100 for the acceptability of the site for proposed nuclear units.

2.3 Meteorology

To ensure that a nuclear power plant or plants can be designed, constructed, and operated on an applicant’s proposed site in compliance with the Commission’s regulations, the NRC staff evaluates regional and local climatological information, including climate extremes and severe weather occurrences that may affect the design and siting of a nuclear plant. The staff reviews information on the atmospheric dispersion characteristics of a nuclear power plant site to determine whether the radioactive effluents from postulated accidental releases, as well as routine operational releases, are within Commission guidelines.

2.3.1 Regional Climatology

2.3.1.1 *Introduction*

Section 2.3, “Meteorology,” of the VEGP COL FSAR addresses regional climatology, including averages and extremes of climatic conditions and regional meteorological phenomena that could affect the safe design and siting of the plant, including information describing the general climate of the region, seasonal and annual frequencies of severe weather phenomena, and other meteorological conditions to be used for design- and operating-basis considerations.

2.3.1.2 *Summary of Application*

Section 2.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.3.1 of the AP1000 DCD, Revision 19, and Section 2.3.1 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.3, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.3-1

The applicant provided additional information in VEGP COL 2.3-1 to address COL Information Item 2.3-1 (COL Action Item 2.3.1-1) related to regional climatology. The applicant stated that VEGP COL 2.3-1 is addressed in Section 2.3.1 of the VEGP ESP SSAR.

This COL item states that the applicant should address site-specific information related to regional climatology; that is, the COL applicant should describe averages and extremes of climatic conditions and regional meteorological phenomena that could affect the safe design and siting of the plant in accordance with Section 2.3.1 of NUREG-0800.

ESP COL Information Item

- VEGP ESP COL 2.3-1

The applicant provided additional information in VEGP ESP COL 2.3-1 to address VEGP ESP COL Action Item 2.3-1 related to the ultimate heat sink (UHS).

This COL item states that if the applicant chooses an alternative plant design other than the AP1000 that requires the use of a UHS cooling tower, the applicant will need to identify the appropriate meteorological characteristics (i.e., maximum evaporation and drift loss and minimum water cooling conditions) used to evaluate the design of the chosen UHS cooling tower. The applicant has chosen the AP1000 reactor design, which does not use a cooling tower to release heat to the atmosphere following a LOCA. Therefore, the applicant need not identify meteorological characteristics for evaluating the design of a UHS cooling tower.

Supplemental Information

- VEGP SUP 2.3-1

The applicant provided supplemental information in VEGP SUP 2.3-1 related to winter precipitation roof loading.

Variances

- VEGP ESP VAR 2.3-1

This ESP variance (VAR) item proposed changes to the VEGP ESP SSAR associated with the maximum and minimum normal air temperature site characteristic values.

2.3.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for regional climatology are given in Section 2.3.1 of NUREG-0800.

The acceptance criteria for the additional regional climatic information presented in the FSAR beyond that presented in the SSAR (i.e., VEGP SUP 2.3-1 and VEGP ESP VAR 2.3-1) are based on meeting the following relevant requirements of 10 CFR Part 52 and 10 CFR Part 100:

- 10 CFR 52.79(a)(iii), as it relates to identifying the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and time in which the historical data have been accumulated.

- 10 CFR 100.20(c)(2) and 10 CFR 100.21(d), with respect to the consideration given to the regional meteorological characteristics of the site.

The related acceptance criteria summarized from NUREG-0800 Section 2.3.1 specify, in part, that an application meets the above requirements, if the application satisfies the following criteria:

- Ambient temperature and humidity statistics should be derived from data recorded at nearby representative climatic stations or obtained from appropriate standards with suitable corrections for local conditions.

- Consistent with the staff's branch position on winter precipitation loads, the winter precipitation loads to be included in the combination of normal live loads to be considered in the design of a nuclear power plant that might be constructed on the proposed site should be based on the weight of the 100-year snowpack or snowfall, whichever is greater, recorded at ground level. Likewise, the winter precipitation loads to be included in the combination of extreme live loads to be considered in the design of a nuclear power plant that might be constructed on the proposed site should be based on the weight of the 100-year snowpack at ground level plus the weight of the 48-hour probable maximum winter precipitation (PMWP) at ground level for the month corresponding to the selected snowpack.

Subsequent to publication of NUREG-0800 Section 2.3.1, the staff issued Interim Staff Guidance (ISG) document DC/COL-ISG-7, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures," to clarify the staff's position on identifying winter precipitation events as site characteristics and site parameters for determining normal and extreme winter precipitation loads on the roofs of Seismic Category I structures.

2.3.1.4 *Technical Evaluation*

The NRC staff reviewed Section 2.3 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information related to regional climatology. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.3-1

The NRC staff reviewed VEGP COL 2.3-1 (related to AP1000 COL Information Item 2.3-1), which addresses regional climatology. The staff found that the applicant appropriately supplied site-specific regional climatological information by incorporating by reference VEGP ESP SSAR Section 2.3.1. The staff has already reviewed Section 2.3.1 of the VEGP ESP SSAR and found the information included therein to be acceptable as documented in NUREG-1923. Therefore, the staff concludes that the information in VEGP ESP SSAR Section 2.3.1 and incorporated by reference in VEGP COL FSAR Section 2.3 is sufficient to satisfy the requirements of COL Information Item 2.3.1. Hence, the NRC staff considers this COL item resolved.

ESP COL Information Item

- VEGP ESP COL 2.3-1

The NRC staff reviewed VEGP ESP COL 2.3-1 (related to VEGP ESP COL Action Item 2.3-1), which addresses the UHS. The applicant has chosen the AP1000 reactor design, which does not use a cooling tower to release heat to the atmosphere following a LOCA. The AP1000

design uses a passive containment cooling system (PCS) to provide the safety-related UHS. The PCS is designed to withstand the maximum safety dry bulb and coincident wet bulb air temperature site parameters specified in the AP1000 DCD. Therefore, the applicant need not identify meteorological characteristics for evaluating the design of a UHS cooling tower. Hence, the NRC staff considers this COL item resolved.

Supplemental Information

- VEGP SUP 2.3-1

The staff reviewed the applicant's supplemental information related to winter precipitation roof loading provided in VEGP COL FSAR Section 2.3.1.3.4. The applicant stated that the AP1000 safety-related roofs are sloped and designed to handle winter snowpack with margin to handle rainfall on top of the 100-year snowpack. According to the applicant, the safety-related roofs will not deflect enough to hold water under the snow load; therefore, ponding of rain water with preexisting snow pack conditions will not occur. The applicant stated that the physical arrangement of the AP1000 sloped roof is designed such that the 100-year snow pack will not prevent the PMWP from draining off the sloped roof system. In addition, the applicant stated that the AP1000 roof includes insulation that assures uniform temperatures on the roof surface. According to the applicant, this minimizes the potential for ice dams that are typically formed across roofs with a temperature differential. The VEGP site-specific 100-year ground snow load of 10 pounds-force per square foot (lbf/ft^2) is well within the AP1000 design basis ground snow load site parameter value of 75 lbf/ft^2.

The NRC staff issued proposed DC/COL-ISG-07 for public comment on August 22, 2008 (73 *Federal Register* [FR] 49712). (The staff notes that ISG-07 was finalized and issued on June 23, 2009.) The proposed ISG clarifies the NRC staff's position on identifying winter precipitation events as site characteristics and site parameters for determining normal and extreme winter precipitation loads on the roofs of Seismic Category I structures. The proposed ISG revises the previously issued NRC staff guidance as discussed in NUREG-0800 Section 2.3.1. The proposed ISG states that normal and extreme winter precipitation events should be identified in NUREG-0800 Section 2.3.1 as COL site characteristics for use in NUREG-0800 Section 3.8.4 in determining the normal and extreme winter precipitation loads on the roofs of Seismic Category I structures. The normal winter precipitation roof load is a function of the normal winter precipitation event, whereas the extreme winter precipitation roof loads are based on the weight of the antecedent snowpack resulting from the normal winter precipitation event plus the larger resultant weight from either: (1) the extreme frozen winter precipitation event; or (2) the extreme liquid winter precipitation event. The extreme frozen winter precipitation event is assumed to accumulate on the roof on top of the antecedent normal winter precipitation event, whereas the extreme liquid winter precipitation event may or may not accumulate on the roof, depending on the geometry of the roof and the type of drainage provided. The proposed ISG further states:

- The normal winter precipitation event should be the highest ground-level weight (in lbf/ft^2) among: (1) the 100-year return period snowpack; (2) the historical maximum snowpack; (3) the 100-year return period two-day snowfall event; or (4) the historical maximum two-day snowfall event in the site region.

- The extreme frozen winter precipitation event should be the higher ground-level weight (in lbf/ft^2) between: (1) the 100-year return period two-day snowfall event; and (2) the historical maximum two-day snowfall event in the site region.

- The extreme liquid winter precipitation event is defined as the theoretically greatest depth of precipitation (in inches (in.) of water) for a 48-hour period that is physically possible over a 25.9-square-kilometer (km) (10-square-mile (mi)) area at a particular geographical location during those months with the historically highest snowpacks.

The NRC staff asked the applicant in RAI 2.3.1-4 to identify the extreme frozen winter precipitation event and the extreme liquid winter precipitation event as site characteristics in accordance with DC/COL-ISG-07.

In response to RAI 2.3.1-4, dated November 18, 2008, the applicant identified its extreme frozen winter precipitation event as 17.2 lbf/ft^2, based on the historic maximum monthly snowfall recorded in the site vicinity (22 in. of snow recorded at Bamberg, South Carolina, in February 1973). The staff finds this acceptable because this historic maximum monthly snowfall total bounds: (1) any historical maximum two-day snowfall event in the site region; and (2) the 100-year return period 48-hour two-day snowfall event for any climatological stations in the region as reported by the National Climatic Data Center's Snow Climatology web site (http://www.ncdc.noaa.gov/ussc/index.jsp, accessed February 9, 2009). The staff notes that the extreme winter precipitation ground load resulting from the combination of the antecedent 100-year return period snowpack (10 lbs/ft^2) and the extreme frozen winter precipitation event (17.2 lbf/ft^2) is significantly less than AP1000 design basis ground snow load site parameter value of 75 lbf/ft^2.

In response to RAI 2.3.1-4, the applicant also identified its extreme liquid winter precipitation event as 28.3 in. of water, which was identified in the VEGP ESP SSAR as the 48-hour PMWP. Therefore, for the reasons cited above, RAI 2.3.1-4 is closed and the staff finds VEGP SUP 2.3-1 to be an acceptable addition to VEGP ESP SSAR Section 2.3.1.3.4.

Variances

- VEGP ESP VAR 2.3-1

The Westinghouse response to AP1000 DCD RAI-SRP2.3.1-RSAC-01 stated that the AP1000 maximum and minimum normal temperature site parameters are based on one-percent and 99-percent seasonal exceedance frequencies, which are approximately equivalent to the 0.4-percent and 99.6-percent annual exceedance values, respectively. The applicant provided one-percent and 99-percent annual exceedance site characteristic temperature values for comparison with the AP1000 maximum and minimum normal temperature site parameter values in Revision 0 to VEGP COL FSAR Table 2.0-201. In RAI 2.3.1-3, the NRC staff asked the applicant to revise the normal temperature site characteristic values presented in VEGP COL FSAR Table 2.0-201 accordingly. In response to RAI 2.3.1-3, the applicant revised VEGP COL FSAR Table 2.0-201 by replacing the one-percent and 99-percent annual exceedance site temperature values with 0.4-percent and 99.6-percent annual exceedance site temperature values for comparison with the AP1000 maximum and minimum normal temperature site parameter values. The 0.4-percent and 99.6-percent annual exceedance site temperature values were provided in VEGP ESP SSAR Section 2.3.1.5 and Table 1-1. Since these site temperature values were already evaluated as part of the ESP, the staff accepts the applicant's 0.4-percent and 99.6-percent annual exceedance site temperature values as being correct. For these reasons, the staff accepts VEGP ESP VAR 2.3-1 and RAI 2.3.1-3 is closed.

2.3.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.3.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to regional climatology, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

In addition, the staff has compared the additional COL information in the application to the relevant NRC regulations and associated acceptance criteria in NUREG-0800 Section 2.3.1. The staff concludes that the applicant is in compliance with the relevant requirements of 10 CFR Parts 52 and 100. COL items VEGP COL 2.3-1, VEGP SUP 2.3-1, VEGP ESP COL 2.3-1, and VEGP ESP VAR 2.3-1 have been adequately addressed by the applicant and are resolved.

The NRC staff acknowledges that long-term climatic change resulting from human or natural causes may introduce changes to the most severe natural phenomena reported for the site. However, no conclusive evidence or consensus of opinion is available on the rapidity or nature of such changes. There is a level of uncertainty in projecting future conditions because the assumptions regarding the future level of emissions of heat-trapping gases depends on projections of population, economic activity, and choice of energy technologies. If it becomes evident that long-term climatic change is influencing the most severe natural phenomena reported at the site, the staff notes that the licensee has a continuing obligation to ensure that its plants stay within the licensing basis.

2.3.2 Local Meteorology

Section 2.3, "Meteorology," of the VEGP COL FSAR addresses local meteorology, including the local (site) meteorological characteristics, an assessment of the potential influence of the proposed plant and its facilities on local meteorological conditions, and a topographical description of the site and its environs.

Section 2.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.3.2 of the DCD, Revision 19, and adds VEGP COL 2.3-2 to address COL Information Item 2.3-2 (COL Action Item 2.3.2-1). The applicant stated that VEGP COL 2.3-2 is addressed in Section 2.3.2 of the VEGP ESP SSAR. The staff found that the applicant appropriately supplied site-specific local meteorological information by incorporating by reference VEGP ESP SSAR Section 2.3.2. The staff had already reviewed Section 2.3.2 of the VEGP ESP SSAR and found the information relating to local meteorology to be acceptable as documented in NUREG-1923. Therefore, the staff concludes that the information in VEGP ESP SSAR Section 2.3.2 and incorporated by reference in VEGP COL FSAR Section 2.3 is sufficient to satisfy the requirements of COL Information Item 2.3-2. Hence, the NRC staff considers COL Item 2.3-2 resolved.

The NRC staff reviewed Section 2.3 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review

topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to local meteorology. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.3.3 Onsite Meteorological Measurement Programs

2.3.3.1 *Introduction*

Section 2.3, "Meteorology," of the VEGP COL FSAR addresses the need for the onsite meteorological monitoring and the resulting data.

2.3.3.2 *Summary of Application*

Section 2.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.3.3 of the AP1000 DCD, Revision 19, and Section 2.3.3 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.3, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.3-3

The applicant provided additional information in VEGP COL 2.3-3 to address COL Information Item 2.3-3 (COL Action Item 2.3.3-1) related to the onsite meteorological measurements program. The applicant stated that VEGP COL 2.3-3 is addressed in VEGP COL FSAR Section 2.3.3.4 and Section 2.3.3 of the VEGP ESP SSAR.

This COL item states that the COL applicant referencing the AP1000 certified design will address the site-specific onsite meteorological measurements program; that is, the COL applicant should describe its onsite meteorological measurements program and provide a copy of the resulting meteorological data in accordance with NUREG-0800 Section 2.3.3. The applicant responded to this COL item by referencing the onsite meteorological program description provided in Section 2.3.3 of the VEGP ESP SSAR, including the 1998–2002 onsite hourly database submitted in support of the VEGP ESP application. The applicant also presented VEGP COL FSAR Section 2.3.3.4 as a new section following VEGP ESP SSAR Section 2.3.3.3. This new section states the monitoring program operated in support of VEGP Units 1 and 2 was found by the staff to be adequate for the purposes of the SSAR and will be used to support the operation of VEGP Units 3 and 4.

2.3.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for onsite meteorological measurements programs are given in Section 2.3.3 of NUREG-0800.

2.3.3.4 *Technical Evaluation*

The NRC staff reviewed Section 2.3 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to onsite meteorological measurement programs. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.3-3

The NRC staff reviewed VEGP COL 2.3-3 related to the onsite meteorological measurements program included under Section 2.3 of the VEGP COL FSAR. The staff found that the applicant appropriately supplied site-specific onsite meteorological measurements program information by incorporating by reference VEGP ESP SSAR Section 2.3.3. The staff had already reviewed Section 2.3.3 of the VEGP ESP SSAR and found the information included therein to be acceptable as documented in NUREG-1923.

The applicant presented VEGP COL FSAR Section 2.3.3.4 as a new section following VEGP ESP SSAR Section 2.3.3.3. This new section states the monitoring program operated in support of VEGP Units 1 and 2 will also support the operation of VEGP Units 3 and 4. The applicant summarized that the NRC evaluated the onsite meteorological measurement program and found it acceptable as documented in Section 2.3.3 of NUREG-1923. It also stated that the current monitoring program and its implementation were determined to meet the guidance in proposed Revision 1 to RG 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants," and found to provide an acceptable basis for estimating atmospheric dispersion conditions for accidental and routine releases of radioactive material to the atmosphere. The staff agrees with the supplemental meteorological monitoring program compliance summary provided and, thus, finds it an acceptable addition to VEGP ESP SSAR Section 2.3.3.3. Hence, the NRC staff considers this COL item resolved.

2.3.3.5 *Post Combined License Activities*

Appendix B (Inspections, Tests, Analyses, and Acceptance Criteria [ITAAC]) of Part 10 (Proposed License Conditions, Including ITAAC) of the VEGP Units 3 and 4 COL application states that the emergency planning (EP) ITAAC included in ESP-004, Appendix E, are incorporated by reference. Appendix E identifies two EP-ITAAC that are involved in demonstrating that the operational onsite meteorological monitoring program appropriately supports the VEGP Units 3 and 4 EP:

- EP Program Element 6.3: The means exist to continuously assess the impact of the release of radioactive materials to the environment, accounting for the relationship between effluent monitor readings, and onsite and offsite exposures and contamination for various meteorological conditions. The acceptance criterion is that the emergency

implementing procedures and the Offsite Dose Calculation Manual calculate the relationship between effluent monitor readings and offsite exposure and contamination.

- EP Program Element 6.4: The means exist to acquire and evaluate meteorological information. The acceptance criterion is wind speed (at 10 m and 60 m), wind direction (at 10 meters [m] and 60 m), standard deviation of horizontal wind direction (at 10 m), vertical temperature difference (between 10 m and 60 m), ambient temperature (at 10 m), dew point temperature (at 10 m) and precipitation (at the tower base) are displayed in the technical support center and control room.

Emergency planning, including EP ITAAC, is addressed in SER Section 13.3, "Emergency Planning."

2.3.3.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information related to onsite meteorological measurement programs, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff concludes that the applicant is in compliance with the relevant requirements of 10 CFR Part 50, "Domestic licensing of production and utilization facilities"; 10 CFR Parts 52; and 100. COL Item VEGP COL 2.3-3 has been adequately addressed by the applicant.

2.3.4 Short-Term Diffusion Estimates (Related to RG 1.206, Section C.III.2, Chapter 2, C.I.2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases")

2.3.4.1 *Introduction*

Section 2.3.4, "Short-Term Diffusion Estimates," of the VEGP COL FSAR addresses short-term atmospheric dispersion estimates, including site-specific information on atmospheric dispersion factor (χ/Q) values at the exclusion area boundary (EAB), the outer boundary of the low population zone (LPZ), and the CR for postulated design-basis accidental radioactive airborne releases.

2.3.4.2 *Summary of Application*

Section 2.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.3.4 of the AP1000 DCD, Revision 19, and Section 2.3.4 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.3.4, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.3-4

The applicant provided additional information in VEGP COL 2.3-4 to address COL Information Item 2.3-4 (COL Action Items 2.3.4-1, 2.3.4-2, and 2.3.4-3) related to short term diffusion estimates. The applicant stated that VEGP COL 2.3-4 is addressed in Sections 2.3.4 and 15.6.5.3.7.3, and in Appendix 15A.3.3 of the VEGP COL FSAR and Section 2.3.4 of the VEGP ESP SSAR.

This COL item states that COL applicants referencing the AP1000 certified design will address the site-specific χ/Q values specified in AP1000 DCD Tier 2, Section 2.3.4; that is, provide site-specific EAB, LPZ, and CR intake χ/Q values. For a site that exceeds the bounding χ/Q values, the COL applicant will address how the radiological consequences associated with the controlling design basis accident continue to meet the dose reference values given in 10 CFR 50.34 and CR operator dose limits given in General Design Criterion (GDC) 19, "Control Room," using site-specific χ/Q values. The COL applicant should consider topographical characteristics in the vicinity of the site for restrictions of horizontal and/or vertical plume spread, channeling or other changes in airflow trajectories, and other unusual conditions affecting atmospheric transport and diffusion between the source and receptors. No further action is required for sites within the bounds of the site parameters for atmospheric dispersion.

The applicant responded to this COL item by incorporating by reference VEGP ESP SSAR Section 2.3.4, with a supplement addressing: (1) the potential changes in the EAB and LPZ χ/Q values presented in VEGP ESP SSAR Section 2.3.4 due to a change in AP1000 building dimensions (i.e., cross sectional area and building height of the containment building) from Revision 15 to Revision 17 of the DCD; (2) radiological accident dispersion estimates for the CR; and (3) dispersion estimates associated with accidental onsite and offsite hazardous material releases. The applicant also demonstrated in VEGP COL FSAR Table 2.0-201 that the VEGP 3 and 4 EAB, LPZ and CR χ/Q site characteristic values fall within the corresponding AP1000 DCD meteorological dispersion site parameter values, thus ensuring the applicant's site meteorological dispersion values result in doses lower than the dose limits given in 10 CFR 50.34 and GDC 19.

This COL item also states that, with regard to assessment of the postulated impact of an accident on the environment, the COL applicant will provide χ/Q values for each cumulative frequency distribution that exceeds the median value (50 percent of the time). This information on the median value χ/Q values is presented in Section 2.3 of VEGP ESP Environmental Report (ER) and used in the VEGP COL ER. Because median value χ/Q values are used exclusively in the VEGP COL ER and the corresponding Environmental Impact Statement (EIS), these values are not reviewed in this SER.

Supplemental Information

- VEGP SUP 2.3-2

The applicant provided supplemental information in VEGP SUP 2.3-2 by adding the following reference, NUREG/CR-6331, "Atmospheric Relative Concentrations in Building Wakes," PNNL-10521, Revision 1, May 1997.

2.3.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for short-term diffusion estimates are given in Section 2.3.4 of NUREG-0800.

The acceptance criteria for the additional short-term diffusion estimates for accident releases presented in the VEGP COL FSAR beyond those presented in the VEGP ESP SSAR (i.e., VEGP COL 2.3-4) are based on meeting the relevant requirements of 10 CFR Part 50. The staff considered the following regulatory requirements in reviewing the applicant's discussion of CR atmospheric dispersion analyses:

- 10 CFR Part 50, Appendix A, GDC 19, with respect to the meteorological considerations used to evaluate the personnel exposures inside the CR during radiological and airborne hazardous material accident conditions.

The related acceptance criteria summarized from NUREG-0800 Section 2.3.4 specifies, in part, that an application meets the GDC 19 requirements if the application provides the following information:

- A description of the atmospheric dispersion models used to calculate χ/Q values for accidental releases of radioactive and hazardous materials to the atmosphere.

- Meteorological data used for the evaluation (as input to the dispersion models), which represent annual cycles of hourly values of wind direction, wind speed, and atmospheric stability for each mode of accidental release.

- A discussion of atmospheric diffusion parameters, such as lateral and vertical plume spread (σ_y and σ_z) as a function of distance, topography, and atmospheric conditions, should be related to measured meteorological data.

- Hourly cumulative frequency distributions of χ/Q values from the effluent release point(s) to the EAB and LPZ should be constructed to describe the probabilities of these χ/Q values being exceeded.

- Atmospheric dispersion factors used for the assessment of consequences related to atmospheric radioactive releases to the CR for design-basis accidents, other accidents, and for onsite and offsite releases of hazardous airborne materials should be provided.

- For CR habitability analysis, a site plan drawn to scale should be included showing true North and potential atmospheric accident release pathways, CR intake, and unfiltered inleakage pathways.

In addition, the short-term atmospheric dispersion estimates for accident releases to the CR should be consistent with the appropriate sections from the following regulatory guides:

- RG 1.23, which provides criteria for an acceptable onsite meteorological measurements program, data from which are used as input to atmospheric dispersion models.

- RG 1.78, "Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release," Revision 1, which presents criteria for characterizing atmospheric dispersion conditions for evaluating the consequences of airborne hazardous material releases to the CR.

- RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," which presents criteria for characterizing atmospheric dispersion conditions for evaluating the consequences of radiological releases to the CR.

2.3.4.4 *Technical Evaluation*

The NRC staff reviewed Section 2.3 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to short-term diffusion estimates. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.3-4

The NRC staff reviewed the applicant's resolution to VEGP COL 2.3-4 related to referencing the EAB and LPZ χ/Q values presented in the VEGP ESP SSAR and new χ/Q values presented in the VEGP COL FSAR that were calculated for the CR.

a. EAB and LPZ χ/Q Values

The NRC staff found the continued use of the VEGP ESP SSAR accident EAB and LPZ χ/Q values acceptable for the following reasons:

- NUREG-0800 Section 2.3.4 states that a COL application referencing an ESP need not include a re-investigation of the site characteristics that have been previously accepted in the referenced ESP.

- The VEGP Units 3 and 4 site layout shown in VEGP COL FSAR Figure 1.1-202 is the same layout shown in VEGP ESP Figure 1-4 and the definitions of the VEGP COL FSAR EAB and LPZ are the same as the VEGP ESP definitions. Consequently, the downwind distances used in the VEGP ESP SSAR to calculate the EAB and LPZ χ/Q

site characteristic values are applicable to the VEGP COL application. The VEGP ESP SSAR defined the "dose calculation" EAB and LPZ as circles that extend 0.5 mi and 2 mi beyond the power block area in order to encompass all potential release locations.

- Other input assumptions used to derive the VEGP ESP SSAR EAB and LPZ accident χ/Q site characteristic values remain bounding for VEGP Units 3 and 4. For example, all release points were treated as ground level releases and the applicant did not take credit for building wake effects. Ignoring building wake effects for a ground-level release decreases the amount of atmospheric turbulence assumed to be in the vicinity of the release point, resulting in higher (more conservative) χ/Q values.

The NRC staff concluded that the input assumptions used to model the VEGP ESP SSAR accident EAB and LPZ χ/Q values bound the actual VEGP Units 3 and 4 plant and site characteristics and the use of one set of accident χ/Q values to model all potential accident release points is appropriate. Therefore, the NRC staff finds that the applicant's use of the VEGP ESP SSAR EAB and LPZ χ/Q values for VEGP Units 3 and 4 is appropriate.

b. CR χ/Q Values

AP1000 DCD Tier 2, Figure 15A-1 shows the VEGP Units 3 and 4 onsite release points (i.e., plant vent, PCS air diffuser, fuel building blowout panel, fuel building rail bay door, steam vent/line break, power operated relief valves and safety valves, condenser air removal stack, and containment shell) and the CR inlet locations (i.e., CR heating, ventilation, and air conditioning (HVAC) intake and the annex building access door). The applicant provided χ/Q values in VEGP COL FSAR Tables 2.3-201 and 2.3-202 for use in evaluating potential doses from these VEGP Units 3 and 4 postulated release locations to the VEGP Units 3 and 4 CR inlets utilizing the same onsite 1998-2002 meteorological database used in the VEGP ESP SSAR for the EAB and LPZ atmospheric dispersion calculations. The applicant stated that it used the ARCON96 atmospheric dispersion computer code (Revision 1 of NUREG/CR-6331) in accordance with guidance provided in RG 1.194.

RG 1.194 states that the ARCON96 computer code is an acceptable methodology for assessing CR χ/Q values for use in design-basis accident radiological analyses, subject to the provisions of RG 1.194. The ARCON96 code estimates χ/Q values for various time-average periods ranging from 2 hours to 30 days. The meteorological input to ARCON96 consists of hourly values of wind speed, wind direction, and atmospheric stability class. The χ/Q values calculated through ARCON96 are based on the theoretical assumption that material released to the atmosphere will be normally distributed (Gaussian) about the plume centerline. A straight-line trajectory is assumed between the release points and receptors. The diffusion coefficients account for enhanced dispersion under low wind speed conditions and in building wakes.

Hourly meteorological data are used to calculate hourly relative concentrations (χ/Q values). The hourly relative concentrations are then combined to estimate concentrations ranging in duration from 2 hours to 30 days. Cumulative frequency distributions are prepared from the average relative concentrations and the relative concentrations that are exceeded no more than five percent of the time for each averaging period is determined.

The diffusion coefficients used in ARCON96 have three components. The first component is the diffusion coefficient used in other NRC models, such as PAVAN (NUREG/CR-2858, "PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations"), which was used in the VEGP

ESP SSAR to generate EAB and LPZ accident χ/Q values. The other two components are corrections to account for enhanced dispersion under low wind speed conditions and in building wakes. These components are based on analysis of diffusion data collected in various building wake diffusion experiments under a wide range of meteorological conditions. Because the diffusion occurs at short distances within the plant's building complex, the ARCON96 diffusion parameters are not affected by nearby topographic features such as hills and bodies of water. Therefore, the NRC staff finds that the applicant's use of the ARCON96 diffusion parameter assumptions is acceptable.

Much of the information needed to run ARCON96 for the AP1000 building configuration is presented in AP1000 DCD Tier 2, Table 15A-7 (e.g., source and receptor heights; distances between sources and receptors). In RAI 2.3.4-1, the staff asked the applicant to provide information related to the direction between the receptors and release points for the VEGP Units 3 and 4 building layout so that the staff could review the inputs used by the applicant and conduct its own confirmatory analysis. The applicant provided the requested information in its response to RAI 2.3.4-1 dated September 11, 2008. The staff reviewed the applicant's receptor-to-source direction data against the AP1000 release points and receptors shown in DCD Tier 2, Figure 15A-1, and obtained similar results. Hence, RAI 2.3.4-1 is considered closed.

The NRC staff found the applicant's CR χ/Q values presented in VEGP COL FSAR Tables 2.3-201 and 2.3-202 acceptable for the following reasons:

- The applicant derived its χ/Q values using the ARCON96 atmospheric dispersion computer code in accordance with the guidance provided in RG 1.194 and the source and receptor data presented in AP1000 DCD Tier 2, Table 15A-7. The staff evaluated the applicability of the ARCON96 model and concluded that there is no unusual siting, building arrangements, release characterization, source-receptor configuration, meteorological regimes, or terrain conditions, which preclude the use of the ARCON96 model for VEGP Units 3 and 4.

- The applicant derived its χ/Q values utilizing the same onsite 1998-2002 meteorological database used to derive the EAB and LPZ χ/Q values presented in the VEGP ESP SSAR. The staff reviewed the 1998-2002 onsite meteorological database in Section 2.3.3 of the VEGP ESP SER and concluded that these data were representative of the dispersion conditions at the VEGP ESP site.

- The NRC staff confirmed the applicant's atmospheric dispersion estimates by running the ARCON96 model and obtaining similar results (i.e., most values were within ± 3 percent).

In light of the foregoing, the staff accepts the CR χ/Q values presented by the applicant.

The applicant also briefly addressed the determination of accident-related concentrations at the CR due to onsite and/or offsite airborne releases of hazardous materials. The NRC staff's technical evaluation of the applicant's dispersion estimates associated with accidental onsite and offsite hazardous material releases is discussed in Section 2.2 of this SER.

The NRC staff considers this COL item resolved for the reasons discussed above.

Supplemental Information

- VEGP SUP 2.3-2

The applicant provided supplemental information in VEGP SUP 2.3-2 to reference NUREG/CR-6331, which is the documentation package for the ARCON96 atmospheric dispersion computer code. Because RG 1.194 states that the ARCON96 computer code is an acceptable methodology for assessing CR χ/Q values and the applicant used the ARCON96 model in its CR χ/Q evaluations, the staff finds the addition of this reference to be acceptable.

2.3.4.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.3.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information related to short-term diffusion estimates, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

In addition, the staff has compared the additional COL information in the application to the relevant NRC regulations and acceptance criteria defined in NUREG-0800 Section 2.3.4. The staff concludes that the applicant is in compliance with the relevant requirements of 10 CFR Parts 50, 52, and 100. COL Items VEGP COL 2.3-4 and VEGP SUP 2.3-2 have been adequately addressed by the applicant.

2.3.5 Long-Term Diffusion Estimates (Related to RG 1.206, Section C.III.2, Chapter 2, C.I.2.3.5, "Long-Term Atmospheric Dispersion Estimates for Routine Releases")

2.3.5.1 *Introduction*

Section 2.3.5, "Long-Term Diffusion Estimates" of the VEGP COL FSAR addresses long-term atmospheric dispersion estimates, including site-specific information on atmospheric dispersion factor (χ/Q) and dry deposition factor (D/Q) values to a distance of 80 km (50 mi) from the plant for releases of radiological effluents to the atmosphere during normal plant operation for annual average release limit calculations and offsite dose estimates.

2.3.5.2 *Summary of Application*

Section 2.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.3.5 of the AP1000 DCD, Revision 19, and Section 2.3.5 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.3.5, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.3-5

The applicant provided additional information in VEGP COL 2.3-5 to address COL Information Item 2.3-5 (COL Action Items 2.3.5-1 and 2.3.5-2) related to long-term diffusion estimates. The applicant stated that VEGP COL 2.3-5 is addressed in Section 2.3.5 of the VEGP COL FSAR and Section 2.3.5 of the VEGP ESP SSAR.

This COL item states that the COL applicant will address long-term diffusion estimates and χ/Q values specified in AP1000 DCD Tier 2, Section 2.3.5; that is, the COL applicant should provide χ/Q and D/Q estimates for calculating concentrations in air and the amount of material deposited on the ground as a result of routine releases of radiological effluents to the atmosphere during normal plant operation. This COL item further states that the COL applicant should consider topographical characteristics in the vicinity of the site for restrictions of horizontal and/or vertical plume spread, channeling or other changes in airflow trajectories, and other unusual conditions affecting atmospheric transport and diffusion between the source and receptors. No further action is required for sites within the bounds of the site parameter for atmospheric dispersion. With regard to environmental assessment, this COL item also states that the COL applicant will provide estimates of annual average χ/Q values for 16 radial sectors to a distance of 50 mi from the plant. The applicant responded to this COL item by referencing the long-term χ/Q and D/Q values presented in VEGP ESP SSAR Section 2.3.5. The applicant also provided a supplement addressing the potential changes in the long-term atmospheric dispersion and deposition values, as presented in VEGP ESP SSAR Section 2.3.5, due to a change in the pertinent AP1000 building dimensions (i.e., cross sectional area and building height of the containment building) from Revision 15 to Revision 17 of the AP1000 DCD.

2.3.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for long-term diffusion estimates are given in Section 2.3.5 of NUREG-0800.

2.3.5.4 *Technical Evaluation*

The NRC staff reviewed Section 2.3 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic (see footnote 1 on page 2-2). The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to long-term diffusion estimates. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.3-5

The NRC staff reviewed VEGP COL 2.3-5 related to long-term diffusion estimates included under Section 2.3.5 of the VEGP COL FSAR.

The applicant stated in Revision 0 to the VEGP COL FSAR Section 2.3.5 that it reevaluated the long-term (routine release) dispersion and deposition estimates at the dose calculation EAB and various receptors using the same assumptions and methodology described in the VEGP ESP SSAR (which relied on the AP1000 DCD, Revision 15), with the exception of the reactor building dimensions provided in the AP1000 DCD, Revision 16. The applicant stated that the revised χ/Q values were bounded by those provided in the VEGP ESP SSAR.

Using an updated reactor building cross-sectional area and containment height while maintaining the other model inputs consistent with the VEGP ESP SSAR, the staff calculated slightly less conservative χ/Q and D/Q values for both the EAB and the various receptors. Consequently, the staff asked the applicant, first in RAI 2.3.5-1, and then again in follow-up RAI 2.3.5-2, to provide clarification on how the revised χ/Q values are less than those presented in the VEGP ESP SSAR.

In its response to RAI 2.3.5-2, dated November 18, 2008, the applicant stated it recalculated the χ/Q values using the same area-weighted ”effective height” methodology used in the VEGP ESPA SSAR to determine the reactor building height. The applicant found that the recalculated χ/Q values for the EAB and other receptor locations were not bounding but were within approximately 3.3 percent of those provided in the VEGP ESP SSAR. The applicant subsequently revised VEGP COL FSAR Section 2.3.5 to reflect this comparison result. The applicant further stated that the χ/Q values from the revised analysis would not appreciably change the normal release dose evaluations and the doses would remain within regulatory limits.

The NRC staff found the continued use of the VEGP ESP SSAR long-term χ/Q and D/Q values to model all routine release pathways acceptable for the following reasons:

- The VEGP Units 3 and 4 site layout shown in VEGP COL FSAR Figure 1.1-202 is the same layout shown in VEGP ESP SSAR Figure 1-4. The VEGP ESP SSAR defined the “dose calculation” EAB as a circle that extends 0.5-mi beyond the power block area in order to encompass all potential release locations (VEGP Units 3 and 4 airborne effluents will normally be released through the plant vent and turbine building vent). Similarly, the shortest distance between the VEGP Units 3 and 4 power block and the nearest residence (i.e., 0.67 mi) was conservatively used in all the directional sectors for all receptors of interest (i.e., meat animal, vegetable garden, and residence).

- The VEGP ESP SSAR long-term χ/Q and D/Q site characteristic values were conservatively determined by treating all releases as ground level releases. A ground level release assumption generally produces more conservative χ/Q and D/Q values for relatively flat terrain sites such as VEGP Units 3 and 4.

- The NRC staff confirmed the applicant's EAB and the various receptors atmospheric dispersion estimates by independently calculating results similar to the VEGP ESP SSAR (within ± 3.3 percent) using the AP1000 DCD, Revision 17 reactor building dimensions.

Because the applicant used conservative assumptions in generating the VEGP ESP SSAR long-term χ/Q and D/Q values and the staff's confirmatory analysis generated similar results, RAIs 2.3.5-1 and 2.3.5-2 are closed. Hence, the NRC staff considers this COL item resolved.

2.3.5.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.3.5.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information related to long-term diffusion estimates, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

In addition, the staff has compared the additional COL information in the application to the relevant NRC regulations and acceptance criteria defined in NUREG-0800 Section 2.3.5. The staff concludes that the applicant is in compliance with the relevant requirements of 10 CFR Parts 50, 52, and 100. COL Item VEGP COL 2.3-5 has been adequately addressed by the applicant.

2.4 Hydrologic Engineering

2.4.1 Hydrologic Description

The hydrologic description of the nuclear power plant site includes the interface of the plant with the hydrosphere, hydrological causal mechanisms, surface and groundwater uses, hydrologic data, and alternate conceptual models. The review covers the following specific areas: (1) interface of the plant with the hydrosphere including descriptions of site location, major hydrological features in the site vicinity, surface- and groundwater-related characteristics, and the proposed water supply to the plant; (2) hydrological causal mechanisms that may require special plant design bases or operating limitations with regard to floods and water supply requirements; (3) current and likely future surface and groundwater uses by the plant and water users in the vicinity of the site that may impact safety of the plant; (4) available spatial and temporal data relevant for the site review; (5) alternate conceptual models of the hydrology of the site that reasonably bound hydrological conditions at the site; and (6) potential effects of seismic and non-seismic data on the postulated design bases and how they relate to the hydrology in the vicinity of the site and the site region.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19 and adds VEGP COL 2.4-1. To address VEGP COL 2.4-1, the applicant incorporates by reference VEGP ESP SSAR Section 2.4.1.

The NRC staff reviewed Section 2.4.1 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the hydrologic description. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.2 Floods

2.4.2.1 *Introduction*

This section of the VEGP COL FSAR discusses flooding at the proposed site or in the region of the site. The information summarizes and identifies the individual types of flood-producing phenomena and combinations of flood-producing phenomena considered in establishing the flood design bases for safety-related plant features. It also covers the potential effects of local intense precipitation. The flood history and the potential for flooding are reviewed. Factors affecting potential runoff, such as urbanization, forest fire, or type of agricultural use, as well as erosion and sediment deposition, are considered in the review. In addition to describing flood history, this section also determines the local intense precipitation on the site to estimate local flooding. Local intense precipitation is reported as a site characteristic used in site grading design.

2.4.2.2 *Summary of Application*

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19, and Section 2.4.2 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.4.2, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.4-2

The applicant added text in VEGP COL FSAR Section 2.4.2.3 to the end of VEGP ESP SSAR Section 2.4.2.3. The applicant provided detailed information on the site drainage plan to address COL Information Item 2.4-2 by confirming that locally intense precipitation would not violate flooding criteria. The applicant provided site descriptions and analyses for a network of drainage channels that would convey local intense precipitation away from the structures that are important to safety.

2.4.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the identification of floods and flood design considerations are given in Section 2.4.2 of NUREG-0800.

The applicable regulatory requirements for identifying floods are:

- 10 CFR Part 100, as it relates to identifying and evaluating hydrological features of the site. The requirement to consider physical site characteristics in site evaluations is specified in 10 CFR 100.20(c).

- 10 CFR 52.79(a)(1)(iii), as it relates to the hydrologic characteristics of the proposed site with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The related guidance document is RG 1.59, "Design Basis Floods for Nuclear Power Plants," Revision 2, as supplemented by best current practices.

2.4.2.4 *Technical Evaluation*

The NRC staff reviewed Section 2.4.2 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents a complete scope of information relating to this review topic.[1] The staff's review confirmed the information in the application and incorporated by reference addresses the required information relating to floods. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.4-2

Specific to the local flooding at the VEGP site, the applicant provided information in the VEGP COL FSAR and numerical modeling files, which were developed using HEC-RAS (U.S. Army Corps of Engineers [USACE] 2008a) and HEC-HMS (USACE 2008b). Numerical modeling was used in the analysis of the local intense precipitation event and the associated drainage effects. The VEGP COL FSAR describes a network of drainage ditches at the site that are designed to move local surface water runoff away from structures important to safety. The VEGP COL FSAR discusses the applicant's design basis for handling floodwaters due to local intense precipitation in the vicinity of the power block and provides commitments to ensure that the drainage system would function as designed throughout the operating life of the power station.

The staff reviewed the information provided in the VEGP COL FSAR and hydrologic and hydraulic models for the site. In the VEGP COL FSAR, the applicant included the overall site map of the VEGP Units 3 and 4, SER Figure 2.4-1 (corresponding to VEGP COL FSAR Figure 1.1-202). While the figure identifies several drainage channels, the applicant's analysis was limited to drainage channels located within or near the VEGP Units 3 and 4 power block. Drainage channels located elsewhere within the site footprint were omitted from the safety analyses because they do not impact the safety-related structures. SER Figure 2.4-2, (corresponding to FSAR Figure 2.4-201), identifies the relevant drainage basins for VEGP Units 3 and 4 within and around the power block and provides more detail of the drainage system around the power block. The staff compared the relevant drainage ditches presented in

SER Figure 2.4-2 with the inventory of channels considered within the safety analysis and identified that two channels were not directly considered in the hydraulic (HEC-RAS) analysis by the applicant. A third channel was included with Feeder Ditch 1 as ineffective flow area. The applicant's analysis of the surface water flow used the HEC-RAS model to determine elevations of the surface water runoff from the site. An important aspect of the HEC-RAS model is that it uses cross sections to define the geometry of the overbank areas and ditch channels. A map with the locations of these cross sections was not originally provided in the VEGP COL FSAR. Therefore, the staff issued RAI 2.4.2-1 requesting the applicant provide a map with HEC-RAS cross-section locations. The applicant provided this in its response to RAI 2.4.2-1, and it can be seen in SER Figure 2.4-6 (corresponding to VEGP COL FSAR Figure 2.4-201a).

As shown in the SER Figure 2.4-1, several culverts were identified within the feeder ditches that drain the power block, and the main ditch was free of culverts. The applicant stated in VEGP COL FSAR Section 2.4.2.3 that the culverts were conservatively assumed to be completely blocked and were simulated as inline weirs. The staff reviewed the VEGP COL FSAR and confirmed that most culverts received this treatment within the HEC-RAS files. To verify this model and its results, the staff conducted sensitivity analyses of the inline weirs to determine the effect of possible blockage with debris during the local intense precipitation event. By reducing the weir coefficient to 2.0 (from the typical value of 2.6), only a small increase in maximum water surface elevation was found. Because of the relatively small width of blockage, flow was able to move onto the overbank areas.

The staff's review of the HEC-RAS input files determined that a culvert within Feeder Ditch 3 is included in the model, but it is not included in VEGP COL FSAR Figure 2.4-102. RAI 2.4.2-1 requested the map be revised to identify all culverts and additional information on these features. SER Figure 2.4-2 also shows a surface feature that appears to cover Feeder Ditches 2 and 3 at their downstream ends, but no such feature appeared in the HEC-RAS input files. The staff also identified that the access road over Feeder Ditch 4 did not include a culvert, although it did include the Feeder Ditch 4 channel. The staff conducted a sensitivity analysis by blocking the channel and simulating the access road crossing as an inline weir (as with the other blocked culvert simulations completed by the applicant). This analysis produced only a small increase (0.01 ft) in water surface elevation in Feeder Ditches 1 and 2 and in the main ditch. The staff requested that the applicant's HEC-RAS model and results be updated by blocking the culvert in Feeder Ditch 4 and that these results be included with the FSAR. The applicant provided an updated HEC-RAS file under a supplemental response letter to RAI 2.4.2-1 dated August 5, 2009. The staff verified that Revision 2 of the VEGP COL FSAR adequately addressed the above discussion.

The applicant provided responses to the four items identified in RAI 2.4.2-1. Item 1 of the RAI requested clarification regarding channels presented in VEGP COL FSAR Figure 2.4-201 that were not included in the HEC-RAS hydraulic analysis of the localized probable maximum precipitation (PMP). The applicant stated in its response to the RAI that only the channels affecting flood levels in the power block are simulated in the HEC-RAS analyses. Other channels and drainage areas were included as contributors of flow from the local intense PMP (SER Figure 2.4-2). These channels are Feeder Ditch 5 and the ditch to the east of Feeder Ditch 1. The applicant's response included statements describing the process of including flows from these other sub-basins in the hydraulic analysis. SER Figure 2.4-3 (from the applicant-provided HEC-HMS files) shows the drainage area connectivity. Based on the applicant-provided HEC-HMS model, SER Table 2.4-2 shows the drainage areas that contribute to the flow in the ditches. The applicant also illustrated the connectivity of the drainage areas in SER Figure 2.4-2 by the identification of HEC-HMS nodes and sub-basins. The staff reviewed

the applicant's response and concluded that the VEGP COL FSAR accurately represents the updated models and agrees with the applicant's response. Consequently, Item 1 of RAI 2.4.2-1 is considered closed.

Item 2 of RAI 2.4.2-1 refers to a culvert included in the HEC-RAS model in Feeder Ditch 3 that is not included in VEGP COL FSAR Figure 2.4-201. Also, the fourth item of the RAI refers to an unknown feature shown in VEGP COL FSAR Figure 2.4-201. The applicant provided an updated figure in the response indicating the location of the culvert, SER Figure 2.4-5 (corresponding to VEGP COL FSAR Figure 2.4-201). The updated figure also identifies the unknown feature as a heavy haul road. The haul road would be used during construction and would have culverts placed in the drainage ditch to handle flows that occur during construction. The local PMP analysis was done for the operational condition in which the heavy haul road would have been removed. The applicant updated this figure in a letter dated March 27, 2009. The RAI response also included a discussion concerning the culvert at the downstream end of Feeder Ditch 4, in which the applicant states inclusion of the effect of a blocked culvert at this location would be minimal. Sensitivity analyses by staff confirmed this assertion as discussed previously. Therefore, Item 2 of RAI 2.4.2-1 is closed.

A supplemental response to RAI 2.4.2-1 was provided in a letter dated August 5, 2009, in which revisions to the HEC-RAS hydraulic model reflect the effect of inclusion of the effect of a blocked culvert at the downstream end of Feeder Ditch 4. The revisions also included correction of channel widths in the main stem channel to make the channel uniform. The modifications produced an increase of 0.02 ft (SER Table 2.4-1). Several revisions to the VEGP COL FSAR were proposed in this supplemental response as follows:

- Updates to the maximum probable maximum flood (PMF) elevation discussion for the local intense precipitation event.

- Assumptions made in the hydraulic analysis concerning surface material type, conservative analysis of culverts with complete blockage, and use of steady-state flows, which is conservative.

- Updates to the discussion concerning flow regime (sub- and super-critical) locations in the main stem ditch.

- Updates to VEGP COL FSAR Table 2.4-207 summarizing the revised HEC-RAS hydraulic model output.

- Updates of proposed VEGP COL FSAR Figure 2.4-201a reflecting the inclusion of the blocked culvert at the downstream end of Feeder Ditch 4 (SER Figure 2.4-7).

The staff verified that the above changes were made to the VEGP COL FSAR.

The applicant provided revised HEC-RAS hydraulic model input files. The staff found them acceptable because they conform to the applicant's statements in the supplemental RAI response.

RAI 2.4.2-1, Item 3 asked for a figure that includes the locations of the cross sections used in the HEC-RAS analyses. The applicant provided a figure in the response, SER Figure 2.4-6 (corresponding to VEGP COL FSAR Figure 2.4-201a). The applicant also provided proposed

text for the revised FSAR to include the figure under letter dated March 27, 2009. The staff verified the updates to the VEGP COL FSAR, Revision 2 for inclusion of the updated Figure 2.4-201a; therefore, RAI 2.4.2-1, Item 3 is considered closed.

RAI 2.4.2-1, Item 4 requested clarification concerning a surface feature in Feeder Ditches 2 and 3. The applicant provided an updated figure in the response, which indicates the location of the culvert and which is shown in SER Figure 2.4-5 (corresponding to VEGP COL FSAR Figure 2.4-201). The applicant provided this information in a letter dated March 27, 2009. The staff verified the updates to the FSAR for the inclusion of the updated Figure 2.4-201; therefore, RAI 2.4.2-1, Item 4 is considered closed.

The VEGP COL FSAR identifies the elevation of 220 ft mean sea level (MSL) as the plant grade and states that entrances and openings for all safety-related facilities are located at or above this elevation. The primary basis for this conclusion was the result of HEC-RAS modeling. The staff performed a variety of sensitivity analyses to verify the validity of the model. The applicant developed the HEC-RAS model cross sections from topographic data for the overbank areas and the proposed geometric configurations for the channels. The staff compared the HEC-RAS model cross sections with the topographic data provided in VEGP COL FSAR Figure 2.4-201. The staff confirmed the channel cross section elevations and structural blockages in the HEC-RAS model, which was used to develop the flooding scenario by the applicant. As stated in VEGP COL FSAR Section 2.4.2.3, the applicant adjusted the conveyance to prevent flooding of the site, but the applicant did not provide a detailed description of the nature of such conveyance adjustments in the FSAR, nor were they clear to the staff following a review of the HEC-RAS input files provided by the applicant. Initially, the staff was unable to independently confirm the adequacy of these adjustments. RAI 2.4.2-2 was issued requesting that the applicant provide additional information on modifications to channel conveyance.

The staff initially interpreted VEGP COL FSAR Section 2.4.2.3 to mean that the applicant, after initially setting up the model, modified the channel conveyance to reduce flooding. In its response to RAI 2.4.2-2, dated March 27, 2009, the applicant clarified that the change in conveyance was from the current (existing) condition to the conditions for the proposed units. The existing channel conveys flow from the western portion of the existing Units 1 and 2. The modification to the channel conveyance was made to address the flood waters from the proposed units. The applicant proposed to remove the statement from the VEGP COL FSAR. The staff agrees with the applicant's response and verified that the misleading statement had been removed from the VEGP COL FSAR. RAI 2.4.2-2 is considered closed.

As stated in VEGP COL FSAR Section 2.4.2.3, the applicant used peak flows from the PMP analysis conducted using the hydrologic model HEC-HMS. These flows were input into the local flooding analysis modeling using HEC-RAS for a steady-state analysis. Flows at the HEC-HMS nodes were linearly interpolated for input into the HEC-RAS model. VEGP COL FSAR Tables 2.4-205 and 2.4-206 present the flows used in the HEC-RAS model and the methodology employed for interpolation to individual cross sections. The flows from the HEC-HMS model as input to HEC-RAS were confirmed by the staff.

The applicant ran the HEC-RAS model under a mixed flow regime, indicating that both sub- and super-critical flows were expected to occur. As shown in SER Figure 2.4-4, extensive backwater conditions were produced in the feeder and main drainage ditches in the applicant's HEC-RAS model setup. At the downstream reach of the main drainage ditch, the water surface has a steep hydraulic gradient, and super-critical flows occur. Because this hydraulic feature occurs away from the safety-related structures, this super-critical flow occurrence is not relevant

from a safety perspective, and the situation is not considered further by the applicant. The staff agrees with this approach.

Examination of the applicant's HEC-RAS input files shows that the channel sections of the feeder and main ditches are small relative to the overall cross section width. The staff found that the top width of both the feeder ditch and main ditch cross sections are approximately 1000 ft, while the top width of the channels is approximately 100 ft. In such a scenario, the conveyance of the overbank might dominate the conveyance of the cross sections. In addition, the staff found that the lengths of the feeder channels are approximately 1200 ft, which makes the modeled area nearly square. The staff also noted the topography of the Units 3 and 4 power blocks is relatively flat. The staff's concern was that PMF flows could short circuit the drainage system. This is an important note because a key assumption of the HEC-RAS modeling analysis is that the flows are one-dimensional with flow only occurring along the channel axis. The staff questioned the validity of this assumption, particularly when the cross sections are completely inundated, and were unable to locate the constraining features of each of the channels in the maps provided in the VEGP COL FSAR. Also, the staff noted that the level of cross-section inundation, as produced by the HEC-RAS model for VEGP and shown in SER Figure 2.4-4, would not necessarily be one-dimensional.

To address this issue, the staff requested in RAI 2.4.2-3 justification for use of a one-dimensional model to identify features that constrain the system to one-dimensional flow. The applicant noted in its response dated March 27, 2009, that while there are no designed constraints to lateral flow between ditches at the cross-sections in question, the effective flow barriers between feeder ditches in the one-dimensional model would produce conservative results. The staff agreed with this assumption and closed RAI 2.4.2-3.

Examination of VEGP COL FSAR Figure 2.4-201 shows that two drainage areas (UN12-N and UN12-S) are located east of Feeder Ditch 1. These areas include the drainage channel west of the existing units, which conveys flow to the north. VEGP COL FSAR Table 2.4-206 shows that flow from UN12-N and drainage at the upstream end of Feeder Ditch 1 (FD1W) are combined to provide flows for the upstream section of Feeder Ditch 1. The flows from UN12-S are added to the downstream section of Feeder Ditch 1. The use of these flows in this analysis is a conservative assumption that considers the blockage of the culvert handling flows from the west side of the existing units.

The applicant states in VEGP COL FSAR Section 2.4.2.3 that the local PMP flood elevation produced by its HEC-RAS model is 219.45 ft MSL, which is 0.55 ft below plant elevation (220 ft MSL). This is the water surface elevation at the upstream end of Feeder Ditch 1. Water surface elevation profiles are shown in SER Figure 2.4-4.

According to VEGP COL FSAR Section 2.4.2.3, the HEC-RAS model was developed using Manning's roughness coefficients for the feeder ditches, which reflect well-maintained concrete lined channels (n = 0.014) and graveled surfaces with concrete curbs in the over bank areas (n = 0.020). For other channels, VEGP COL FSAR Section 2.4.2.3 indicates Manning's roughness coefficients were selected to reflect float-finished concrete (n = 0.015) with short-grass cover chosen for overbanks areas (n = 0.030). Examination of the HEC-RAS input files showed that the model setup included two cross sections, located in the lower reaches of the main drainage ditch, with Manning's roughness coefficients indicative of short-grass. Otherwise, all overbank areas along the main drainage ditch used Manning's roughness coefficients indicative of graveled surfaces.

The staff conducted sensitivity tests for the model inputs, including systematic variations of the channel and overbank roughness (Manning's n); contraction-expansion coefficients at the culverts; and inline weir coefficients. These parameters were selected following a review of the FSAR and the applicant's HEC-RAS model. Summary results showing the impact of these sensitivity tests on water surface elevations are shown in SER Table 2.4-1. The following paragraphs discuss these sensitivity analyses.

Of particular note was the model's sensitivity to Manning's roughness. For both feeder ditches and the main ditch, staff examined a range of bed-roughness values for the overbanks and channel sections. The impact on water surface elevations was assessed for Manning's roughness values of 0.025, 0.030, and 0.050. These represent the range of roughness for the construction materials stated in the VEGP COL FSAR (USACE, 2008). The effect of overbank roughness was the primary parameter examined, but sensitivity assessments related to varying channel roughness were also conducted. The results of overbank roughness sensitivity assessments indicate that water surface elevations are expected to remain below the plant elevation of 220 ft MSL, with a maximum computed water surface elevation of 219.65 ft at the upstream end of Feeder Ditch 3 (SER Table 2.4-1). However, for a scenario reflecting a very conservative condition of Manning's roughness set to 0.025 for the overbanks and main channels for all cross sections, staff determined a maximum water surface elevation of 220.11 ft at the upstream end of the Feeder Ditch 1. When using this scenario, the maximum water surface elevation in all ditches was determined to exceed the safety grade elevation of 220 ft.

Varying the Manning's roughness also affected the conveyance capacity of the different regions of the cross section. The staff compared the conveyance at cross section 71+00 in Feeder Ditch 3 and determined the flow along the overbanks and channel at this cross section. The results of the analysis are below:

Left Overbank, 1558.35 cfs Channel, 1821.85 cfs Right Overbank, 1763.81 cfs

The staff performed a sensitivity analysis using Manning's roughness = 0.025 for the overbank areas and produced the following flow values:

Left Overbank, 1426.71 cfs Channel, 2101.11 cfs Right Overbank, 1616.18 cfs

The staff observed the modeling results and the changes in conveyance in the channel and overbank areas. The intended effect was to decrease flow in the overbank areas in the sensitivity run; however, in both cases, the HEC-RAS estimated flow in the overbank areas are greater than in the channel. This sensitivity test illustrates that the overbank conveys significant flow. Therefore, it is especially important that the drainage system be maintained during operational times as it was designed and modeled.

To ensure water surface elevations remain below plant grade, the staff issued RAI 2.4.2-4 asking the applicant to include information in the FSAR about the planned maintenance of the drainage channels and overbank areas so that the surface roughness would continue over the operating life of each unit to be the same as used in the design-basis calculations. The applicant's response to the RAI proposed quarterly inspections of the drainage system and provided proposed text revision to the FSAR. Additionally, the applicant committed to procedural requirements to assure that the overbanks would be maintained in the configuration originally modeled. The applicant updated the FSAR to include this commitment. Accordingly, the staff agrees that the commitment would ensure that the very conservative roughness condition would not occur and concludes that this is an acceptable response. The staff verified

that Revision 2 of the VEGP COL FSAR adequately addressed the staff's concern. RAI 2.4.2-4 is closed.

The staff examined the effects of greater contraction and expansion coefficients to evaluate the effect of blockage and associated hydraulic energy losses. Contraction and expansion coefficients account for energy losses between cross sections. Typical coefficient values range from 0.1 to 0.3 for gradual transitions, 0.3 to 0.5 for typical bridge sections, and 0.6 to 1.0 (maximum) for abrupt transitions (USACE, 2008a). The staff performed a sensitivity test to examine the effect on maximum water surface elevations produced by abrupt transitions at the culvert cross sections. The staff's analyses using contraction and expansion coefficients of 0.6 and 0.8 produced minimal variation in the maximum water surface elevations (SER Table 2.4-1). Consequently, the effects of the increased contraction and expansion coefficients of the channels are offset by the large extent of the overbank areas.

The applicant's HEC-RAS model conservatively assumed the culverts completely blocked and represented as inline (broad-crested) weirs. The user-specified weir coefficient for inline weirs accounts for the energy losses and affects the upstream water surface elevation. A smaller weir coefficient will result in reduced flow over the weir and higher upstream water surface elevation. Typical broad-crested weir coefficients range from 2.6 to 3.1 (USACE, 2008a). To simulate the effect of blockage on maximum water surface elevations, the staff examined a smaller weir coefficient (2.0) than used by the applicant (2.6). This produced no change in the maximum water surface elevations of the ditches. As previously indicated, examination of the channel conveyance of the cross section showed the overbank areas convey approximately two-thirds of the total flow, as computed by HEC-RAS. Consequently, the effects of the reduced weir coefficients are offset by the large extent of the overbank areas.

Based on the staff's review and verification of the methods used to determine the local flooding at the VEGP site, the staff determined that the application and the development of the flood elevation are acceptable. The applicant has provided reasonable assurances in an updated FSAR and responses to RAIs for staff to conclude that the variability of the flood elevation based on the overbank flood would not allow the site to become flooded.

2.4.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.4.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to floods, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

As set forth above, the applicant has presented and substantiated information relative to the PMF from local intense precipitation important to the design and siting of this plant. The staff reviewed the available information provided including VEGP COL 2.4-2 related to PMF from local intense precipitation. For the reasons given above, the staff concludes that the identification and consideration of the PMF from local intense precipitation at the site area are

acceptable and meet the relevant requirements of 10 CFR 52.79 and 10 CFR 100.20(c), with respect to determining the acceptability of the site for the AP1000 design.

2.4.3 Probable Maximum Flood on Streams and Rivers

The PMF on streams and rivers is used to determine the extent of any flood protection required for those safety-related structures, systems, and components (SSCs) necessary to ensure the capability to shut down the reactor and maintain it in a safe shutdown condition. The specific areas of review are as follows: (1) design basis for flooding in streams and rivers; (2) design basis for site drainage; and (3) consideration of other site-related evaluation criteria.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19, and adds VEGP COL 2.4-2. To address that portion of VEGP COL 2.4-2 related to PMF on streams and rivers, the applicant incorporates by reference VEGP ESP SSAR Section 2.4.3.

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to PMF on streams and rivers. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.4 Potential Dam Failures

The potential dam failures are addressed to ensure that any potential hazard to the safety-related facilities due to the failure of onsite, upstream, and downstream water control structures is considered in the plant design. The specific areas of review are as follows: (1) flood waves resulting from a dam breach or failure, including those due to hydrologic failure as a result of overtopping for any reason, routed to the site and the resulting highest water surface elevation that may result in the flooding of SSCs important to safety; (2) successive failures of several dams in the path to the plant site caused by the failure of an upstream dam due to plausible reasons, such as a PMF, landslide-induced severe flood, earthquakes, or volcanic activity and the effect of the highest water surface elevation at the site under the cascading failure conditions; (3) dynamic effects of dam failure-induced flood waves on SSCs important to safety; (4) failure of a dam downstream of the plant site that may affect the availability of a safety-related water supply to the plant; (5) effects of sediment deposition or erosion during dam failure-induced flood waves that may result in blockage or loss of function of SSCs important to safety; (6) failure of onsite water control or storage structures such as levees, dikes, and any engineered water storage facilities that are located above site grade and may induce flooding at the site; (7) the potential effects of seismic and non-seismic data on the postulated design bases and how they relate to dam failures in the vicinity of the site and the site region.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19, and adds VEGP COL 2.4-2. To address that portion of VEGP COL 2.4-2 related to potential dam failures, the applicant incorporates by reference VEGP ESP SSAR Section 2.4.4 with no variances or supplements.

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to potential dam failures. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.5 Probable Maximum Surge and Seiche Flooding

The probable maximum surge and seiche flooding are addressed to ensure that any potential hazard to the safety-related facilities due to the effects of probable maximum surge and seiche is considered in plant design. The specific areas of review are as follows: (1) probable maximum hurricane (PMH) that causes the probable maximum surge as it approaches the site along a critical path at an optimum rate of movement; (2) probable maximum wind storm (PMWS) from a hypothetical extratropical cyclone or a moving squall line that approaches the site along a critical path at an optimum rate of movement; (3) a seiche near the site, and the potential for seiche wave oscillations at the natural periodicity of a water body that may affect flood water surface elevations near the site or cause a low water surface elevation affecting safety-related water supplies; (4) wind-induced wave run-up under a PMH or PMWS winds; (5) effects of sediment erosion and deposition during a storm surge and seiche-induced waves that may result in blockage or loss of function of SSCs important to safety; and (6) the potential effects of seismic and non-seismic information on the postulated design bases and how they relate to a surge and seiche in the vicinity of the site and the site region.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19, and adds VEGP COL 2.4-2. To address that portion of VEGP COL 2.4-2 related to probable maximum surge and seiche flooding, the applicant incorporates by reference VEGP ESP SSAR Section 2.4.5 with no variances or supplements.

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to probable maximum surge and seiche flooding. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.6 Probable Maximum Tsunami Hazards

The probable maximum tsunami (PMT) hazards are addressed to ensure that any potential tsunami hazards to the SSCs important to safety are considered in plant design. The specific areas of review are as follows: (1) historical tsunami data, including paleotsunami mappings and interpretations, regional records and eyewitness reports, and more recently available tide gauge and real-time bottom pressure gauge data; (2) PMT that may pose hazards to the site; (3) tsunami wave propagation models and model parameters used to simulate the tsunami wave propagation from the source toward the site; (4) extent and duration of wave run-up during the inundation phase of the PMT event; (5) static and dynamic force metrics including the inundation and drawdown depths, current speed, acceleration, inertial component, and

momentum flux that quantify the forces on any safety-related SSCs that may be exposed to the tsunami waves; (6) debris and water-borne projectiles that accompany tsunami currents and may impact safety-related SSCs; (7) effects of sediment erosion and deposition caused by tsunami waves that may result in blockage or loss of function of safety-related SSCs; and (8) potential effects of seismic and non-seismic information on the postulated design bases and how they relate to tsunami in the vicinity of the site and the site region.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19, and adds VEGP COL 2.4-2. To address that portion of VEGP COL 2.4-2 related to PMT hazards, the applicant incorporates by reference VEGP ESP SSAR Section 2.4.6 with no variances or supplements.

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to PMT hazards. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.7 Ice Effects

The ice effects are addressed to ensure that safety-related facilities and water supplies are not affected by ice-induced hazards. The specific areas of review are as follows: (1) regional history and types of historical ice accumulations (i.e., ice jams, wind-driven ice ridges, floes, frazil ice formation, etc.); (2) potential effects of ice-induced, high- or low-flow levels on safety-related facilities and water supplies; (3) potential effects of a surface ice-sheet to reduce the volume of available liquid water in safety-related water reservoirs; (4) potential effects of ice to produce forces on, or cause blockage of, safety-related facilities; and (5) potential effects of seismic and non-seismic data on the postulated worst-case icing scenario for the proposed plant site.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements related to ice effects, Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.7, "Ice Effects" of VEGP ESP SSAR, Revision 5. The NRC staff reviewed the application and checked the referenced VEGP ESP SSAR to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.8 Cooling Water Canals and Reservoirs

The cooling water canals and reservoirs used to transport and impound water supplied to the SSCs important to safety are reviewed to verify their hydraulic design basis. The specific areas of review are as follows: (1) design bases postulated and used by the applicant to protect structures such as riprap, inasmuch as they apply to safety-related water supply; (2) design bases of canals pertaining to capacity, protection against wind waves, erosion, sedimentation, and freeboard and the ability to withstand a PMF (surges, etc.), inasmuch as they apply to a safety-related water supply; (3) design bases of reservoirs pertaining to capacity, PMF design basis, wind wave and run-up protection, discharge facilities (e.g., low-level outlet, spillways,

etc.), outlet protection, freeboard, and erosion and sedimentation processes, inasmuch as they apply to a safety-related water supply; and (4) potential effects of seismic and non-seismic information on the postulated hydraulic design bases of canals and reservoirs for the proposed plant site.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements related to cooling water canals and reservoirs, Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.8, "Cooling Water Canals and Reservoirs" of VEGP ESP SSAR, Revision 5. The NRC staff reviewed the application and checked the referenced VEGP ESP SSAR to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.9 Channel Diversions

Plant and essential water supplies used to transport and impound water supplies were evaluated to ensure that they will not be adversely affected by stream or channel diversions. The review includes stream channel diversions away from the site (which may lead to a loss of safety-related water) and stream channel diversions toward the site (which may lead to flooding). In addition, in such an event, the applicant needs to show that alternate water supplies are available to safety-related equipment. The specific areas of review are as follows: (1) historical channel migration phenomena including cutoffs, subsidence, and uplift; (2) regional topographic evidence that suggests a future channel diversion may or may not occur (used in conjunction with evidence of historical diversions); (3) thermal causes of channel diversion, such as ice jams, which may result from downstream ice blockages that may lead to flooding from backwater or upstream ice blockages that can divert the flow of water away from the intake; (4) potential for forces on safety-related facilities or the blockage of water supplies resulting from channel migration-induced flooding (flooding not addressed by hydrometeorological-induced flooding scenarios in other sections); (5) potential of channel diversion from human-induced causes (i.e., land-use changes, diking, channelization, armoring, or failure of structures); (6) alternate water sources and operating procedures; and (7) potential effects of seismic and non-seismic information on the postulated worst-case channel diversion scenario for the proposed plant site.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements related to channel diversions, Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.9, "Channel Diversions" of VEGP ESP SSAR, Revision 5. The NRC staff reviewed the application and checked the referenced VEGP ESP SSAR to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.10 Flooding Protection Requirements

2.4.10.1 *Introduction*

The flooding protection requirements address the locations and elevations of safety-related facilities and those of structures and components required for protection of safety-related facilities. These requirements are then compared with design-basis flood conditions to

determine whether flood effects need to be considered in the plant's design or in emergency procedures. The specific areas of review are as follows: (1) safety-related facilities exposed to flooding; (2) type of flood protection (e.g., "hardened facilities," sandbags, flood doors, bulkheads, etc.) provided to the SSCs exposed to floods; (3) emergency procedures needed to implement flood protection activities and warning times available for their implementation reviewed by the organization responsible for reviewing issues related to plant emergency procedures; and (4) potential effects of seismic and non-seismic information on the postulated flooding protection for the proposed plant site.

2.4.10.2 *Summary of Application*

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.10 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.4, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.4-2 Flooding

The supplemental information discussed flood protection requirements due to onsite drainage to address COL Information Item 2.4-2 and verified that local intense precipitation would not violate flooding criteria. VEGP COL FSAR Section 2.4.10 references VEGP COL FSAR Section 2.4.2 and states that based on the site-specific analysis of local intense precipitation, no additional flood protection requirements are needed.

2.4.10.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the identification of floods and flood design considerations are given in Section 2.4.10 of NUREG-0800.

2.4.10.4 *Technical Evaluation*

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to flooding protection requirements. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.4-2

The staff's technical evaluation was limited to the supplemental information provided in VEGP COL FSAR Section 2.4.10. The staff reviewed the supplemental information addressing flood protection requirements and the information incorporated by reference in the VEGP ESP SSAR. The staff reviewed the local intense precipitation in Section 2.4.2 of this SER and determined that the flooding elevation due to local intense precipitation will not require additional flood protection onsite because the maximum flood elevation is below the elevation of safety-related structures.

2.4.10.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.4.10.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to flooding protection requirements, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

As set forth above, the applicant has presented and substantiated information relative to the effects of the flooding protection requirements important to the design and siting of this plant. The staff reviewed the available information provided including VEGP COL 2.4-2 related to flood protection. For the reasons given above, the staff concluded that the identification and consideration of the effects of the flooding protection requirements at the site and in the surrounding area are acceptable and meet the relevant requirements of 10 CFR 52.79, 10 CFR 100.23(d), and 10 CFR 100.20(c).

2.4.11 Low Water Considerations

The low water considerations address natural events that may reduce or limit the available safety-related cooling water supply. The applicant ensures that an adequate water supply will exist to shut the plant down under conditions requiring safety-related cooling. The specific areas of review are as follows: (1) worst drought considered reasonably possible in the region; (2) effects of low water surface elevations caused by various hydrometeorological events and a potential blockage of intakes by sediment, debris, littoral drift, and ice because they can affect the safety-related water supply; (3) effects on the intake structure and pump design bases in relation to the events described in safety analysis report (SAR) Sections 2.4.7, 2.4.8, 2.4.9, and 2.4.11, which consider the range of water supply required by the plant (including minimum operating and shutdown flows during anticipated operational occurrences and emergency conditions) compared with availability (considering the capability of the UHS to provide adequate cooling water under conditions requiring safety-related cooling); (4) use limitations imposed or under discussion by Federal, State, or local agencies authorizing the use of the

water; and (5) potential effects of seismic and non-seismic information on the postulated worst-case low water scenario for the proposed plant site.

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements related to low water considerations, Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.7, "Low Water Considerations" of VEGP ESP SSAR, Revision 5. The NRC staff reviewed the application and checked the referenced ESP SSAR to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.4.12 Groundwater

2.4.12.1 *Introduction*

The groundwater section describes the hydrogeological characteristics of the site. The specific areas of review are as follows: (1) identification of the aquifers, types of onsite groundwater use, sources of recharge, present withdrawals and known and likely future withdrawals, flow rates, travel time, gradients (and other properties that affect the movement of accidental contaminants in groundwater), groundwater levels beneath the site, seasonal and climatic fluctuations, monitoring and protection requirements, and fabricated changes that have the potential to cause long-term changes in local groundwater regime; (2) effects of groundwater levels and other hydrodynamic effects of groundwater on design bases of plant foundations and other SSCs important to safety; (3) reliability of groundwater resources and related systems used to supply safety-related water to the plant; (4) reliability of dewatering systems to maintain groundwater conditions within the plant's design bases; and (5) potential effects of seismic and non-seismic information on the postulated worst-case groundwater conditions for the proposed plant site.

2.4.12.2 *Summary of Application*

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.12 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.4, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 2.4-3

In VEGP COL FSAR Section 2.4, the applicant incorporated by reference VEGP ESP SSAR Section 2.4.12 to address COL Information Item 2.4-3 related to the cooling water supply.

- VEGP COL 2.4-4

In VEGP COL FSAR Section 2.4, the applicant incorporated by reference VEGP ESP SSAR Section 2.4.12 to address COL Information Item 2.4-4 related to the groundwater.

Supplemental Information

- VEGP SUP 2.4-1

The applicant supplemented VEGP COL FSAR Section 2.4.12 to address a commitment in VEGP ESP SSAR Section 2.4.12.3 to evaluate the existing groundwater monitoring program to determine whether changes to the program will be required to adequately monitor impacts on groundwater from construction and operation of VEGP Units 3 and 4 related to long term groundwater level monitoring.

2.4.12.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the identification of floods and flood design considerations are given in Section 2.4.12 of NUREG-0800.

2.4.12.4 *Technical Evaluation*

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to groundwater. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Items

- VEGP COL 2.4-3

In VEGP COL FSAR Section 2.4, the applicant incorporated by reference, with no variances or supplements, VEGP ESP SSAR Section 2.4.12 to address COL Information Item 2.4-3 related to the cooling water supply.

- VEGP COL 2.4-4

In VEGP COL FSAR Section 2.4, the applicant incorporated by reference, with no variances or supplements, VEGP ESP SSAR Section 2.4.12 to address COL Information Item 2.4-4 related to the groundwater.

Supplemental Information

- VEGP SUP 2.4-1

In VEGP COL FSAR Section 2.4.12.3.1, the applicant provided additional information about post-construction monitoring of groundwater levels. The applicant stated that many of the existing monitoring wells would be impacted by construction activities. The number and location of replacement monitoring wells would be determined during construction, with some of the replacement wells installed in the power block areas of Units 3 and 4. Monitoring would commence prior to commercial operation of VEGP Unit 3.

The NRC staff's technical evaluation was based on the staff's SER for the VEGP ESP and the supplemental information provided in VEGP COL FSAR Section 2.4.12. The staff reviewed the supplemental information provided in the FSAR regarding groundwater monitoring programs. The staff recognizes that groundwater monitoring is an ongoing activity and monitoring wells may need to be closed and new wells installed because of changing site access conditions during construction. The staff agrees that further evaluation of the existing groundwater monitoring program and the installation of new monitoring wells would be valuable to confirm that groundwater levels would be adequately monitored as site conditions change. The purpose of the groundwater monitoring program described in VEGP COL FSAR Section 2.4.12.4 is to protect present and projected groundwater users (RG 1.206, Section C.I.2.4.12.4) and to ensure the reliability of groundwater resources and systems used for safety-related purposes (NUREG-0800 Section 2.4.12). During the VEGP ESP review, the staff evaluated the effects of groundwater uses and proposed plant facilities on the groundwater system and concluded that the projected maximum groundwater level (165 ft MSL) would be far enough below the site grade (220 ft MSL) so as not to violate any safety concerns or regulatory requirements. The staff finds VEGP SUP 2.4-1 acceptable.

2.4.12.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.4.12.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to groundwater, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

As set forth above, the applicant has presented and substantiated information relative to groundwater and the long term groundwater level monitoring important to the design and siting of this plant. The staff reviewed the available information provided including VEGP COL 2.4-3, VEGP COL 2.4-4 and VEGP SUP 2.4-1. For the reasons given above, the staff concluded that the groundwater characteristics and the identification and consideration of the long term groundwater level monitoring at the site and in the surrounding area are acceptable and meet the relevant requirements of 10 CFR 52.17(a)(1)(vi), 10 CFR 52.79, 10 CFR 100.23(d), and 10 CFR 100.20(c).

2.4.13 Accidental Release of Radioactive Liquid Effluent in Ground and Surface Waters

2.4.13.1 *Introduction*

This section considers the potential effects of postulated accidental releases from the radwaste systems and their components that handle liquid effluents generated during normal plant operations. Such releases would have relatively low levels of radioactivity, but could be large in volume. Normal releases are considered in the applicant's ER, as are releases from design-basis and severe accidents.

The accidental release of radioactive liquid effluents in ground and surface waters is evaluated based on the hydrogeological characteristics of the site that govern existing uses of groundwater and surface water and their known and likely future uses. The source term from a postulated accidental release is reviewed under NUREG-0800 Section 11.2 following the guidance in Branch Technical Position (BTP) 11-6, "Postulated Radioactive Releases Due to Liquid-containing Tank Failures." The source term is determined from a postulated release from a single tank outside of the containment.

The specific areas of review are: (1) alternate conceptual models of the hydrology at the site that reasonably bound hydrogeological conditions at the site, inasmuch as these conditions affect the transport of radioactive liquid effluents in the ground and surface water environment; (2) a bounding set of plausible surface and subsurface pathways from potential points of an accidental release to determine the critical pathways that may result in the most severe impact on existing uses and known and likely future uses of ground and surface water resources in any unrestricted area; (3) ability of the groundwater and surface water environments to delay, disperse, dilute, or concentrate accidentally released radioactive liquid effluents during transport; and (4) assessment of scenarios, wherein an accidental release of radioactive effluents is combined with potential effects of seismic and non-seismic events.

2.4.13.2 *Summary of Application*

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.13 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.4, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.4-5

In VEGP COL FSAR Section 2.4, the applicant incorporated by reference VEGP ESP SSAR Section 2.4.13 to address COL Information Items 2.4-5 and 15.7-1 related to accidental release of liquid effluents into groundwater and surface water.

VEGP ESP COL Action Item

- VEGP ESP COL Action Item 2.4-1

In VEGP COL FSAR Section 11.2.2.1.6, the applicant provided information related to chelating agents to address the VEGP ESP COL Action Item 2.4-1 related to the chelating agents.

2.4.13.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the accidental release of radioactive liquid effluents in ground and surface waters considerations are given in Sections 2.4.13 and 11.2 of NUREG-0800.

2.4.13.4 *Technical Evaluation*

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to accidental release of radioactive liquid effluent in ground and surface waters. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.4-5

The staff's evaluation of VEGP COL 2.4-5 is addressed in Section 11.2 of this SER.

VEGP ESP COL Action Item

- VEGP ESP COL Action Item 2.4-1

The staff's technical review of this application was limited to the supplemental information pertaining to Vogtle ESP COL Action Item 2.4-1 related to the chelating agents.

The staff concluded in VEGP ESP SER Section 2.4.13.3.2 that a release of a radioactive liquid effluent to the groundwater environment will meet the requirements of 10 CFR Part 20, "Standards for protection against radiation," Appendix B, and Table 2. However, the staff stated that the use of the minimum distribution coefficients in their analysis assumes that no chelating agents can be comingled with the radioactive liquid effluents. Therefore, COL Action Item 2.4-1 requires the following:

> A COL or CP [construction permit] applicant will need to confirm that no chelating agents will be comingled with radioactive waste liquids and that such agents will not be used to mitigate an accidental release. Alternatively, the applicant should repeat the distribution coefficient experiments with chelating agents included and incorporate these newly determined distribution coefficients into the analysis to demonstrate that 10 CFR Part 20, Appendix B, Table 2 is satisfied.

In VEGP COL FSAR Section 11.2.2.1.6, the applicant stated that chelating agents will not be routinely used in liquid radioactive processing, and, in the event chelating agents are required for a specific purpose, controls will be implemented to prevent comingling of chelating agents with the plant's normal liquid radioactive waste system. In a letter dated March 27, 2009, the applicant stated that the AP1000 standard design does not require the use of chelating agents in liquid radioactive waste processing and such agents will not be used. The staff determined that VEGP COL FSAR content resolves VEGP ESP COL Action Item 2.4-1.

2.4.13.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.4.13.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to the use of chelating agents, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The applicant provided supplemental information on the use of chelating agents in the liquid radioactive waste system and in mitigating an accidental release. This information addresses and resolves VEGP ESP COL Action Item 2.4-1. Therefore, the staff concludes that the requirements of 10 CFR 52.17(a)(1)(vi), 10 CFR 100.20(c), and 10 CFR 100.21(d) have been met with respect to determining the acceptability of the site for the AP1000 design.

2.4.14 Technical Specification and Emergency Operation Requirements

2.4.14.1 *Introduction*

The technical specifications and emergency operation requirements described here implement protection against floods for safety-related facilities to ensure that an adequate supply of water for shutdown and cool-down purposes is available. The specific areas of review are (1) controlling hydrological events to identify bases for emergency actions required during these events; (2) the amount of time available to initiate and complete emergency procedures before the onset of conditions while controlling hydrological events that may prevent such action; (3) reviewing technical specifications related to all emergency procedures required to ensure adequate plant safety from controlling hydrological events by the organization responsible for the review of issues related to technical specifications; and (4) potential effects of seismic and non-seismic information on the postulated technical specifications and emergency operations for the proposed plant site.

2.4.14.2 *Summary of Application*

Section 2.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.4 of the AP1000 DCD, Revision 19 and Section 2.4.14 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Section 2.4, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 2.4-6

The applicant provided Section 2.4.14 in the VEGP COL FSAR to address COL Information Item 2.4-6 and referenced Section 2.4.2 of the VEGP COL FSAR and Section 2.4.3 of the VEGP ESP SSAR regarding design basis floods and their impacts on safety-related SSCs. The applicant concluded that the combination of the DCD design and the plant grade elevation do not necessitate emergency procedures or technical specifications.

2.4.14.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and the VEGP ESP.

The guidance relevant to the Commission's regulations for the technical specifications and emergency operation requirements, and the associated acceptance criteria, are given in Section 2.4.14 of NUREG-0800. The applicable regulatory requirements for reviewing the applicant's discussion of technical specifications and emergency operation are described in 10 CFR Part 100, 10 CFR 100.23(d), 10 CFR 52.79(a)(1)(iii), and 10 CFR 50.36, "Technical specifications."

2.4.14.4 *Technical Evaluation*

The NRC staff reviewed Section 2.4 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to technical specifications and emergency operation requirements. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 2.4-6

The NRC staff reviewed the resolution to COL Information Item 2.4-6, related to the technical specifications and emergency operation requirements that implement protection against floods for safety-related facilities to ensure that an adequate supply of water for shutdown and cool-down purposes is available. Based on the applicant's selection of a design basis plant grade of 220 ft MSL, which is above the expected surface water and groundwater elevations, no emergency procedures or technical specifications are necessary.

2.4.14.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.4.14.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to technical specifications and emergency operation requirements, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The review confirmed that no emergency procedures or technical specifications are necessary to prevent hydrological phenomena from degrading the UHS and VEGP COL 2.4-6 is acceptable. No outstanding information is expected to be addressed in the FSAR related to this section. Therefore, the staff concludes that the relevant requirements of 10 CFR 50.36 and 10 CFR 100.20(c) have been met with respect to determining the acceptability of the site for the AP1000 design.

2.5 Geology, Seismology, and Geotechnical Engineering

2.5.1 Basic Geologic and Seismic Information

Section 2.5 of the VEGP COL FSAR, Revision 5 describes the basic geologic and seismic information that was collected by the applicant. This technical information resulted primarily from surface and subsurface geologic, seismic, geophysical, and geotechnical investigations, performed in progressively greater detail closer to the site, within each of four areas defined by circles drawn around the site using radii of 320 km (200 mi), 40 km (25 mi), 8 km (5 mi), and 1 km (0.6 mi). These four circumscribed areas correspond, respectively, to site region, site vicinity, site area, and site location. The primary purposes for conducting these investigations are to determine geologic and seismic suitability of the site, to provide the bases for plant design, and to determine whether there is significant new tectonic or ground motion information that could impact seismic design bases as determined by probabilistic seismic hazard analysis (PSHA). The geologic, seismic, geophysical, and geotechnical information provided by the applicant addresses the following three specific topics necessary for review of regional and site geology: tectonic and seismic information, non-tectonic deformation information, and conditions caused by human activities.

Section 2.5 of the VEGP COL FSAR, incorporates by reference Section 2.5.1 of the AP1000 DCD, Revision 19, and adds VEGP COL 2.5-1 to address COL Information Item 2.5-1 (COL Action Item 2.5.1-1). In VEGP COL 2.5-1, the applicant incorporates by reference Sections 2.5.1, 2.5.2, and 2.5.4 of the VEGP ESP SSAR, Revision 5, with no variances or supplements. The staff has already reviewed Sections 2.5.1, 2.5.2, and 2.5.4 of the VEGP ESP SSAR and found the basic geologic and seismic information to be acceptable. Therefore, the NRC staff considers VEGP COL 2.5-1 resolved.

The NRC staff reviewed Section 2.5 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to basic geologic and seismic information. The results of the NRC staff's evaluation of the information incorporated by

reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.5.2 Vibratory Ground Motion

2.5.2.1 *Introduction*

The vibratory ground motion is evaluated based on seismological, geological, geophysical, and geotechnical investigations carried out to determine the site-specific ground motion response spectra (GMRS), which is the safe shutdown earthquake (SSE) ground motion for the site. The GMRS is defined as the free-field horizontal and vertical GMRS at the plant site. The development of the GMRS is based upon a detailed evaluation of earthquake potential, taking into account the regional and local geology, Quaternary (1.8 million years ago to present) tectonics, seismicity, and site-specific geotechnical engineering characteristics of the site subsurface material. The specific investigations necessary to determine the GMRS include the seismicity of the site region and the correlation of earthquake activity with seismic sources. Seismic sources are identified and characterized, including the rates of occurrence of earthquakes associated with each seismic source. Seismic sources that have any part within 320 km (200 mi) of the site must be identified. More distant sources that have a potential for earthquakes large enough to affect the site must also be identified. Seismic sources can be capable tectonic sources or seismogenic sources. The review covers the following specific areas: (1) seismicity; (2) geologic and tectonic characteristics of the site and region; (3) correlation of earthquake activity with seismic sources; (4) PSHA and controlling earthquakes; (5) seismic wave transmission characteristics of the site; and (6) site-specific GMRS.

2.5.2.2 *Summary of Application*

Section 2.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.5.2 of the AP1000 DCD, Revision 19 and Sections 2.5.2 and 2.5.4 of the VEGP ESP SSAR, Revision 5.

In addition, in VEGP COL FSAR Sections 2.5.7.2 and 2.5.7.3, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 2.5-2

The applicant provided additional information in VEGP COL 2.5-2 to resolve COL Information Item 2.5-2 (COL Action Item 2.5.2-1 identified in NUREG-1793). The applicant stated that VEGP COL 2.5-2 is addressed in VEGP ESP SSAR Sections 2.5.2 and 2.5.4.
VEGP COL 2.5-2 addresses the provision of site-specific information related to the vibratory ground motion aspects of the site: seismicity; geologic and tectonic characteristics of site and region; correlation of earthquake activity with seismic sources; PSHA and controlling earthquakes; seismic wave transmission characteristics of the site; and the SSE ground motion.

- VEGP COL 2.5-3

The applicant provided additional information in VEGP COL 2.5-3 to resolve COL Information Item 2.5-3 (COL Action Item 2.6.3 identified in NUREG-1793). The applicant stated that VEGP COL 2.5-3 is addressed in VEGP ESP SSAR Sections 2.5.2 and 2.5.4.

VEGP COL 2.5-3 addresses the site-specific evaluation that is needed if the site-specific spectra at the foundation level exceed the certified seismic design response spectra (CSDRS) at any frequency, or if soil conditions were outside the range evaluated for AP1000 DC. The AP1000 DCD also provides steps for conducting site-specific soil structure interaction (SSI) analysis and developing in-structure response spectra (ISRS) at six specified locations on the nuclear island (NI) to determine the suitability of the site for an AP1000 plant.

In the referenced VEGP ESP SSAR Section 2.5.2, the applicant addresses vibratory ground motion. VEGP ESP SSAR Section 2.5.2.1, "Seismicity," describes the development of a current earthquake catalog for the site region (within a 320 km (200 mi) radius); VEGP ESP SSAR Section 2.5.2.2, "Geologic and Tectonic Characteristics of the Site and Region," describes the seismic sources and seismicity parameters that the applicant used to calculate the seismic ground motion hazard for the VEGP site; VEGP ESP SSAR Section 2.5.2.3, "Correlation of Earthquake Activity with Seismic Sources," describes the correlation of updated seismicity with the Electric Power Research Institute (EPRI) seismic source model; VEGP ESP SSAR Section 2.5.2.4, "Probabilistic Seismic Hazard Analysis and Controlling Earthquakes," presents the results of the applicant's PSHA for the VEGP site; VEGP ESP SSAR Section 2.5.2.5, "Seismic Wave Transmission Characteristics of the Site," describes the method used by the applicant to develop the site free-field soil ground motion; and, VEGP ESP SSAR Section 2.5.2.6, "Ground Motion Response Spectra," describes the method used to develop the horizontal and vertical site-specific GMRS.

2.5.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and its supplements and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for vibratory ground motion are given in Section 2.5.2 of NUREG-0800.

The applicable regulatory requirement for reviewing the applicant's discussion of vibratory ground motion is:

- 10 CFR 100.23, "Geologic and Seismic Siting Criteria," with respect to obtaining geologic and seismic information necessary to determine site suitability and ascertain that any new information derived from site-specific investigations does not impact the GMRS derived by a PSHA. In complying with this regulation, the applicant also meets guidance in RG 1.132, "Site Investigations for Foundations of Nuclear Power Plants," Revision 2; and RG 1.208, "A Performance-Based Approach to Define Site-Specific Earthquake Ground Motion."

The related acceptance criteria summarized from NUREG-0800 Section 2.5.2 are as follows:

- Seismicity: To meet the requirements in 10 CFR 100.23, this section is accepted when the complete historical record of earthquakes in the region is listed and when all available parameters are given for each earthquake in the historical record.

- Geologic and Tectonic Characteristics of Site and Region: Seismic sources identified and characterized by the Lawrence Livermore National Laboratory (LLNL) and the EPRI were used for studies in the Central and Eastern United States (CEUS) in the past.

- Correlation of Earthquake Activity with Seismic Sources: To meet the requirements in 10 CFR 100.23, acceptance of this section is based on the development of the relationship between the history of earthquake activity and seismic sources of a region.

- PSHA and Controlling Earthquakes: For CEUS sites relying on LLNL or EPRI methods and databases, the staff will review the applicant's PSHA, including the underlying assumptions and how the results of the site investigations are used to update the existing sources in the PSHA, how they are used to develop additional sources, or how they are used to develop a new database.

- Seismic Wave Transmission Characteristics of the Site: In the PSHA procedure described in RG 1.208, the controlling earthquakes are determined for generic rock conditions.

- GMRS: In this section, the staff reviews the applicant's procedure to determine the GMRS.

In addition, the geologic characteristics should be consistent with appropriate sections from: RG 1.132; RG 4.7, "General Site Suitability Criteria for Nuclear Power Stations," Revision 2; RG 1.208; and RG 1.206.

2.5.2.4 *Technical Evaluation*

The NRC staff reviewed Section 2.5 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to vibratory ground motion. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements, and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Items

- VEGP COL 2.5-2

The NRC staff reviewed VEGP COL 2.5-2 related to COL Information Item 2.5-2, which requires the COL applicant to provide information pertaining to the following vibratory ground motion aspects of the site and region:

- Seismicity
- Geologic and tectonic characteristics of site and region
- Correlation of earthquake activity with seismic sources
- PSHA and controlling earthquakes
- Seismic wave transmission characteristics of the site
- SSE ground motion

The applicant incorporated by reference all the information in Section 2.5.2 of the VEGP ESP SSAR, which includes the above vibratory ground motion aspects of the VEGP Units 3 and 4 site. The staff has already reviewed the VEGP ESP SSAR and found the information included therein to be acceptable. Therefore, the staff concludes that the information in VEGP ESP SSAR Sections 2.5.2 and 2.5.4 and incorporated by reference in VEGP COL FSAR Section 2.5.7.2 is sufficient to satisfy, in part, the requirements of VEGP COL 2.5-2.

With respect to COL Information Item 2.5-2, the COL applicant is also required to demonstrate that the free-field peak ground acceleration at the finished grade level is less than or equal to a 0.30g SSE and that the site-specific GMRS at the finished grade level in the free-field are less than or equal to the AP1000 CSDRS. The applicant is also required to demonstrate that the site conditions are comparable to those used in the AP1000 generic soil site analyses or, alternatively, perform a site-specific evaluation to demonstrate that the AP1000 plant designed for the CSDRS is acceptable for the proposed site.

In VEGP ESP SSAR Appendix 2.5E, the applicant stated that the VEGP geotechnical conditions and ground materials have differences from the design analyses performed for the AP1000 seismic analyses. Furthermore, the applicant compared the VEGP GMRS (defined at the ground surface) and foundation input response spectra (FIRS) (defined at a depth of 40 ft (12.2 m)) to the AP1000 CSDRS, in Figures 3-4 and 3-5 of Appendix 2.5E and observed that there are exceedances above the CSDRS.

Thus, the applicant performed a site-specific seismic evaluation, which is referenced in Section 2.5.2.9 of the VEGP ESP SSAR and documented in detail in VEGP ESP SSAR Appendix 2.5E. The staff reviewed the results of the applicant's 2D system for analysis of soil structure interaction (SASSI) analyses, which are provided in VEGP ESP SSAR Figures 2.5.2-59 to 2.5.2-64, and noted that the CSDRS enveloped the generated ISRS at the key locations identified by the AP1000 DCD with significant margin except for a narrow band in the 0.5 to 0.6 Hz frequency range. To address this concern, the staff issued RAI 3.7.2-1 to request that the applicant perform 3D SASSI analysis to more accurately predict in-structure response. In response to RAI 3.7.2-1, the applicant provided a justification for the low frequency exceedances of the AP1000 ISRS. The staff's review of the applicant's response is being evaluated in SER Section 3.7.

- VEGP COL 2.5-3

The NRC staff reviewed VEGP COL 2.5-3 related to COL Information Item 2.5-3, which requires the COL applicant to perform a site-specific seismic evaluation if the site-specific spectra at the foundation level exceed the CSDRS at any frequency, or if site conditions are outside the range evaluated for the AP1000 DC. As described above, the applicant performed site-specific SSI analyses using a 2D SASSI model, which is documented in VEGP ESP SSAR Appendix 2.5E. The staff concludes that the applicant conducted a site-specific evaluation to show that the AP1000 CSDRS is adequate for the VEGP Units 3 and 4 site and satisfies the requirements of VEGP COL 2.5-3.

2.5.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

2.5.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant addressed the required information relating to vibratory ground motion, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The NRC staff concludes that VEGP COL FSAR Sections 2.5.7.2 and 2.5.7.3 adequately incorporate by reference Sections 2.5.2 and 2.5.4 of the VEGP ESP SSAR and the information pertaining to vibratory ground motion is acceptable. In addition, the staff concludes that VEGP COL 2.5-2 and VEGP COL 2.5-3 have been adequately addressed by the applicant. Therefore, the staff concludes that the site is suitable with respect to the vibratory ground motion criteria for new nuclear power plants and meets the applicable requirements of 10 CFR 100.23.

2.5.3 Surface Faulting

VEGP COL FSAR Section 2.5.7.4 is concerned with the potential for surface deformation due to faulting and references VEGP ESP SSAR Section 2.5.3. The information related to surface deformation due to faulting was collected by the applicant during the ESP site characterization investigations. The information provided by the applicant in the VEGP ESP SSAR addressed the following specific topics related to surface faulting: geologic, seismic, and geophysical investigations; evidence or absence of evidence for tectonic surface deformation; correlation of earthquakes with capable tectonic sources; ages of most recent deformation; relationship of tectonic structures in the site area to regional tectonic structures; characterization of capable tectonic sources; designation of zones of Quaternary deformation in the site region; and potential for surface tectonic deformation at the site.

Section 2.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 2.5.3 of the AP1000 DCD, Revision 19, and adds VEGP COL 2.5-4 to address COL Information Item 2.5-4 (COL Action Item 2.5.3-1). In VEGP COL 2.5-4, the applicant incorporates by reference Section 2.5.3 of the VEGP ESP SSAR, Revision 5, with no variances or supplements. The staff has already reviewed Section 2.5.3 of the VEGP ESP SSAR and found the information relating to surface faulting to be acceptable. Therefore, the NRC staff considers VEGP COL 2.5-4 resolved.

The NRC staff reviewed Section 2.5 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to surface faulting. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

2.5.4 Stability of Subsurface Materials and Foundations

2.5.4.1 *Introduction*

This section addresses the properties and stability of the soil and rock underlying the site that could affect the safe design and siting of the plant. The review covers the following specific areas: (1) geologic features of the site and vicinity; (2) static and dynamic engineering properties of soil and rock strata underlying the site; (3) relationship of the foundations for safety-related facilities and the engineering properties of underlying materials; (4) results of seismic refraction and reflection surveys, including in-hole and cross-hole explorations; (5) safety-related excavation and backfill plans and engineered earthwork analysis and criteria; (6) groundwater conditions and piezometric pressure in all critical strata as they affect the loading and stability of foundation materials; (7) responses of site soils or rocks to dynamic loading; (8) liquefaction potential and consequences of liquefaction of all subsurface soils, including the settlement of foundations; (9) earthquake design bases; (10) results of investigations and analyses conducted to determine foundation material stability, deformation and settlement under static conditions; (11) criteria, references, and design methods used in static and seismic analyses of foundation materials; and (12) techniques and specifications to improve subsurface conditions, which are to be used at the site to provide suitable foundation conditions.

2.5.4.2 *Summary of Application*

Section 2.5 of the VEGP COL FSAR Revision 5, incorporates by reference Section 2.5.4 of the AP1000 DCD, Revision 19 and Section 2.5.4 of the VEGP ESP SSAR, Revision 5. The ASE with confirmatory items for Section 2.5.4 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. The applicant added VEGP DEP 2.5-1 in Revision 5 of the VEGP COL FSAR. In addition, in VEGP COL FSAR Table 1.8-204, Section 2.5.4.10.3, Sections 2.5.7.5 through 2.5.7.13, and Section 2.5.7.16, the applicant provided the following:

Tier 2 Departure

- VEGP DEP 2.5-1

The applicant provided a departure from the AP1000 DCD to address the design information regarding the mudmat.

AP1000 COL Information Items

- VEGP COL 2.5-5

The applicant provided VEGP COL 2.5-5 to resolve COL Information Item 2.5-5 (COL Action Item 2.5.1-1). The applicant stated that VEGP COL 2.5-5 is addressed in VEGP ESP SSAR Section 2.5.4. It addresses the provision of site-specific information regarding the underlying site conditions and geologic features, including site topographical features and the locations of seismic Category I structures.

- VEGP COL 2.5-6

The applicant provided VEGP COL 2.5-6 to resolve COL Information Item 2.5-6 discussed in Section 2.5.4.6.2 of the AP1000 DCD. The applicant stated that VEGP COL 2.5-6 is addressed in VEGP ESP SSAR Section 2.5.4. It addresses the properties of the foundation soils to be within the range considered for design of the NI basemat.

- VEGP COL 2.5-7

The applicant provided VEGP COL 2.5-7 to resolve COL Information Item 2.5-7 discussed in Section 2.5.4.6.3 of the AP1000 DCD. The applicant stated that VEGP COL 2.5-7 is addressed in VEGP ESP SSAR Section 2.5.4. It addresses the information concerning the extent (horizontal and vertical) of seismic Category I excavations, fills, and slopes.

- VEGP COL 2.5-8

The applicant provided VEGP COL 2.5-8 to resolve COL Information Item 2.5-8 (COL Action Item 2.4.1-1). The applicant stated that VEGP COL 2.5-8 is addressed in VEGP ESP SSAR Section 2.5.4. It addresses the ground water conditions relative to the foundation stability of the safety-related structures at the site.

- VEGP COL 2.5-9

The applicant provided VEGP COL 2.5-9 to resolve COL Information Item 2.5-9 (COL Action Item 2.5.4-3). The applicant stated that VEGP COL 2.5-9 is addressed in VEGP ESP SSAR Section 2.5.4, where the demonstration that the potential for liquefaction is negligible is provided.

- VEGP COL 2.5-10

The applicant provided VEGP COL 2.5-10 to resolve COL Information Item 2.5-10 (COL Action Item 2.6-4). The applicant stated that VEGP COL 2.5-10 is addressed in VEGP ESP SSAR Section 2.5.4, where the verification that the maximum bearing reaction determined from the analyses described in AP1000 DCD, Appendix 3G is less than 35,000 pounds per square foot (psf) under all combined loads, including the SSE for static and dynamic loads, is provided.

- VEGP COL 2.5-11

The applicant provided additional information for VEGP COL 2.5-11 to resolve COL Information Item 2.5-11 discussed in Section 2.5.4.6.7 of the AP1000 DCD. The applicant provided information regarding lateral earth pressure in VEGP COL FSAR Section 2.5.4.10.3 and also stated that VEGP COL 2.5-11 is addressed in VEGP ESP SSAR Section 2.5.4, where the methodology used in determination of static and dynamic lateral earth pressures and hydrostatic groundwater pressures acting on plant safety-related facilities using soil parameters as evaluated in previous sections is discussed.

- VEGP COL 2.5-12

The applicant provided VEGP COL 2.5-12 to resolve COL Information Item 2.5-12 discussed in Section 2.5.4.6.9 of the AP1000 DCD. The applicant stated that VEGP COL 2.5-12 is

addressed in VEGP ESP SSAR Section 2.5.4, where soil characteristics affecting the stability of the NI including foundation rebound, settlement, and differential settlement are discussed.

- VEGP COL 2.5-13

The applicant provided VEGP COL 2.5-13 to resolve COL Information Item 2.5-13 (COL Action Item 2.6-5). The applicant stated that VEGP COL 2.5-13 is addressed in VEGP ESP SSAR Section 2.5, Appendix 2.5E, where instrumentation for monitoring the performance of the foundations of the NI, along with the location for benchmarks and markers for monitoring the settlement, is identified.

- VEGP COL 2.5-16

The applicant provided additional information in VEGP COL 2.5-16 to address COL Information Item 2.5-16 discussed in Section 2.5.4.6.11 of the AP1000 DCD. The applicant stated that VEGP COL 2.5-16 is addressed in VEGP ESP SSAR Section 2.5.4, where data on short-term (elastic) and long-term (heave and consolidation) settlement for soil sites for the history of loads imposed on the foundation consistent with the construction sequence are provided.

- VEGP COL 2.5-17

This COL Information Item was provided in a letter dated July 1, 2010, to reflect a response from Westinghouse dated July 21, 2009, regarding NRC RAI AP1000 DCD RAI-TR85-SEB1-36 R2. Westinghouse proposed COL Information Item 2.5-17 to provide a waterproofing system used for the below grade, exterior walls exposed to flood and groundwater under seismic Category I structures. COL Information Item 2.5-17 states that:

> The Combined License applicant will provide a waterproofing system used for the below grade, exterior walls exposed to flood and groundwater under seismic Category I structures. Waterproofing membrane should be placed immediately beneath the upper Mud Mat, and on top of the lower Mud Mat. The performance requirements to be met by the COL applicant for the waterproofing system are described in subsection 3.4.1.1.1.1.

Evaluation of the waterproofing capability of the system presented in VEGP COL 2.5-17 occurs in Section 3.8 of this SER. The evaluation of the system's ability to meet the seismic requirements outlined in DCD Section 3.4.1.1.1.1 is located in Section 3.8 of this SER.

The ASE with confirmatory items for Section 2.5.4 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. The applicant added VEGP SUP 2.5-1 in Revision 4 of the VEGP COL FSAR

Supplemental Information

- VEGP SUP 2.5-1

The applicant added Section 2.5.4.13 to the VEGP COL FSAR. This addition, along with new Figure 2.5-203, describes the heavy lift derrick (HLD) and counterweight to be built at the site. The ring foundation for the HLD and counterweight will be abandoned in place and below-grade

following construction of Units 3 and 4. The applicant states that the HLD system will not affect the stability of safety-related structures at the site.

ESP Permit Conditions

- ESP PC 1

The applicant provided additional information in VEGP COL FSAR Table 1.8-204 and VEGP COL Part 10, Appendix B, to address ESP PC 1 relating to eliminating soil liquefaction potential.

2.5.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSERs related to the DCD and its supplements and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for stability of subsurface materials and foundations are given in Section 2.5.4 of NUREG-0800.

The applicable regulatory requirements for reviewing the applicant's discussion of stability of subsurface materials and foundations are as follows:

- 10 CFR 50.55a, "Codes and Standards," requires that SSCs be designed, fabricated, erected, constructed, tested and inspected in accordance with the requirements of applicable codes and standards commensurate with the importance of the safety function to be performed.

- 10 CFR Part 50, Appendix A, GDC 1, "Quality Standards and Records," requires that SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. It also requires that appropriate records of the design, fabrication, erection, and testing of SSCs important to safety be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit.

- 10 CFR Part 50, Appendix A, GDC 2, "Design Bases for Protection Against Natural Phenomena," relates to the consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

- 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants," establishes quality assurance requirements for the design, construction, and operation of those SSCs of nuclear power plants that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public.

- 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," applies to the design of nuclear power plant SSCs important to safety to withstand the effects of earthquakes.

- 10 CFR Part 100 provides the criteria that guide the evaluation of the suitability of proposed sites for nuclear power and testing reactors.

- 10 CFR 100.23 provides the nature of the investigations required to obtain the geologic and seismic data necessary to determine site suitability and identify geologic and seismic factors required to be taken into account in the siting and design of nuclear power plants.

The related acceptance criteria summarized from NUREG-0800 Section 2.5.4 are as follows:

- Geologic Features: In meeting the requirements of 10 CFR Parts 50 and 100, the section defining geologic features is acceptable if the discussions, maps, and profiles of the site stratigraphy, lithology, structural geology, geologic history, and engineering geology are complete and are supported by site investigations sufficiently detailed to obtain an unambiguous representation of the geology.

- Properties of Subsurface Materials: In meeting the requirements of 10 CFR Parts 50 and 100, the description of properties of underlying materials is considered acceptable if state-of-the-art methods are used to determine the static and dynamic engineering properties of all foundation soils and rocks in the site area.

- Foundation Interfaces: In meeting the requirements of 10 CFR Parts 50 and 100, the discussion of the relationship of foundations and underlying materials is acceptable if it includes: (1) a plot plan or plans showing the locations of all site explorations, such as borings, trenches, seismic lines, piezometers, geologic profiles, and excavations with the locations of the safety-related facilities superimposed thereon; (2) profiles illustrating the detailed relationship of the foundations of all seismic Category I and other safety-related facilities to the subsurface materials; (3) logs of core borings and test pits; and (4) logs and maps of exploratory trenches in the application for a COL.

- Geophysical Surveys: In meeting the requirements of 10 CFR 100.23, the presentation of the dynamic characteristics of soil or rock is acceptable if geophysical investigations have been performed at the site and the results obtained there from are presented in detail.

- Excavation and Backfill: In meeting the requirements of 10 CFR Part 50, the presentation of the data concerning excavation, backfill, and earthwork analyses is acceptable if: (1) the sources and quantities of backfill and borrow are identified and are shown to have been adequately investigated by borings, pits, and laboratory property and strength testing (dynamic and static) and these data are included, interpreted, and summarized; (2) the extent (horizontally and vertically) of all Category I excavations, fills, and slopes are clearly shown on plot plans and profiles; (3) compaction specifications and embankment and foundation designs are justified by field and laboratory tests and analyses to ensure stability and reliable performance; (4) the impact of compaction methods are incorporated into the structural design of the plant facilities; (5) quality control methods are discussed and the quality assurance program described and referenced; (6) control of groundwater during excavation to preclude degradation of foundation materials and properties is described and referenced.

- Ground Water Conditions: In meeting the requirements of 10 CFR Parts 50 and 100, the analysis of groundwater conditions is acceptable if the following are included in this section or cross-referenced to the appropriate sections in NUREG-0800 Section 2.4 of the SAR: (1) discussion of critical cases of groundwater conditions relative to the foundation settlement and stability of the safety-related facilities of the nuclear power plant; (2) plans for dewatering during construction and the impact of the dewatering on temporary and permanent structures; (3) analysis and interpretation of seepage and potential piping conditions during construction; (4) records of field and laboratory permeability tests, as well as dewatering induced settlements; (5) history of groundwater fluctuations as determined by periodic monitoring of 16 local wells and piezometers.

- Response of Soil and Rock to Dynamic Loading: In meeting the requirements of 10 CFR Parts 50 and 100, descriptions of the response of soil and rock to dynamic loading are acceptable if: (1) an investigation has been conducted and discussed to determine the effects of prior earthquakes on the soils and rocks in the vicinity of the site; (2) field seismic surveys (surface refraction and reflection and in-hole and cross-hole seismic explorations) have been accomplished and the data presented and interpreted to develop bounding P and S wave velocity profiles; (3) dynamic tests have been performed in the laboratory on undisturbed samples of the foundation soil and rock sufficient to develop strain-dependent modulus reduction and hysteretic damping properties of the soils and the results included.

- Liquefaction Potential: In meeting the requirements of 10 CFR Parts 50 and 100, if the foundation materials at the site adjacent to and under Category I structures and facilities are saturated soils and the water table is above bedrock, then an analysis of the liquefaction potential at the site is required.

- Static Stability: In meeting the requirements of 10 CFR Parts 50 and 100, the discussions of static analyses are acceptable if the stability of all safety-related facilities has been analyzed from a static stability standpoint including bearing capacity, rebound, settlement, and differential settlements under deadloads of fills and plant facilities, and lateral loading conditions.

- Design Criteria: In meeting the requirements of 10 CFR Part 50, the discussion of criteria and design methods is acceptable if the criteria used for the design, the design methods employed, and the factors of safety obtained in the design analyses are described and a list of references presented.

- Techniques to Improve Subsurface Conditions: In meeting the requirements of 10 CFR Part 50, the discussion of techniques to improve subsurface conditions is acceptable if plans, summaries of specifications, and methods of quality control are described for all techniques to be used to improve foundation conditions (such as grouting, vibroflotation, dental work, rock bolting, or anchors).

In addition, the geologic characteristics should be consistent with appropriate sections from: RG 1.27, “Ultimate Heat Sink for Nuclear Power Plants,” Revision 2; RG 1.28, “Quality Assurance Program Requirements (Design and Construction),” Revision 4; RG 1.132; RG 1.138, “Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants,” Revision 2; RG 1.198, “Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites”; and RG 1.206.

2.5.4.4 *Technical Evaluation*

The NRC staff reviewed Section 2.5 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information related to stability of subsurface materials and foundations. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff reviewed the information in the VEGP COL FSAR:

Tier 2 Departure

- VEGP DEP 2.5-1

The AP1000 DCD states that the lower and upper mudmats are each a minimum 150 mm (6 inches) thick of un-reinforced concrete. However, the lower and upper mudmats chosen for the VEGP ESP SSAR consist of 150 mm (6 inch) layers of non-reinforced concrete.

This Tier 2 departure is associated with the thickness of the lower and upper mudmats. Lower and upper mudmats that are nominally 6 inches thick each, but may be less than 6 inches thick due to construction tolerances, are sufficient to meet the DCD functional requirements. The mudmats will provide a working surface prior to initiating the placement of reinforcement for the foundation mat structural concrete while also protecting the waterproof membrane, which is placed between the mudmats, from damage during construction of the nuclear island foundation. The lower and upper mudmats are as described in ESPA SSAR Subsection 3.8.5.1. Lower and upper mudmats with a nominal thickness of 150 mm (6 inches) each will provide an adequate transfer of horizontal shear forces from the nuclear island to the seismic Category 1 backfill through use of un-reinforced concrete with a minimum compressive strength of 17,237 kPa (2,500 psi), consistent with the AP1000 DCD design.

As a result, the staff considers VEGP DEP 2.5-1 acceptable.

AP1000 COL Information Items

- VEGP COL 2.5-5

The NRC staff reviewed VEGP COL 2.5-5 related to COL Information Item 2.5-5, which requires the applicant to provide site-specific information regarding the underlying site conditions and geologic features, including site topographical features and the locations of seismic Category I structures. VEGP COL FSAR Section 2.5.7.5 refers to Section 2.5.4 of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-5. VEGP ESP SSAR Section 2.5.4.1 refers to SSAR Section 2.5.1 for detailed descriptions of the geologic features in the VEGP Units 3 and 4 site region and site area. Since the staff already reviewed this topic and concluded that it has been resolved, as documented in the SER for the VEGP ESP and limited work authorization (LWA) applications, no further evaluation is needed for VEGP COL 2.5-5.

- VEGP COL 2.5-6

The NRC staff reviewed VEGP COL 2.5-6 related to COL Information Item 2.5-6, which requires the applicant to confirm the properties of the foundation soils to be within the range considered for design of the NI basemat. VEGP COL FSAR Section 2.5.7.6 refers to Section 2.5.4 of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-6. Since the staff has already reviewed this topic and concluded that it has been resolved, as documented in the SER for the VEGP ESP and LWA applications, no further evaluation is needed for VEGP COL 2.5-6.

- VEGP COL 2.5-7

The NRC staff reviewed VEGP COL 2.5-7 related to COL Information Item 2.5-7, which requires the applicant to provide information concerning the extent (horizontal and vertical) of seismic Category I excavations, fills, and slopes. VEGP COL FSAR Section 2.5.7.7 refers to Section 2.5.4 of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-7. Since the staff has already reviewed this topic and concluded that it has been resolved, as documented in the SER for the VEGP ESP and LWA applications, no further evaluation is needed for VEGP COL 2.5-7.

- VEGP COL 2.5-8

The NRC staff reviewed VEGP COL 2.5-8 related to COL Information Item 2.5-8, which requires the applicant to assess the ground water conditions relative to the foundation stability of the safety-related structures at the site. In VEGP COL FSAR Section 2.5.7.8, the applicant referred to Section 2.5.4 of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-8. Since the staff has already reviewed this topic and concluded that it has been resolved, as documented in the SER for the VEGP ESP and LWA applications, no further evaluation is needed for VEGP COL 2.5-8.

- VEGP COL 2.5-9

The NRC staff reviewed VEGP COL 2.5-9 related to COL Information Item 2.5-9, which requires the applicant to demonstrate that the potential for liquefaction is negligible. In VEGP COL FSAR Section 2.5.7.9, the applicant referred to VEGP ESP SSAR Section 2.5.4 for the information that addresses VEGP COL 2.5-9. Since the staff already reviewed this topic and concluded that it has been resolved, as documented in the SER for the VEGP ESP and LWA applications, no further evaluation is needed for VEGP COL 2.5-9.

- VEGP COL 2.5-10

The NRC staff reviewed VEGP COL 2.5-10 related to COL Information Item 2.5-10, which requires the applicant to verify that the maximum bearing reaction determined from the analyses described in AP1000 DCD, Appendix 3G is less than 35,000 psf under all combined loads, including the SSE, for static and dynamic loads, and for the COL applicant to verify that the site-specific allowable soil bearing capacities for the static and dynamic loads at the site exceed this demand. VEGP COL FSAR Section 2.5.7.10 refers to Section 2.5.4 of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-10. Since the staff already reviewed this topic and concluded that it has been resolved, as documented in the SER for the VEGP ESP and LWA applications, no further evaluation is needed for VEGP COL 2.5-10.

- VEGP COL 2.5-11

The NRC staff reviewed VEGP COL 2.5-11 related to COL Information Item 2.5-11, which requires the applicant to describe the methodology used in the determination of static and dynamic lateral earth pressures and hydrostatic groundwater pressures acting on plant safety-related facilities using soil parameters as evaluated in previous sections. In VEGP COL FSAR Section 2.5.7.11, the applicant referred to Section 2.5.4 of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-11. The staff asked the applicant to provide additional explanations of the methodologies used to determine the lateral earth pressures and the hydrostatic pressures acting on the safety-related structures at the VEGP Units 3 and 4 site in RAI 2.5.4-1.

In response to RAI 2.5.4-1, dated December 11, 2008, the applicant proposed a revision to the VEGP FSAR to include information on the development and mitigation of lateral earth pressures against the below-grade structures. The RAI response provided an analysis utilizing the Mononobe-Okabe (M-O) method. Based on the staff's review of the applicant's response to RAI 2.5.4-1, as well as the concerns surrounding the use of the M-O method, which does not consider the non-yielding and under at-rest conditions for foundation of structures below grade, the staff concluded that the response was not fully consistent with the AP1000 DCD.

Accordingly, in RAI 2.5.4-3, the staff asked the applicant to address the issues identified by the staff regarding the use of the M-O method. In its response, dated April 9, 2009, the applicant presented a revised site-specific total lateral earth pressure calculation that included both the dynamic Wood solution and the peak passive pressure solution evaluation and compared it with the enveloping lateral earth pressures of the design case for the below grade NI walls of the AP1000 DCD. The applicant also proposed changes to VEGP COL FSAR Section 2.5 by adding a new Section 2.5.4.10.3, with associated references and figures, to incorporate the RAI response into the FSAR. Based on the applicant's commitment to revise the FSAR to include an additional discussion of the earth pressures at the site, the staff concluded that the applicant provided a satisfactory response to resolve RAI 2.5.4-3, as well as RAI 2.5.4-1. The staff verified that the VEGP COL FSAR adequately incorporates the above. As a result, RAIs 2.5.4-1 and 2.5.4-3 are closed, and VEGP COL 2.5-11 is resolved.

- VEGP COL 2.5-12

The NRC staff reviewed VEGP COL 2.5-12 related to COL Information Item 2.5-12, which requires the applicant to address the soil characteristics affecting the stability of the NI, including foundation rebound, settlement, and differential settlement. VEGP COL FSAR Section 2.5.7.12 refers to VEGP ESP SSAR Section 2.5.4 for the information that addresses VEGP COL 2.5-12. The staff already reviewed this topic and concluded that it had been resolved, as documented in the SER for the VEGP ESP and LWA applications. No further evaluation is needed for VEGP COL 2.5-12.

- VEGP COL 2.5-13

The NRC staff reviewed VEGP COL 2.5-13 related to COL Information Item 2.5-13, which requires the applicant to describe the instrumentation to be used to monitor the performance of the foundations of the NI, along with the location for benchmarks and markers for monitoring the settlement. VEGP COL FSAR Section 2.5.7.13 refers to Section 2.5, Appendix 2.5E of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-13. The staff concluded

that this topic has been adequately addressed, as documented in the SER for the VEGP ESP and LWA applications.

However, the staff noted that in AP1000 DCD, Revision 17, the differential settlement between the NI and other structures is set as less than 1.27 centimeters (cm) (1/2 in.), not 7.62 cm (3 in.) as previously specified when the VEGP ESP SSAR was approved. Accordingly, in RAI 2.5.4-5, the staff asked the applicant to provide detailed information on whether the site-specific settlement analysis results meet the revised standard design requirement. In a letter dated March 2, 2010, the applicant indicated that the revision of the AP1000 DCD would correct the differential settlement between NI and other structures from 1.27 cm (1/2 in.) to 7.62 cm (3 in.) and the applicant would incorporate this DCD change into the VEGP COL FSAR. The staff considers this action acceptable pending formal revision to the VEGP COL FSAR. Accordingly this is **Confirmatory Item 2.5-1**.

Resolution of VEGP Site-specific Confirmatory Item 2.5-1

Confirmatory Item 2.5-1 is an applicant commitment to incorporate an AP1000 DCD change regarding the differential settlement between NI and other structures. The staff verified that the AP1000 DCD change was appropriately incorporated into the VEGP COL FSAR. As a result, Confirmatory Item 2.5-1 is now closed.

- VEGP COL 2.5-16

The NRC staff reviewed VEGP COL 2.5-16 related to COL Information Item 2.5-16, which requires the applicant to provide data on short-term (elastic) and long-term (heave and consolidation) settlement for soil sites for the history of loads imposed on the foundation consistent with the construction sequence. VEGP COL FSAR Section 2.5.7.16 refers to Section 2.5.4 of the VEGP ESP SSAR for the information that addresses VEGP COL 2.5-16. The staff concluded that VEGP ESP SSAR Section 2.5.4 related to short-term and long-term settlement had been resolved, as documented in the SER for the VEGP ESP and LWA applications, and that no further evaluation was needed for VEGP COL 2.5-16.

Supplemental Information

- VEGP SUP 2.5-1

The staff reviewed FSAR Section 2.5.4.13, which was added to the VEGP COL FSAR. To evaluate the impacts of the HLD system on safety-related structures, the staff first examined the weights of the load and loading areas, and the distances from the loads to the structures, since those factors determine the impacts of external loading on the stability of adjacent safety-related structures. By using the methods based on the Boussinesq solution for the distribution of stresses in subsurface materials resulting from surface loads (Vesic 1975), the extra stress induced from the external-load on the subsurface materials would increase by less than five-percent of the surface loading pressure. This conclusion assumes that the distance between the load and the safety-related structures is more than four times the diameter of the load's area, and that the external load is at the same or higher elevation than the safety-related structures. When this condition is met, the effect of the external load on the stability of the safety-related structures is insignificant. The staff notes that the bottom of the HLD counterweight will be located at elevation 57 m (187 ft); the diameter of loading area is 5.9 m (19.3 ft) and at least 85 m (278 ft) away from the edge of Units 3 and 4 NI; and the ring foundation will be at elevation 64 m (210 ft) with a width of 9.1 m (30 ft) and at least 45 m

(148 ft) away from the edge of the NI. The NI will be founded at about elevation of 54.9 m (180 ft). This results in a distance between the HLD system and NI more than five times the diameter of the loading area. Based on this information, the staff concludes that although the HLD counterweight weighs approximately 45 Meganewton (MN) (10,100 kilopounds (kips)) and the ring foundation could bear as much as twice that weight, the induced stress on the subsurface material underneath the NI will be very small. In addition, the load will be at an elevation higher than the NI and, therefore, the HLD loads will not reduce the safety margin of the bearing capacity of the NI foundations, and thus will not affect the stability of safety-related structures at the site.

ESP Permit Conditions

- ESP PC 1

To address ESP PC 1 related to eliminating soil liquefaction potential, the applicant proposed, in Part 10 of the COL application, certain ITAAC (safety-related backfill). Specifically, the applicant stated that the ITAAC identified in ESP SSAR Section 2.5.4.5.5 are incorporated by reference. The staff previously reviewed VEGP ESP SSAR Section 2.5.4 and accepted the backfill ITAAC, as documented in the SER for the VEGP ESP and LWA applications. To complete these ITAAC, the applicant will replace soil that has liquefaction potential with non-liquefiable backfill.

As part of its COL-stage review, the NRC staff reviewed the safety-related backfill ITAAC identified in ESP SSAR Section 2.5.4.5.5 and their relationship to the terms of ESP PC 1. The staff concludes that the placement of safety-related backfill that would be verified through these ITAAC would satisfy the PC. However, because at this time the applicant has not yet completed the previously-approved placement of the safety-related backfill and thus has not closed the backfill ITAAC, the applicant has not satisfied the PC. Consequently, this ESP PC will be included as COL License Condition.

2.5.4.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the ESP PC as a license condition and the backfill ITAAC:

- License Condition (2-1) - The licensee shall either remove and replace, or shall improve, the soils directly above the bluff marl for soils under or adjacent to Seismic Category I structures, to eliminate any liquefaction potential.

- The license shall perform and satisy the backfill ITAAC defined in Table 2.5-1.

However, for the reasons described above, the staff concludes that if the safety-related backfill is placed in accordance with the previously-approved LWA, the closure of the associated backfill ITAAC will also constitute compliance with the license condition.

2.5.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD and the VEGP ESP SSAR. The NRC staff's review confirmed that the applicant had addressed the required information relating to stability of subsurface materials and foundations, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this

section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

The staff further concludes that the applicant has performed sufficient investigations at the site to justify the soil and rock characteristics used in the design, and that the design analyses contain adequate margins of safety for construction and operation of the nuclear power plant and meet the requirements of 10 CFR Part 50, Appendix A (GDC 1; GDC 2; and GDC 44, "Cooling Water"); Appendices B and S of 10 CFR Parts 50; and 100.23.

Based on the review and evaluation, the staff also concludes that VEGP DEP 2.5-1, VEGP COL 2.5-5 through VEGP COL 2.5-12, VEGP COL 2.5-13, VEGP COL 2.5-16, and VEGP SUP 2.5-1 have been resolved.

2.5.5 Stability of Slopes

The stability of slopes addresses the stability of all earth and rock slopes both natural and manmade (cuts, fill, embankments, dams, etc.) whose failure, under any of the conditions to which they could be exposed during the life of the plant, could adversely affect the safety of the plant. The following subjects are evaluated using the applicant's data in the VEGP COL FSAR and information available from other sources: (1) slope characteristics; (2) design criteria and design analyses; (3) results of the investigations including borings, shafts, pits, trenches, and laboratory tests; and (4) properties of borrow material, compaction and excavation specifications.

Section 2.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Sections 2.5.5 and 2.5.6 of the AP1000 DCD, Revision 19, and adds VEGP COL 2.5-14 to address COL Information Item 2.5-14 (COL Action Item 2.5.5-1). In VEGP COL 2.5-14, the applicant incorporates by reference Section 2.5.5 of the VEGP ESP SSAR, Revision 5, with no variances or supplements. The applicant also adds VEGP COL 2.5-15 to address COL Information Item 2.5-15 (COL Action Item 2.5.6-1). In VEGP COL 2.5-15, the applicant incorporates by reference Section 2.5.6 of the VEGP ESP SSAR, Revision 5, with no variances or supplements. The staff has already reviewed Sections 2.5.5 and 2.5.6 of the VEGP ESP SSAR and found the information relating to the stability of slopes to be acceptable. Therefore, the NRC staff considers VEGP COL 2.5-14 and VEGP COL 2.5-15 resolved.

The NRC staff reviewed Section 2.5 of the VEGP COL FSAR and checked the referenced DCD and the VEGP ESP SSAR to ensure that the combination of the DCD, the VEGP ESP SSAR and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the stability of slopes. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

Table 2.4-1. Maximum Water Surface Elevations (ft) from the Applicant's Model Setup and Sensitivity Analyses

Model Reach	Applicant's Model	Manning's Roughness of Overbanks and Channels			Contraction/ Expansion Coefficient of Culvert Cross Sections	Inline Weir Coefficient of Blocked Culverts
		0.025	0.030	0.050	0.6, 0.8	2.0
Feeder Ditch 1	219.45 219.47 [r]	219.47 [a] 219.49 [b] 220.11 [c]	219.49 [a] 219.52 [b]	219.57 [a] 219.62 [b]	219.46	219.45
Feeder Ditch 2	219.40 219.42 [r]	219.40 [a] 219.41 [b] 220.09 [c]	219.40 [a] 219.42 [b]	219.40 [a] 219.45 [b]	219.40	219.40
Feeder Ditch 3	219.42 219.43 [r]	219.45 [a] 219.45 [b] 220.10 [c]	219.49 [a] 219.48 [b]	219.65 [a] 219.64 [b]	219.42	219.42
Main Stem + M1 through M4	219.37 219.39 [r]	219.37 [a] 219.39 [b] 220.07 [c]	219.37 [a] 219.40 [b]	219.37 [a] 219.43 [b]	219.37	219.37

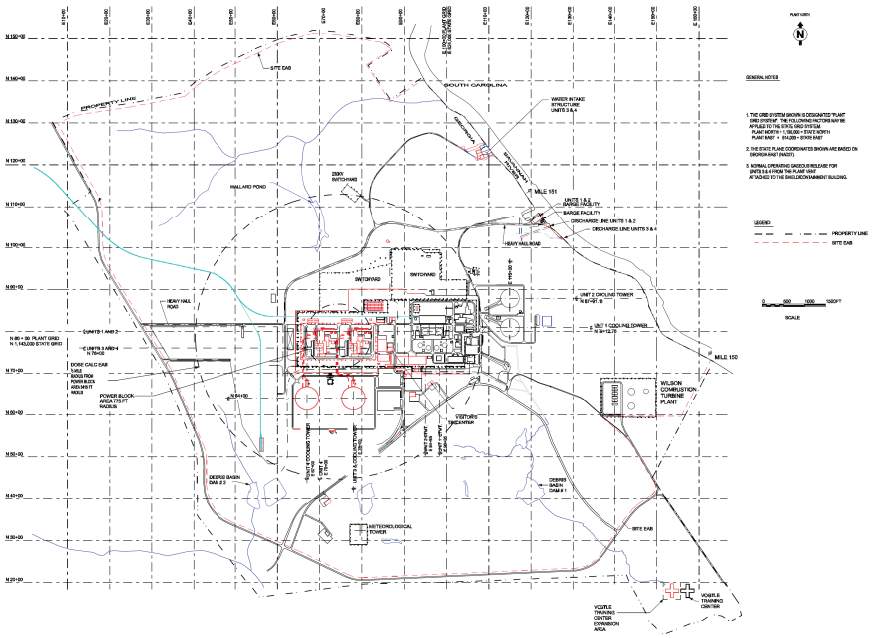
a–minimum value in overbank areas of feeder ditches and reach 1 of the main ditch only
b–minimum value in overbank areas of all ditches
c–applied to all overbank areas and channel cross sections
r–results from applicant's model revision 1

Table 2.4-2. Summary of Contributing Sub-basins the Feeder and Main Stem Ditches (based on HEC-HMS Hydrologic Model Configuration shown in Figure 2.4.2.4-103. For each ditch the sub-basin and upstream ditch are provided so that the number of contributing sub-basins increases at downstream ditches)

Ditch	Contributing Sub-basins
Feeder Ditch (FD) 1	FD1W, UN12-N,
Feeder Ditch (FD) 2	FD2W, FD2E
Feeder Ditch (FD) 3	FD3E, FD3W, OF1, OF2
Main Stem (M) 1	FD1, UN12S, M1W, M1S
Main Stem (M) 2	M1, FD2, M2E, M2W, M2S
Main Stem (M) 3	M2, FD3, M3W, M3E, M3S, LD2
Main Stem (M) 4	M3, M4W
Main Stem (M) 5	M4, M5W, LD3
Main Stem (M) 6	M5,M6W, LD4, FD5aN
Main Stem (M) 7	M6, M7W, M7E, LD5, FD6bE,FD6aE
Main Stem (M) 8	M7, M8W, M8Cat

Table 2.5-1 Backfill ITAAC

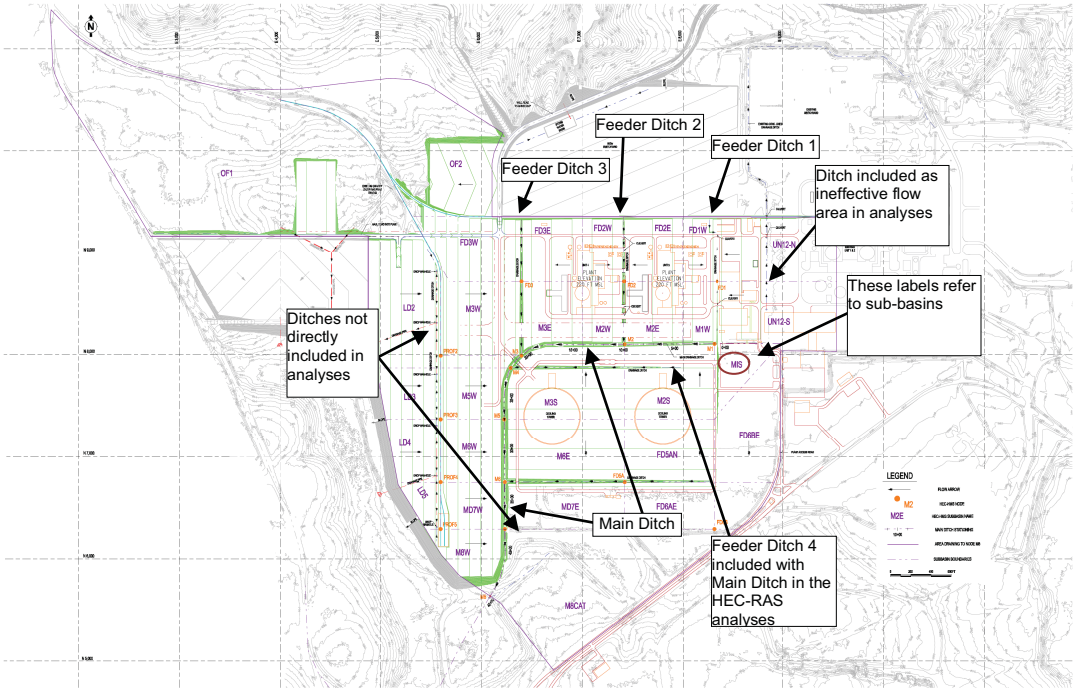
Design Requirement	Inspections, Tests, Analyses	Acceptance Criteria
Backfill material under Seismic Category 1 structures is installed to meet a minimum of 95 percent modified Proctor compaction.	Required testing will be performed during placement of the backfill materials.	A report exists that documents that the backfill material under Seismic Category 1structures meets the minimum 95 percent modified Proctor compaction
Backfill shear wave velocity is greater than or equal to 1,000 fps at the depth of the NI foundation and below.	Field shear wave velocity measurements will be performed when backfill placement is at the elevation of the bottom of the Nuclear Island foundation and at finish grade.	A report exists and documents that the asbuilt backfill shear wave velocity at the NI foundation depth and below is greater than or equal to 1,000 fps.



VEGP COL 2.1-1

Figure 1.1-202
Site Layout

Figure 2.4-1. VEGP Site Map VEGP
(VEGP FSAR Figure 1.1-202)



VEGP COL 2.4-2

Figure 2.4-201
Site Plan with PMP Drainage Boundaries and Flow Paths

Figure 2.4-2. Basins Drainage Plan
(Based on VEGP FSAR Figure 2.4-201. The figure identifies several ditches included in the HEC-RAS hydraulic analysis.)

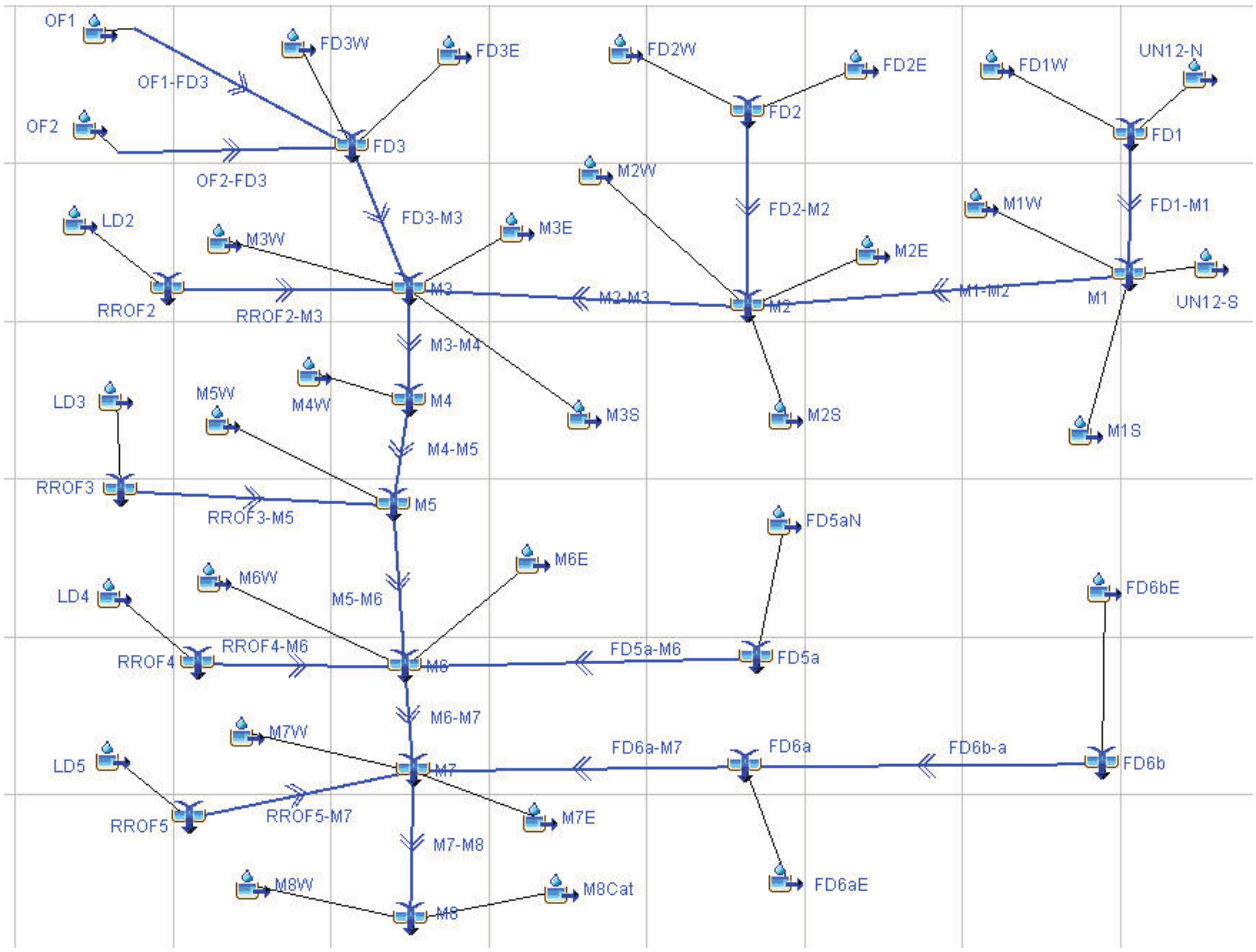


Figure 2.4-3. HEC-HMS Drainage Basin Configuration
(As received from the applicant)

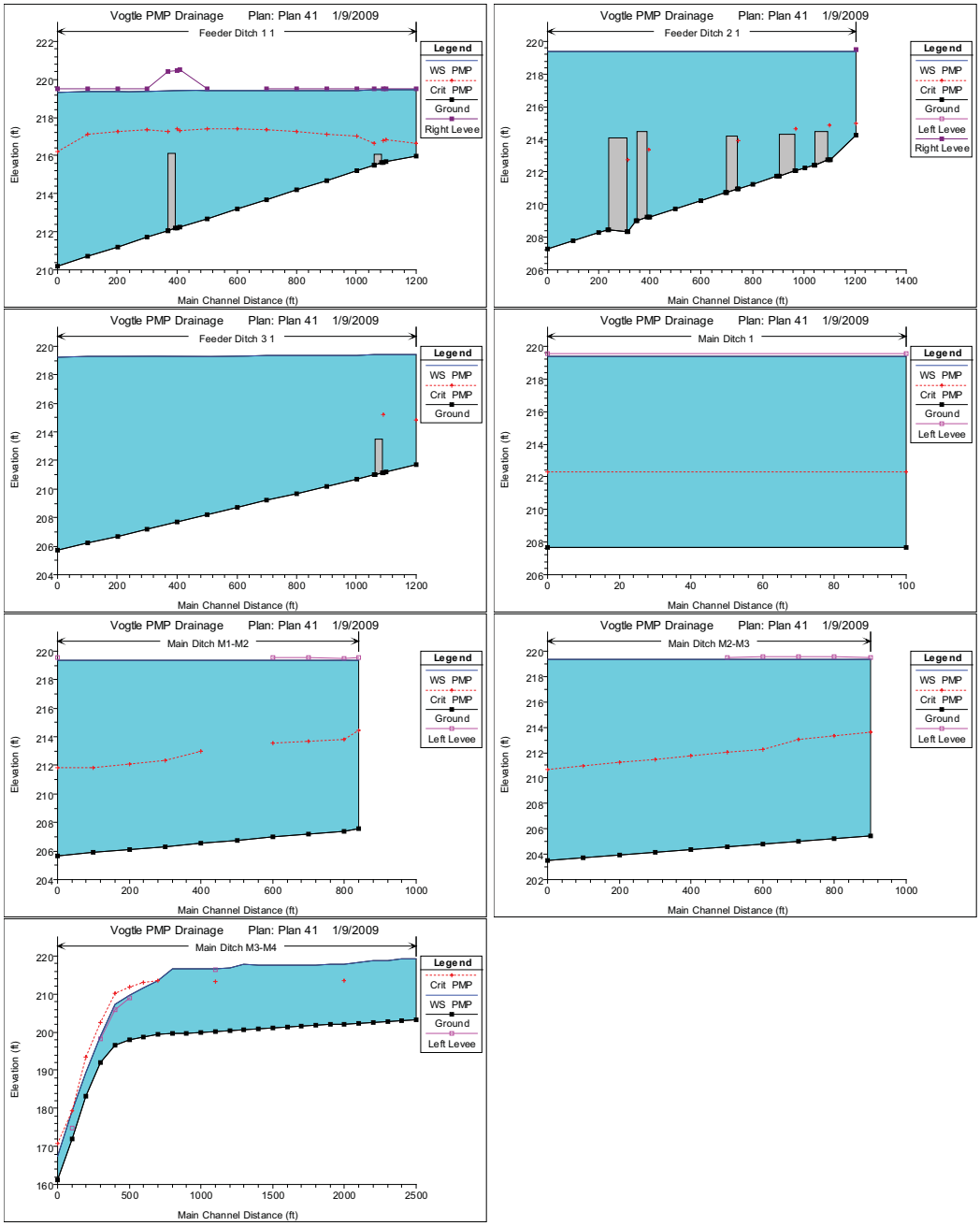


Figure 2.4-4. HEC-RAS Water Surface Elevation Profiles for the Applicant's Model Setup

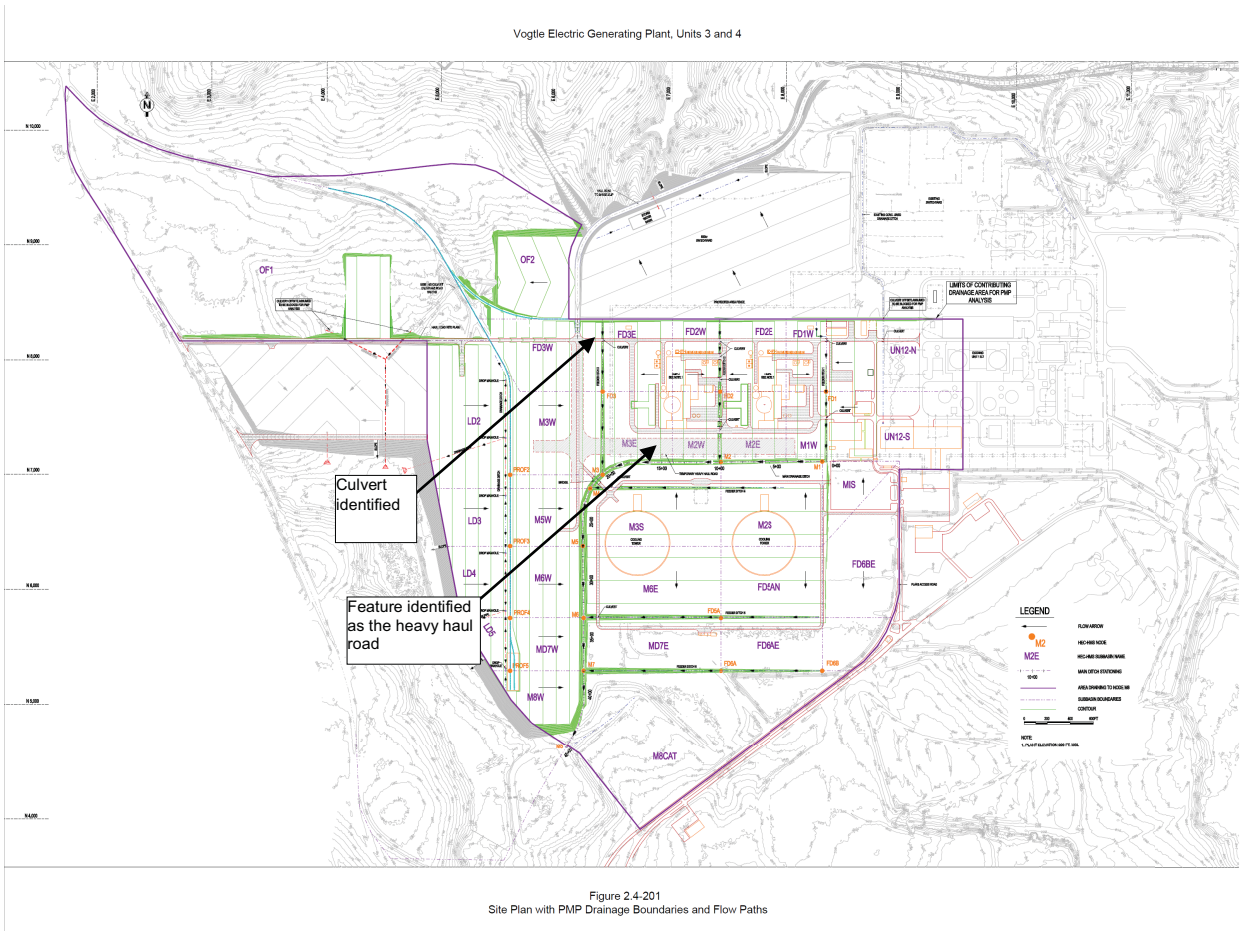


Figure 2.4-201
Site Plan with PMP Drainage Boundaries and Flow Paths

Figure 2.4-5. Basins Drainage Plan with all Culverts and Heavy Haul Road Identified
(Based on VEGP FSAR Figure 2.4-201 and provided by the applicant in response to RAI 01.04.02-1, Items 2 and 4)

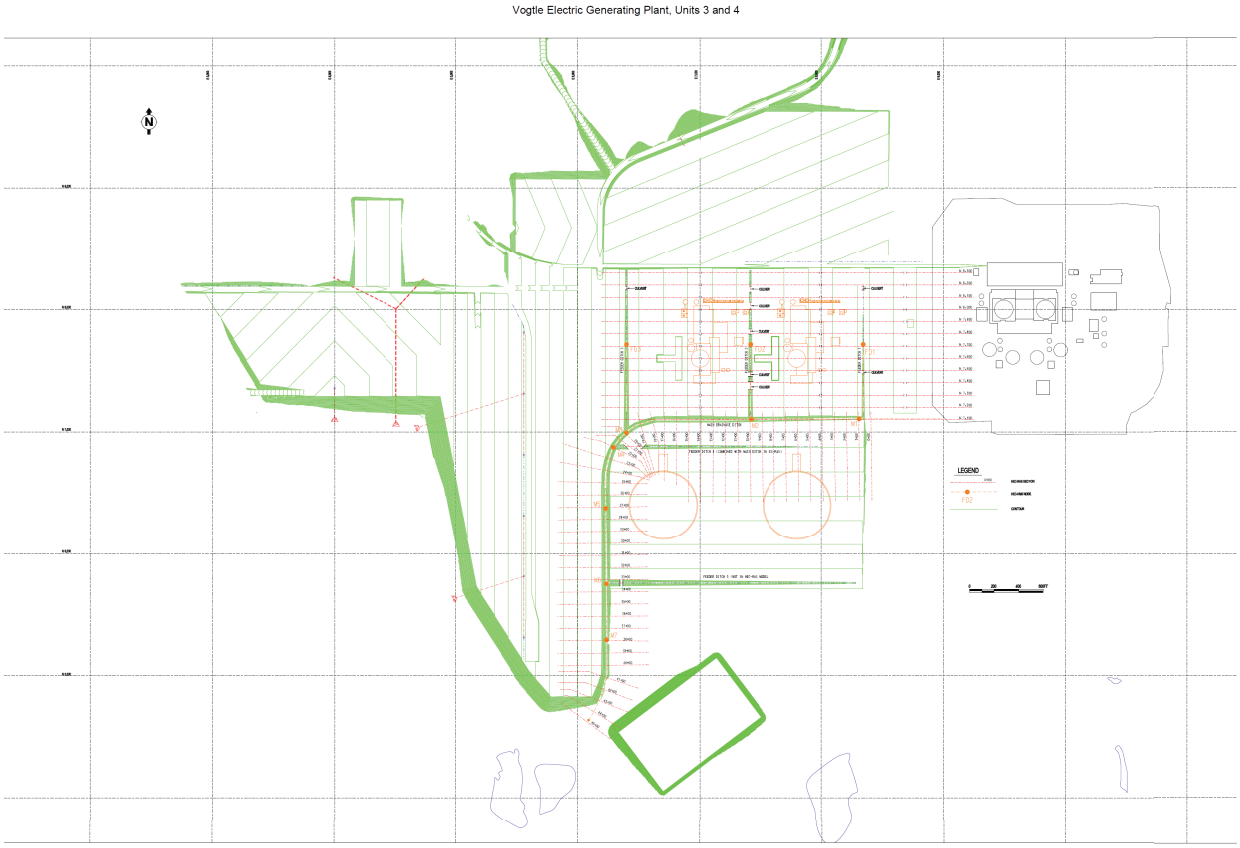


Figure 2.4-201a
Cross-Section Location Map for HEC-RAS Model of Local PMF for Units 3 and 4

Figure 2.4-6. Basins Drainage Plan with Cross Section Locations Used in the HEC-RAS Analyses

(Based on VEGP FSAR Figure 2.4-201 and provided by the applicant in response to RAI 01.04.02-1, Item 3)

Figure 2.4-201a
Cross-Section Location Map for HEC-RAS Model of Local PMF for Units 3 and 4

Figure 2.4-7. Basins Drainage Plan with Cross Section Locations Used in the HEC-RAS Analyses

(Based on FSAR Figure 2.4-201 and provided by the applicant in the supplemental response to RAI 01.04.02-1)

3.0 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT AND SYSTEMS

3.1 Conformance with NRC General Design Criteria

Section 3.1 of the Vogtle Electric Generating Plant (VEGP) combined license (COL) Final Safety Analysis Report (FSAR), Revision 5, incorporates by reference, with no departures or supplements, Section 3.1, "Conformance with NRC General Design Criteria," of Revision 19 of the AP1000 Design Control Document (DCD). The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[18] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements.

3.2 Classification of Structures, Components, and Systems

3.2.1 Seismic Classification

3.2.1.1 *Introduction*

Nuclear power plant structures, systems, and components (SSCs) important to safety are to be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. Important to safety SSCs are defined in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic licensing of production and utilization facilities, "Appendix A, "General Design Criteria for Nuclear Power Plants," as those SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Important to safety SSCs include safety-related SSCs that perform safety-related functions to ensure: (1) the integrity of the reactor coolant pressure boundary (RCPB); (2) the capability to shut down the reactor and maintain it in a safe-shutdown condition; and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures. The earthquake for which these safety-related plant features are designed is defined as the safe shutdown earthquake (SSE). The SSE is based on an evaluation of the maximum earthquake potential for the site and is an earthquake that produces the maximum vibratory ground motion for which SSCs are designed to remain functional. The regulatory treatment of nonsafety systems (RTNSS) process is applied to define seismic requirements for SSCs that are nonsafety-related but perform risk-significant functions.

The methodology in the referenced AP1000 DCD classifies SSCs into three categories: seismic Category I, seismic Category II and nonseismic (NS). Those plant features that are designed to remain functional, if an SSE occurs, are designated seismic Category I. Seismic Category I applies to both functionality and integrity, and seismic Category II applies only to integrity. NS items located in the proximity of safety-related items, the failure of which during an SSE could result in the loss of function of safety-related items, are designated as seismic Category II. This methodology is similar to Regulatory Guide (RG) 1.29, "Seismic Design Classification," Revision 4, except that RG 1.29 does not use the terms seismic Category II and NS.

[18] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification (DC).

3.2.1.2 *Summary of Application*

Section 3.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.2 of the AP1000 DCD, Revision 19. Section 3.2 of the DCD includes Section 3.2.1.

In addition, in VEGP COL FSAR Section 3.2, the applicant provided the following:

Supplemental Information

- VEGP Supplement (SUP) 3.2-1

The applicant provided supplemental information by adding text to the end of DCD Section 3.2.1, "Seismic Classification," stating that there are no safety-related SSCs at VEGP Units 3 and 4 outside the scope of the DCD, except for engineered fill, which is classified as a seismic Category I, safety-related structure. The applicant also states that the nonsafety-related SSCs outside the scope of the DCD are classified as NS.

3.2.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic classification are given in Section 3.2.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

The regulatory basis for acceptance of the supplemental information of defining the scope of safety-related SSCs is established in General Design Criteria (GDC) 2, "Design Bases for Protection Against Natural Phenomena," which requires that all SSCs important to safety be designed to withstand the effects of natural phenomena, including earthquakes and guidance on how to meet this requirement is in RG 1.29.

3.2.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to seismic classification. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this safety evaluation report (SER) provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the Bellefonte Nuclear Plant (BLN) Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL

FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application, with one exception discussed below. This standard content material is identified in this SER by use of italicized, double-indented formatting. The resolution of one of the RAIs not endorsed by the VEGP applicant is discussed by the staff following the standard content material.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 3.2-1

The NRC staff reviewed VEGP SUP 3.2-1, related to the seismic classification of safety-related SSCs included under Section 3.2.1 of the VEGP COL FSAR, which states that there are no safety-related SSCs outside the scope of the DCD at VEGP Units 3 and 4, except for engineered fill, which is classified as a seismic Category I, safety-related structure. The seismic Category I classification of engineered backfill that supports seismic Category I structures is consistent with RG 1.29 that designates such safety-related SSCs including their foundations as seismic Category I. Therefore, the seismic classification is acceptable.

The following portion of this technical evaluation section is reproduced from Section 3.2.1.4 of the BLN SER:

> *Important to Safety SSCs*
>
> *GDC 2 states, in part, that SSCs important to safety shall be designed to withstand the effects of earthquakes. BLN COL FSAR Section 3.2.1 states there are no safety-related SSCs outside the scope of the DCD. In request for additional information (RAI) 3.2.1-1, the applicant was requested to clarify if there is any site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety and, if so, identify the appropriate seismic classification of such SSCs. The applicant's response identified that there are no site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety and that non-safety-related SSCs outside the scope of the DCD are classified as non-seismic. In Revision 1 of the BLN COL FSAR, the applicant added the statement that the non-safety-related SSCs outside the scope of the DCD are classified as non-seismic. The revised BLN COL FSAR is acceptable, and the staff's concern is closed. The staff based its conclusion on the applicant's response that there are no site-specific non-safety-related SSCs outside the DCD that are important to safety.*

Seismic Classification of Other Site-Specific SSCs

Section 1.8 of the AP1000 DCD, Revision 16 identified certain site-specific SSCs that are outside the scope of the AP1000 standard plant, such as the circulating water system (CWS) and its heat sink, for which the COL applicant must provide site-specific information. The seismic classification of the CWS is not identified in DCD Table 3.2-3. Section 1.8 of BLN COL FSAR identifies certain COL items that represent interfaces for the standard design, but the seismic classification is not identified for the CWS.

In RAI 3.2.1-2, the applicant was requested to clarify if there are any site-specific SSCs outside the scope of the DCD that are not included in DCD Tables 3.2-2 and 3.2-3 that are to be seismically classified in the COL. For example, site-specific structures, the CWS and miscellaneous items such as reactor vessel insulation are not included in the tables. If so, the applicant was requested to identify the appropriate seismic classification of such SSCs. This concern was also identified in an RAI for the review of AP1000 Revision 16 and the DC applicant clarified that the seismic categorization of CWS and reactor vessel insulation are not plant-specific and are to be classified in the DCD. Therefore, this concern is closed and seismic classification of these components is to be addressed in the DCD rather than the BLN COL FSAR.

Quality Assurance for Seismic Category II SSCs

It is not clear in the BLN COL FSAR how Title 10 of the Code of Federal Regulations (CFR) 50, Appendix B is applied to seismic Category II SSCs, including those that may be site-specific. DCD Appendix 1A identifies that AP1000 conforms to RG 1.29, Regulatory Position C.4 and Section 1.8 identifies COL Information Item 17.5-1 for quality assurance (QA) in the design phase. DCD Section 17.5.2 identifies that the COL applicant will address its QA program and that the QA program will include provisions for seismic Category II SSCs. In RAI 3.2.1-4, the applicant was requested to clarify the extent that pertinent QA requirements of Appendix B to 10 CFR Part 50 in Regulatory Position C.4 of RG 1.29 apply to those activities affecting the safety-related functions of those portions of SSCs covered under Regulatory Positions 2 and 3 of RG 1.29, including any site-specific SSCs. If this issue will be resolved in the DCD rather than the COL for all plant SSCs, including those that are site-specific, the applicant was requested to advise the NRC staff that this was the case. The RAI response identified that there are no site-specific seismic Category II SSCs and that the application of 10 CFR Part 50, Appendix B is addressed by the DCD. Since there are no site-specific seismic Category II SSCs, this COL concern is closed for the BLN COL FSAR.

Consistency with RG 1.29, Revision 4

Section 3.2.1 of the BLN COL FSAR does not identify any departures relative to seismic classification identified in the DCD and BLN COL FSAR, Appendix 1AA identifies conformance with RG 1.29, Revision 3 as stated in the DCD rather than Revision 4 of RG 1.29, dated March 2007. In RAI 3.2.1-3, the applicant was requested to clarify if seismic classifications of site-specific SSCs are consistent with RG 1.29, Revision 4. The RAI response identified that seismic classification

of site-specific SSCs not addressed in the DCD is consistent with RG 1.29, Revision 4. This position is acceptable to the staff, since it represents the current RG revision. The applicant revised Appendix 1AA in Revision 1 of the BLN COL FSAR to indicate conformance to RG 1.29, Revision 4.

Correction to Standard Content Evaluation

The third paragraph of the BLN SER does not apply. The VEGP applicant identified in a letter dated October 1, 2008, that it did not endorse the standard response to RAI 3.2.1-2. Classification of safety-related fill (VEGP SUP 3.2-1) is evaluated above. Also, for conformance with RG 1.29, the applicant stated that compliance is covered in the VEGP Early Site Permit (ESP) Site Safety Analysis Report (SSAR), Revision 5. The staff has reviewed and accepted this compliance with RG 1.29 in NUREG-1923, "Safety Evaluation Report for an Early Site Permit (ESP) at Vogtle Electric Generating Plant (VEGP) ESP Site."

3.2.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.2.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to seismic classification, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, and GDC 2. The staff based its conclusion on the following:

- VEGP SUP 3.2-1 is acceptable because the VEGP COL FSAR states that there are no safety-related SSCs outside the scope of the AP1000 DCD, except for the engineered fill. The VEGP COL FSAR also states that the nonsafety-related SSCs outside the scope of the DCD are classified as NS. The engineered fill is classified as a seismic Category I, safety-related structure. Therefore, the requirements of 10 CFR Part 50, Appendix A, GDC 2, the acceptance criteria in NUREG-0800, Section 3.2.1, and the guidelines in RG 1.29 are satisfied.

3.2.2 AP1000 Classification Systems (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.2.2, "System Quality Group Classification")

3.2.2.1 *Introduction*

The system and component quality group classification addresses, in part, the general design criterion that nuclear power plant SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. Important to safety SSCs are defined in 10 CFR Part 50, Appendix A as those SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Important to safety SSCs include safety-related SSCs that

perform one of the following safety-related functions to ensure: (1) the integrity of the RCPB; (2) the capability to shut down the reactor and maintain it in a safe-shutdown condition; and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures. The RTNSS process is applied to define supplemental quality requirements for SSCs that are nonsafety-related but perform risk significant function.

The system and component quality group classification in combination with the RTNSS process define appropriate classifications, codes and standards and special treatment important to safety pressure-retaining components and their supports, depending on their safety function. RG 1.26, "Quality Group Classification and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Revision 4, provides the regulatory guidance for classifying SSCs important to safety systems and the appropriate quality standards.

3.2.2.2 *Summary of Application*

Section 3.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.2 of the AP1000 DCD, Revision 19. Section 3.2 of the DCD includes Section 3.2.2.

In addition, in VEGP COL FSAR Section 3.2, the applicant provided the following:

Supplemental Information

- VEGP SUP 3.2-1

The applicant provided supplemental information by adding text to the end of DCD Section 3.2.2, "AP1000 Classification System," stating that there are no safety-related SSCs at VEGP Units 3 and 4 outside the scope of the DCD, except for engineered fill, which is classified as a seismic Category I, safety-related structure.

3.2.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the system quality group classification are given in Section 3.2.2 of NUREG-0800.

The basis for acceptance of the supplemental information of defining the scope of safety-related SSCs is established in RG 1.26 and applicable American Society of Mechanical Engineers (ASME) Codes and industry standards, which provide assurance that component quality will be commensurate with the importance of the safety functions of these systems. Thus, this constitutes the basis for satisfying GDC 1, "Quality Standards and Records," for pressure-retaining components and their supports.

3.2.2.4 *Technical Evaluation*

The NRC staff reviewed Section 3.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the

information in the application and incorporated by reference addresses the required information relating to the system quality group classification. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 3.2-1

The NRC staff reviewed VEGP SUP 3.2-1 related to the seismic classification of safety-related SSCs included under Section 3.2.2 of the VEGP COL FSAR, which states that there are no safety-related SSCs outside the scope of the DCD at VEGP Units 3 and 4, except for engineered fill, which is classified as a seismic Category I, safety-related structure.

The NRC staff reviewed VEGP SUP 3.2-1 related to quality group classification of systems included under Section 3.2.2 of the VEGP COL FSAR. VEGP SUP 3.2-1 is identical to STD SUP 3.2-1 in the BLN COL FSAR with respect to quality group classification of systems included under Section 3.2.2 of the FSAR. Additional information was needed to evaluate STD SUP 3.2-1 and RAIs were submitted to the BLN applicant. The VEGP applicant endorsed the BLN RAI response in a letter dated October 1, 2008. As such, review of VEGP SUP 3.2-1 is addressed through the comparison with the BLN SER. As discussed below, there are no site-specific nonsafety-related SSCs outside the scope of the AP1000 DCD that are important to safety, so there are no changes to the quality group classifications listed in VEGP COL FSAR Section 3.2.

The following portion of this technical evaluation section is reproduced from Section 3.2.2.4 of the BLN SER:

Special Treatment for Risk-Significant SSCs

GDC 1 identifies, in part, that SSCs important to safety shall be designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. Supplemental quality standards and QA programs applicable to passive SSCs used in non-safety-related regulatory treatment of non-safety systems that may be important to safety are not clearly defined in the BLN COL FSAR for site-specific SSCs.

In RAI 3.2.2-2, the applicant was requested to clarify what supplemental quality standards are applied to non-safety-related site-specific SSCs that are important to safety to ensure that all SSCs important to safety are designed, fabricated, erected, and tested to quality standards commensurate with the safety function to be performed. Any site-specific SSCs that are considered important to safety may also require special treatment, but the response to RAI 3.2.1-1 identified that there are no site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety. Therefore, this concern is closed.

Codes and Standards

The Staff Requirements Memorandum (SRM), dated July 21, 1993, concerning SECY-93-087 identified that the staff will review passive plant design applications using the newest codes and standards endorsed by the NRC and unapproved revisions to the codes will be reviewed on a case by case basis. Editions of various codes and standards referenced in DCD Section 3.2.6 are not current and newer codes and standards are not referenced in BLN COL FSAR Sections 3.2 or 1.8. In RAI 3.2.2-3, the applicant was requested to clarify if any different or current codes and standards are applied to the design and procurement of site-specific SSCs, other than those identified in the DCD. The RAI response identified that the applicant intends to implement the DCD identified codes and standards and that the codes and standards applied to the design and procurement of non-safety-related site-specific SSCs are those identified in various sections of the BLN COL FSAR. Although codes and standards for site-specific SSCs would be expected to be identified and reviewed in the COL application rather than the DCD, the response to RAI 3.2.1-1 identified that there are no site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety. Therefore, this concern is closed.

Consistency with RG 1.26, Revision 4

Section 3.2.2 of the BLN COL FSAR does not identify any departures relative to quality group classification identified in the DCD and BLN COL FSAR, Appendix 1AA identifies conformance with RG 1.26, Revision 3 in the DCD rather than Revision 4, dated March 2007. In RAI 3.2.2-1, the applicant was requested to clarify if quality group classifications of site-specific SSCs are consistent with RG 1.26, Revision 4. The applicant's response clarified that the quality group classification of site-specific SSCs is consistent with RG 1.26, Revision 4. This

position is acceptable to the staff, since it represents the current RG revision. This staff concern is closed and the BLN COL FSAR Appendix 1AA has been revised accordingly to reflect this RAI response.

3.2.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.2.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the system quality group classification, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, GDC 1. The staff based its conclusion on the following:

- VEGP SUP 3.2-1 is acceptable with regard to quality group classifications because no change was made to the quality group classifications in Section 3.2 and there are no site-specific nonsafety-related SSCs outside the scope of the AP1000 DCD that are important to safety. Therefore, the requirements of 10 CFR Part 50, Appendix A, GDC 1, the acceptance criteria in NUREG-0800, Section 3.2.1, and the guidelines in RG 1.29 are satisfied.

3.3 Wind and Tornado Loadings

Seismic Category I and II buildings and structures are designed to withstand extreme wind and tornado loading conditions in compliance with the requirements dictated in GDC 2 in Appendix A to 10 CFR Part 50, which states that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures shall reflect the appropriate consideration of the most severe of the natural phenomena that have been historically reported in the area of the plant, with sufficient margin to account for limited accuracy, quantity, and period of time for collection of data.

In Section 3.3 of this SER, the staff reviewed the seismic Category I and II structures subjected to wind and tornado loadings; other natural phenomena effects, such as earthquakes, floods, tsunami, and seiches, are evaluated in Sections 3.4, 3.7 and 3.8 of this SER.

3.3.1 Wind Loadings

3.3.1.1 *Introduction*

Seismic Category I structures must withstand the effects of the specified design wind speed for the plant to ensure conformance with 10 CFR Part 50, Appendix A, GDC 2. The specific areas of review are the design wind speed, its recurrence interval, speed variation with height, and

applicable gust factors from the standpoint of use in defining the input parameters for the appropriate structural design criteria for wind loading.

3.3.1.2 *Summary of Application*

Section 3.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.3 of the AP1000 DCD, Revision 19. Section 3.3 of the DCD includes Section 3.3.1.

In addition, in VEGP COL FSAR Section 3.3.1, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 3.3-1

The applicant provided additional information in VEGP COL 3.3-1 to address COL Information Item 3.3-1 (COL Action Item 3.3.2.2-1) by stating that the wind velocity characteristics for the VEGP site are given in Section 2.3.1.3.1 of the VEGP ESP SSAR, Revision 5. The applicant states that these values are bounded by the design wind velocities specified in AP1000 DCD Section 3.3.1.1 for the standard AP1000 plant design. In addition, the applicant states that the effects of wind on the safety-related SSCs due to failures in an adjacent AP1000 plant and VEGP Units 1 and 2 are bounded by the evaluation of the buildings and structures in a single unit. The portion of VEGP COL 3.3-1 relating to design tornado site characteristics and the effects of wind on the safety-related SSCs due to failures in an adjacent AP1000 plant and VEGP Units 1 and 2, is reviewed in SER Section 3.3.2.

- VEGP COL 3.5-1

The portion of VEGP COL 3.5-1 included in VEGP COL FSAR Section 3.3.1 is identical to the information added by VEGP COL 3.3-1, and is addressed by the staff in its evaluation of VEGP COL 3.3-1 in this SER section. The additional information in VEGP COL 3.5-1 included in VEGP COL FSAR Section 3.5 is addressed in Section 3.5 of this SER.

3.3.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for wind loadings are given in Section 3.3.1 of NUREG-0800.

The regulatory basis for VEGP COL 3.3-1 is 10 CFR Part 50, Appendix A, GDC 2, and the regulatory guidance is in RG 1.76, “Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants,” Revision 1, which states that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions.

3.3.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.3 of VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff’s review confirmed that the

information in the application and incorporated by reference addresses the required information relating to wind loadings. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 3.3-1

The NRC staff reviewed VEGP COL 3.3-1 related to design wind loads applied on safety-related SSCs included under Section 3.3.1.1 of the VEGP COL FSAR.

The commitment was also captured as COL Action Item 3.3.2.2-1 in NUREG-1793, Appendix F, "Combined License Action Items," which states:

> COL applicants referencing the AP1000 certified design will address site interface criteria for wind and tornadoes.

The applicant proposed a clarification to VEGP COL FSAR in Section 3.3.1.1 in a letter dated September 20, 2010. The staff agrees with the change that will state, "The wind velocity characteristics for the Vogtle Electric Generating Plant, Units 3 and 4 (VEGP), are given in ESPA SSAR Subsection 2.3.1.3.1. These values are bounded by the design wind velocity values given in DCD Subsection 3.3.1.1 for the AP1000 plant." The incorporation of the planned changes to the VEGP COL FSAR will be tracked as **Confirmatory Item 3.3-1.**

Resolution of VEGP Site-specific Confirmatory Item 3.3-1

Confirmatory Item 3.3-1 is an applicant commitment to revise its FSAR to specify the windy velocity characteristics. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.3-1 is now closed.

In Section 2.3.1.3.3.1 of NUREG-1923, the staff concluded that a site characteristic 3-second gust basic wind speed value of 104 miles per hour (mph) is an acceptable design wind speed for this site. Since this value is bounded by the AP1000 design wind speed of 145 mph, the staff concludes that the design wind velocities for the VEGP site are in compliance with GDC 2; therefore, VEGP COL 3.3-1 is resolved.

3.3.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.3.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to wind loadings, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of GDC 2. The staff based its conclusion on the following:

- VEGP COL 3.3-1, as it relates to design wind loads, is acceptable based on the site-specific wind velocities, reviewed and approved in NUREG-1923, being bounded by the AP1000 DCD design wind velocities, and therefore, complying with GDC 2.

3.3.2 Tornado Loading

3.3.2.1 *Introduction*

Tornado loadings are considered for design in accordance with Section 3.3.2, "Tornado Loadings," of the AP1000 DCD. Section 3.3.2 of the AP1000 DCD addresses tornado loadings for seismic Category I structures using applicable tornado design parameters to determine forces on structures as explained in Section 3.3.1.2 of the AP1000 DCD. Also in Section 3.3.2.1 of the DCD, it is stated that the estimated probability of tornado wind speeds to be greater than the design basis tornado is between 10^{-6} and 10^{-7} per year for an AP1000 at a "worst location" anywhere within the contiguous United States.

The specific areas of review in accordance with Section 3.3.2 of NUREG-0800 include:

the tornado wind translational and rotational speeds
the tornado-generated atmospheric pressure change
the spectrum of tornado-generated missiles

3.3.2.2 *Summary of Application*

Section 3.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.3 of the AP1000 DCD, Revision 19. Section 3.3 of the DCD includes Section 3.3.2.

In addition, in VEGP COL FSAR Section 3.3.2, the applicant provided the following:

AP1000 COL Information Items

VEGP COL 3.3-1

The applicant provided additional information in VEGP COL 3.3-1 to resolve COL Information Item 3.3-1 (COL Action Item 3.3.2.2-1). In VEGP COL 3.3-1, the applicant states that tornado characteristics for VEGP Units 3 and 4, given in Section 2.3.1.3.2 of the VEGP ESP SSAR are bounded by the tornado design parameters given in DCD Section 3.3.2.1 for the standard AP1000 plant. In addition, the applicant states that the effects of wind and tornado on the safety-related SSCs due to failures in an adjacent AP1000 plant and VEGP Units 1 and 2 are bounded by the evaluation of the buildings and structures in a single unit. The portion of VEGP COL 3.3-1 relating to design wind velocity characteristics is reviewed in SER Section 3.3.1.

- VEGP COL 3.5-1

The portion of VEGP COL 3.5-1 included in VEGP COL FSAR Section 3.3.2 is identical to the information added by VEGP COL 3.3-1, and is addressed by the staff in its evaluation of VEGP COL 3.3-1 in this SER section. The additional information in VEGP COL 3.5-1 included in VEGP COL FSAR Section 3.5 is addressed in Section 3.5 of this SER.

3.3.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for tornado loading are given in Section 3.3.2 of NUREG-0800.

Acceptance of the information addressing VEGP COL 3.3-1 is established based on site-specific parameters and verification of bounding conditions for relevant parameters related to the DCD interface criteria for tornado, site arrangement, and building construction. The design of AP1000 safety-related SSCs for tornado loads using acceptable procedures must meet the requirements of 10 CFR Part 50, Appendix A, GDC 2, which states that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions.

3.3.2.4 *Technical Evaluation*

The NRC staff reviewed Section 3.3.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to tornado loading. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

VEGP COL 3.3-1

The NRC staff reviewed VEGP COL 3.3-1 included under Sections 3.3.2 and 3.5.1 of the VEGP COL FSAR. Specific information provided by the applicant to address COL Action Item 3.3.2.2-1 includes development of site-specific parameters and verification of bounding conditions, site arrangement and building construction. This information is provided to satisfy the commitment documented in Appendix F of NUREG-1793, which states:

> COL applicants referencing the AP1000 certified design will address site interface criteria for winds and tornadoes.

In VEGP COL 3.3-1, the applicant states that the tornado characteristics for VEGP Units 3 and 4, given in Section 2.3.1.3.2 of the VEGP ESP SSAR, are bounded by the tornado design parameters given in DCD Section 3.3.2.1 for the standard AP1000 plant design. In addition, the applicant states that the effects of wind and tornado on the safety-related SSCs

due to failures in an adjacent AP1000 plant are bounded by the evaluation of the buildings and structures in a single unit.

In Section 2.3.1.3.3.2 of NUREG-1923, the staff concluded that tornado site characteristics chosen by the applicant were acceptable. Since these values match the design tornado site characteristics included in the AP1000 DCD, the staff concludes that the design tornado site characteristics for the VEGP site are in compliance with GDC 2.

The scope of VEGP COL 3.3-1 also includes the effects of wind and tornado on the safety-related SSCs due to failure of nonsafety-related buildings in an adjacent AP1000 plant and VEGP Units 1 and 2. The applicant states that these effects are bounded by the evaluation of the buildings and structures in a single unit.

In order to assure the failure of structures or components not designed for wind or tornado loadings does not affect the capability of safety-related SSCs to perform their intended safety functions, the COL applicants were offered three options in Section 3.3.2.3 of the DCD:

(1) Design the adjacent nonsafety-related structure to the design basis tornado loading.

(2) Analyze the effect of failure of adjacent nonsafety-related structures on nuclear island (NI) structures to assure that no impairment of safety function will result.

(3) Design a structural barrier to protect seismic Category I SSCs from adjacent structural collapse.

In VEGP COL 3.3-1, the applicant used Option (2), indicating that the effects of wind and tornado on the safety-related SSCs due to failure of an adjacent nonsafety-related building are bounded by the evaluation of the structures in a single unit at VEGP. The analysis of the impact of building collapse on the NI structures is in Section 3.7.2.8 of the AP1000 DCD. The staff's review of this analysis is provided in NUREG-1793 and its supplements.

Based on the above discussion, the NRC staff finds VEGP COL 3.3-1 to be resolved.

3.3.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.3.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to tornado loading, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented within the VEGP COL FSAR, section 3.3.2 is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, GDC 2. The staff based its conclusion on the following:

- VEGP COL 3.3-1, as it relates to design tornado loads, is acceptable based on the design tornado site characteristics, reviewed and approved in NUREG-1923, matching the AP1000 DCD design tornado site characteristics, and therefore, complying with GDC 2. VEGP COL 3.3-1, as it relates to the effects of wind and tornado on the safety-related SSCs due to failure of nonsafety-related buildings in an adjacent AP1000 plant and VEGP Units 1 and 2, is acceptable because the applicant incorporated by reference acceptable methodology from DCD Section 3.7.2.8.

3.4 Water Level (Flood) Design

3.4.1 Flood Protection

3.4.1.1 *Introduction*

Seismic Category I SSCs have flood protection measures for both external flooding and postulated internal flooding from plant component failures.

3.4.1.2 *Summary of Application*

Section 3.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.4 of the AP1000 DCD, Revision 19. Section 3.4 of the DCD includes Section 3.4.1.

In addition, in VEGP COL FSAR Section 3.4, the applicant provided the following:

Tier 2 Departure

- VEGP DEP 3.4-1

This departure is described and evaluated in SER Section 3.8.5.

AP1000 COL Information Item

VEGP COL 3.4-1

The applicant provided additional information in VEGP COL 3.4-1 to resolve COL Information Item 3.4-1 (COL Action Item 3.4.1.1-1), which addresses plant-specific information on site-specific flooding hazards protective measures. VEGP COL 3.4-1, in VEGP COL FSAR Section 3.4.1.3, “Permanent Dewatering System,” states that no permanent dewatering system is required because site groundwater levels are two feet or more below site grade level as described in VEGP ESP SSAR Section 2.4.12.

VEGP COL 3.4-1, in VEGP COL FSAR Section 3.4.3, “Combined License Information,” states that the site-specific design basis flood levels given in VEGP COL FSAR Section 3.4.1.3 and VEGP ESP SSAR Section 2.4 satisfy the interface requirements identified in AP1000 DCD Section 2.4.

- VEGP COL 2.5-17

This COL information item is addressed in SER Section 3.8.5.

3.4.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for flood protection measures are given in Section 3.4.1 of NUREG-0800.

Further, the acceptance criteria associated with the relevant requirements of the Commission regulations for the identification of floods and flood design considerations are given in Section 2.4 of NUREG-0800.

3.4.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to flood protection measures. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

VEGP COL 3.4-1

The NRC staff reviewed VEGP COL 3.4-1, which addresses permanent dewatering system and site-specific water levels in Sections 3.4.1.3 and 3.4.3 of the VEGP COL FSAR, respectively.

The applicant provided additional information in VEGP COL 3.4-1 to address COL Information Item 3.4-1. COL Information Item 3.4-1 states:

> The Combined License [COL] applicant will demonstrate that the site satisfies the interface requirements as described in Section 2.4. If these criteria cannot be satisfied because of site-specific flooding hazards, the Combined License [COL] applicant may propose protective measures as discussed in Section 2.4.

The commitment was also captured as COL Action Item 3.4.1.1-1 in Appendix F of NUREG-1793, which states:

> The COL applicant will evaluate events leading to potential flooding and demonstrate that the design will fall within the values of these site parameters.

In VEGP COL FSAR Section 3.4, the applicant provided the following plant-specific information to resolve COL Information Item 3.4-1 (COL Action Item 3.4.1.1-1) on site-specific flooding hazards protective measures:

VEGP COL 3.4-1, in VEGP COL FSAR Section 3.4.1.3, "Permanent Dewatering System," states that no permanent dewatering system is required because site groundwater levels

are two feet or more below site grade level as described in VEGP ESP SSAR Section 2.4.12.

VEGP COL 3.4-1, in VEGP COL FSAR Section 3.4.3, "Combined License Information," states that the site-specific design basis flood levels given in VEGP COL FSAR Section 3.4.1.3 and VEGP ESP SSAR Section 2.4 satisfy the interface requirements identified in DCD Section 2.4.

In Section 2.4.12 of NUREG-1923, the staff accepted the VEGP applicant's position that no permanent dewatering system is required and in Section 2.4.12 of this SER, the staff concluded that the site-specific groundwater level characteristics for the VEGP site are acceptable. Also, in Section 2.4 of this SER, the staff concluded that the site-specific design based flood levels and the consideration of flood protection measures are acceptable. Therefore, the staff concludes that the site-specific information in VEGP COL 3.4-1 is acceptable.

3.4.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.4.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to flood protection measures, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the regulatory guidance in Sections 2.4.12 and 3.4.1 of NUREG-0800. The staff based its conclusion on the following:

- VEGP COL 3.4-1, is acceptable based on: 1) the staff's conclusions in NUREG-1923 regarding the need for a permanent dewatering system and on the staff's conclusions in Section 2.4.12 of this SER regarding the adequacy of the site-specific groundwater levels; and 2) the staff's conclusions in NUREG-1923 regarding the determination of the site-specific design based flood levels and on the staff's conclusions in Section 2.4 of this SER regarding the consideration of flood protection measures.

3.4.2 Analytical and Test Procedures (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.4.2, "Analysis Procedures")

Analysis methods and procedures are described for the design of AP1000 standard plants to assess the maximum water levels due to internal flooding caused by equipment failure or external flooding caused by natural phenomena and make sure that they do not jeopardize the safety of the plant or the ability to achieve and maintain safe shutdown conditions.

Section 3.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.4.2, "Analytical and Test Procedures," of Revision 19 of the AP1000 DCD. Section 3.4.2 of the AP1000 DCD states that the analytical approach for external and internal flooding events is described in DCD Section 3.4.1.2, "Evaluation of Flooding

Events." The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.5 Missile Protection

Seismic Category I structures are analyzed and designed to be protected from a wide spectrum of missiles (e.g., missiles from rotating and pressurized equipment, gravitational missiles, and missiles generated from tornado winds). Once a potential missile is identified, its statistical significance is determined (a significant missile is one which could cause unacceptable consequences or violate the guidelines of 10 CFR Part 100, "Reactor site criteria").

3.5.1 Missile Selection and Description

3.5.1.1 *Introduction*

SSCs important to safety are protected against internally generated missiles (outside containment), in accordance with Section 3.5.1.1 of NUREG-0800. The missiles generated outside containment by rotating or pressurized (high-energy fluid system) equipment are included.

The design credits only safety-related systems to establish and maintain safe shutdown conditions. The safety-related systems and components needed to bring the plant to safe shutdown, including the main control room and the recirculating service water system, are located inside the containment shield building and the auxiliary building. Both buildings are seismic Category I NI structures having thick structural concrete walls that provide internal and external missile protection. No nonsafety-related systems or components that require protection from missiles are housed in these buildings.

All SSCs that are necessary to perform safety functions are to be protected against damage from the following:

Internally generated missiles (outside containment)
Internally generated missiles (inside containment)
Turbine missiles
Missiles generated by tornadoes and extreme winds
Site proximity missiles (except aircraft)
Aircraft hazards

3.5.1.2 *Summary of Application*

Section 3.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.5 of the AP1000 DCD, Revision 19, and Section 3.5.1.6 of the VEGP ESP SSAR, Revision 5. Section 3.5 of the DCD includes Section 3.5.1. VEGP SER Section 2.2.3 provides an evaluation of potential accidents.

In addition, in VEGP COL FSAR Section 3.5, the applicant provided the following:

AP1000 COL Information Item

VEGP COL 3.3-1 and VEGP COL 3.5-1

The applicant provided additional information in VEGP COL 3.3-1 to resolve COL Information Item 3.3-1 (COL Action Item 3.3.2.2-1) and in VEGP COL 3.5-1 to resolve COL Information Item 3.5-1 (COL Action Item 3.5.1.5-1). VEGP COL 3.3-1 and VEGP COL 3.5-1, in VEGP COL FSAR Section 3.5.1.5, "Missiles Generated by Events Near the Site," states that the buildings and structures at the VEGP site are common structures that are located at a nuclear power plant. They are of similar design and construction to those that are typical at nuclear power plants. Therefore, any missiles resulting from a tornado-initiated failure are not more energetic than tornado missiles postulated for design of the AP1000.

In addition, VEGP COL 3.3-1 and VEGP COL 3.5-1 in VEGP COL FSAR Section 3.5.1.6, "Aircraft Hazards," states that Section 3.5.1.6 of the referenced VEGP ESP SSAR is incorporated by reference with no variances or supplements.

Supplemental Information

STD SUP 3.5-1

The applicant provided supplemental information by adding text to the end of DCD Section 3.5.1.3. This supplemental information states that the potential for a turbine missile from another AP1000 plant in close proximity has been considered for VEGP Units 3 and 4 in accordance with RG 1.115, "Protection Against Low-Trajectory Turbine Missiles," Revision 1.

STD SUP 3.5-2

The applicant provided supplemental information by stating that the turbine system maintenance and inspection program is discussed in DCD Section 10.2.3.6.

VEGP SUP 3.5-1

The applicant provided supplemental information by stating that the orientation of the VEGP Units 1 and 2 turbines has been evaluated and VEGP Units 3 and 4 are located outside of the low trajectory strike zones as described in RG 1.115. Therefore, the applicant stated that there is no potential for a turbine missile from Units 1 and 2 to impact Units 3 and 4.

3.5.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for missile selection and description are given in Sections 3.5.1.1 through 3.5.1.6 of NUREG-0800.

The regulatory basis for acceptance of VEGP COL 3.5-1 is based on the development of site-specific parameters and verification of bounding conditions compared to the DCD interface

criteria for missile generation, site arrangement, and building construction. The design of AP1000 safety-related structures for protection against missiles using acceptable procedures must meet the requirements of GDC 4, "Environmental and Dynamic Effects Design Bases." Regulatory requirements for potential hazards associated with nearby transportation routes, industrial and military facilities are provided in 10 CFR 100.21(e), "Non-seismic site criteria."

Additional regulatory guidance related to the review of the issues in this SER section are given in RG 1.91, "Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," Revision 1; RG 1.115 and RG 1.117, "Design Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1.

3.5.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.5 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to missile protection of safety-related SSCs. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 1-1) to resolve. The resolution of the item is addressed in this SER.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Items

- VEGP COL 3.3-1 and VEGP COL 3.5-1

In Section 3.5.1.5 of the VEGP COL FSAR, the applicant provided the site-specific information to resolve COL Information Items 3.3-1 and 3.5-1. VEGP COL FSAR Section 3.5.1.5 states that in accordance with VEGP ESP SSAR Section 2.2.3, the effects of explosions have been evaluated and it has been determined that the over pressure criteria of RG 1.91 is not exceeded. Consistent with RG 1.91, the effect of blast-generated missiles will be less than those associated with the blast over-pressure levels considered, and, therefore, no further evaluation of blast-generated missiles is required.

VEGP COL FSAR Section 3.5.1.6, "Aircraft Hazards," states that Section 3.5.1.6 of the referenced VEGP ESP SSAR is incorporated by reference with no variances or supplements.

The NRC staff reviewed and found acceptable, in Sections 2.2.3 and 3.5.1.6 of NUREG-1923, the information provided by the applicant in VEGP ESP SSAR Sections 2.2.3 and 3.5.1.6, respectively, related to the issues covered by VEGP COL 3.3-1 and VEGP COL 3.5-1. Therefore, VEGP COL 3.3-1 and VEGP COL 3.5-1 are acceptable.

The following portion of this technical evaluation section is reproduced from Section 3.5.1.4 of the BLN SER:

> *Supplemental Information*
>
> - *STD SUP 3.5-1*
>
> *The NRC staff reviewed the standard supplementary information (STD SUP 3.5-1) on the probability of turbine missiles from another AP1000 plant in close proximity affecting SSCs. The applicant proposes to add to the AP1000 DCD, Section 3.5.1.3, a statement that the potential for a turbine missile from another AP1000 plant in close proximity is less than $1x10^{-5}$ per year, and that the shield building and auxiliary building walls, roofs, and floors satisfies the guidance of RG 1.115 for two AP1000 plants side-by-side.*
>
> *It should be noted that AP1000 DCD, Section 1.2.2 refers to Figure 1.2 2 of the AP1000 DCD for the building structure orientation with respect to the turbine building and the nuclear island. Figure 1.2 2 illustrates the AP1000 plant as a single unit. Section 1.2.1.3.1 of the AP1000 DCD also states that the turbine orientation minimizes potential interaction between turbine missiles and safety-related structures and components. In addition, Section 3.5.1.3 of the AP1000 DCD states that the turbine generator is located north of the nuclear island with its shaft oriented north-south so that safety-related systems are located outside the high-velocity, low trajectory missile strike zone. With this information, the AP1000 design is considered to favorably orient the turbine building with respect to safety-related SSCs as defined in RG 1.115. However, since BLN Units 3 and 4 will be side-by-side, the staff notes that each turbine generator may not be oriented favorably with respect to the other plant's*

safety-related SSCs (i.e., BLN Unit 3 turbine generator not favorably orientated to BLN Unit 4 safety-related SSCs, and vice versa).

In Revision 1 of the BLN COL FSAR, the applicant revised STD SUP 3.5-1 to state that when two or more AP1000 units are situated side-by-side, the turbine generators are orientated unfavorably with respect to the other nuclear island which contains safety-related SSCs. The BLN site has two AP1000 units situated side-by-side. Therefore, the staff notes that to meet the guidance of RG 1.115 and Section 3.5.1.3 of NUREG-0800, for an unfavorable turbine generator orientation, the probability of generating a turbine missile must be equal to or less than $1x10^{-5}$ per year. As stated in the BLN COL FSAR, Section 3.5.1.3, the probability of generating a missile for the AP1000 turbine generator is less than $1x10^{-5}$ per year as calculated in the applicable bounding turbine missile analysis topical report referenced in the AP1000 DCD, Sections 3.5.1.3 and 10.2.8. The staff has not completed its review of the DCD with respect to this issue. Therefore, the staff is unable to make final determination. This is ***Open Item 1-1****.*

- *STD SUP 3.5-2*

STD SUP 3.5-2 to BLN COL, Section 3.5.1.3 states, "The turbine system maintenance and inspection program is discussed in Section 10.2.3.6." This statement refers to Section 10.2.3.6 of the BLN COL, for information concerning the turbine maintenance and inspection program. The staff's review of the turbine maintenance and inspection program is included in Section 10.2.3 [sic 10.2] *of this SER.*

Resolution of the Standard Content Evaluation Concerning Open Item 1-1 for Turbine Missiles

The NRC staff identified a statement in the text reproduced above from Section 3.5.1.4 of the BLN SER that requires clarification for the VEGP COL application. The BLN SER states that the review of the AP1000 DCD with respect to the probability of generating a turbine missile was not completed and, therefore, identified it as Open Item 1-1. The results of the NRC staff's technical evaluation of the AP1000 DC amendment application are documented in NUREG-1793 and its supplements, and include the final staff conclusions on the issue of probability of a missile striking a safety-related component.

Therefore, the staff finds that the probability of generating a turbine missile meets the guidance in Section 3.5.1.3 of NUREG-0800 and the requirements of GDC 4, since the probability of a missile striking a safety-related component is acceptably low. As an additional conservative measure, the shield building and auxiliary building walls, roofs, and floors provide some inherent protection of the safety-related components, but are not credited in preventing turbine missile strikes of safety-related components. As a result, Open Item 1-1, as it relates to the probability of a missile striking a safety-related component, is closed for the VEGP application review.

VEGP SUP 3.5-1

The applicant provided supplemental information by stating that the orientation of the VEGP Units 1 and 2 turbines has been evaluated and VEGP Units 3 and 4 are located outside of the low trajectory strike zones as described in RG 1.115. Therefore, the applicant stated that there

is no potential for a turbine missile from Units 1 and 2 to impact Units 3 and 4. The NRC staff reviewed this information and found that the potential turbine orientation and placement, provides a high degree of confidence that low-trajectory missiles resulting from turbine failures will not damage essential systems. Therefore, the staff considers the applicant's conclusions acceptable.

3.5.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.5.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to missile protection, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the regulatory guidance in Sections 3.5.1.1 through 3.5.1.6 of NUREG-0800. The staff based its conclusion on the following:

- VEGP COL 3.3-1 and VEGP COL 3.5-1 are acceptable because they meet the acceptance criteria provided in Sections 3.5.1.5 and 3.5.1.6 of NUREG-0800.

- STD SUP 3.5-1 is acceptable because the turbine missile evaluation for co-located AP1000 units meets the guidance of NUREG-0800 Section 3.5.1.3; therefore, ensures that the requirements of GDC 4 to 10 CFR Part 50 are met for protecting safety-related SSCs against the effects of turbine missiles.

- STD SUP 3.5-2 provides information on the turbine maintenance and inspection program. The staff's review of the turbine maintenance and inspection program is included in Section 10.2 of this SER.

VEGP SUP 3.5-1 is acceptable because the protection of safety-related SSCs from turbine missiles meets the acceptance criteria defined in NUREG-0800, Section 3.5.1.

3.5.2 Protection from Externally Generated Missiles

Systems required for safe shutdown are protected from the effects of missiles. Protection from external missiles, including those generated by natural phenomena, is provided by the external walls and roof of the seismic Category I NI structures. The external walls and roofs are reinforced concrete. The structural design requirements for the shield building and auxiliary building are outlined in AP1000 DCD Section 3.8.4. Openings through these walls are evaluated on a case-by-case basis to provide confidence that a missile passing through the opening would not prevent safe shutdown and would not result in an offsite release exceeding the limits defined in 10 CFR Part 100.

Section 3.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.5.2, "Protection from Externally Generated Missiles," of the AP1000 DCD, Revision 19 without any

departures or supplements. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.5.3 Barrier Design Procedures

Missile barriers and protective structures are designed to withstand and absorb missile impact loads to prevent damage to safety-related systems or components. Formulae used for missile penetration calculations into steel or concrete barriers are the Modified National Defense Research Committee formula for concrete and either the Ballistic Research Laboratory or Stanford formulae for steel as documented in AP1000 DCD, Section 3.5.3.

Section 3.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.5.3, "Barrier Design Procedures," of the AP1000 DCD, Revision 19 without any departures or supplements. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.6 Protection against Dynamic Effects Associated with the Postulated Rupture of Piping

3.6.1 Introduction

The design basis and criteria are described to demonstrate that safety-related systems are protected from pipe ruptures. This section also evaluates design bases for locating postulated breaks and cracks in high- and moderate-energy piping systems inside and outside the containment; the procedures used to define the jet thrust reaction at the break location; the procedures used to define the jet impingement loading on adjacent essential SSCs; pipe whip restraint design; and the protective assembly design. Pipe breaks in several high-energy systems, including the reactor coolant loop (RCL) and surge line, are replaced by small leakage cracks when the leak-before-break (LBB) criteria are applied. Jet impingement and pipe whip effects are not evaluated for these small leakage cracks.

Mechanistic pipe break evaluations (also referred to as LBB) demonstrate that for piping lines meeting the criteria, sudden catastrophic failure of the pipe is not credible. The evaluations demonstrate that piping that satisfies the criteria leaks at a detectable rate from postulated flaws prior to growth of the flaw to a size that would fail due to applied loads resulting from normal conditions, anticipated transients, and a postulated SSE.

3.6.2 Summary of Application

Section 3.6 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.6 of the AP1000 DCD, Revision 19. Section 3.6 of the DCD includes Section 3.6.4.

In addition, in VEGP COL FSAR Section 3.6.4, the applicant provided the following:

AP1000 COL Information Items

- STD COL 3.6-1

The applicant provided additional information in STD COL 3.6-1 to address COL Information Item 3.6-1. Specifically, the applicant stated that a pipe rupture hazard analysis is part of the piping design. It is used to identify postulated break locations and layout changes, support design, whip restraint design, and jet shield design. The applicant further stated that the final design of these activities will be completed prior to fabrication and installation of the piping and connected components.

- STD COL 3.6-4

The applicant provided additional information in STD COL 3.6-4 to address COL Information Item 3.6-4, regarding LBB inspections.

License Condition

- Part 10, License Condition 2, Item 3.6-1

The applicant has proposed a license condition addressing the as-designed pipe rupture hazards analysis completion schedule.

Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)

In a letter dated April 23, 2010, the applicant has proposed ITAAC requiring the completion of an as-designed pipe rupture hazards analysis to demonstrate that SSCs required to be functional during and following a postulated pipe failure are protected against or qualified to withstand the dynamic and environmental effects resulting from postulated failures in high- and moderate-energy piping.

3.6.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations (GDC 4 of Appendix A to 10 CFR Part 50) for the piping design against pipe breaks, pipe break locations and characteristics in safety-related piping, and LBB evaluation procedures are given in Sections 3.6.1, 3.6.2, and 3.6.3 of NUREG-0800.

3.6.4 Technical Evaluation

The NRC staff reviewed Section 3.6 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the piping design against pipe break, pipe break locations and characteristics in safety-related piping, and LBB evaluation procedures. The results of the NRC staff's evaluation

of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 3.6-1) to resolve. The resolution of the item is addressed in this SER.

AP1000 COL Information Items

The following portion of this technical evaluation section is reproduced from Section 3.6.4 of the BLN SER:

- *STD COL 3.6-1*

The staff notes that there are two different actions to be addressed: 1) the COL holder item addresses the as-designed pipe rupture hazard analysis report; and 2) the ITAAC addresses as-built reconciliation of the pipe rupture hazard analysis report. The ITAAC has a stated schedule, prior to fuel load, and a regulatory requirement that the ITAAC schedule be provided one year after the license is granted.

Based on the review of the information included in the BLN COL FSAR, it is unclear to the staff when the as-designed pipe rupture hazard analysis report will be completed by the applicant. As identified in 10 CFR 52.79(d)(3), the applicant should supply the NRC with a schedule for completion of detailed engineering information, in this case, the as-designed pipe rupture hazard analysis report. The applicant is requested to revise the implementation milestone for the License Condition to address the as-designed pipe rupture hazard analysis report (as opposed to as-built reconciliation) to allow coordination of activities with the NRC construction inspection program following the issuance of the COL such that the analysis would be made available to verify the design was completed in accordance with the regulations and DCD prior to fabrication and installation of

the piping and connected components. In RAI 3.6.2-1, the staff requested the applicant provide a description pertaining to the closure milestone of the as-designed pipe rupture hazard analysis activities.

The applicant responded to RAI 3.6.2-1, however, based on its review of the applicant's response, the staff determined that it is not acceptable. Specifically, RAI 3.6.2-1 requested that the applicant address the implementation milestone of the as-designed pipe rupture hazard analysis report. However, the applicant's RAI response addressed the as-built rather than the as-designed aspect. Therefore, RAI 3.6.2-1 remains unresolved and will be tracked as ***Open Item 3.6-1.***

- *STD COL 3.6-4*

The BLN COL FSAR replaced the first paragraph of Section 3.6.4.4 of AP1000 DCD with the following text:

> *Alloy 690 is not used in leak-before-break [LBB] piping. No additional or augmented inspections are required beyond the inservice inspection [ISI] program for leak-before-break [LBB] piping. An as-built verification of the leak-before-break piping is required to verify that no change was introduced that would invalidate the conclusion reached in this subsection.*

Based upon its review of the replaced Section 3.6.4.4, the staff determined that additional information was needed by the COL applicant to address whether Alloy 690 material is being used in the BLN-specific LBB piping systems. Accordingly, the staff issued several RAIs.

In RAI 3.6.3-1, the staff noted that it was unclear why Alloy 690 was not used in LBB piping applications. If Alloy 690 base material and Alloy 52/152 weld material was not being used, the staff asked the applicant to identify what material was being used for the piping.

In RAI 3.6.3-2, the staff asked if another base material was being used other than Alloy 690/52/152, then the applicant should provide its reasons for using this material in LBB piping applications based upon operating experience, and provide justification as to why no augmented inspection plans and evaluation criteria were considered necessary. Additionally, the staff requested that the applicant provide a discussion which supports the use of an alternative material and discuss why concerns for potential PWSCC [primary water stress-corrosion cracking] should not be considered a factor.

In RAI 3.6.3-3, for piping requiring dissimilar metal welds, the applicant was requested to address that if Alloy 52/152 is not being used for the weld material, then they should identify the weld material and provide justification for its use. In addition, the applicant should provide a discussion which supports the use of an alternative weld material and why concerns regarding the potential for PWSCC should not be considered a factor. The staff noted that there are currently ASME Code cases being developed for dissimilar-metal welds due to PWSCC concerns.

In its response to these RAIs, the applicant provided additional information to clarify the material that is used for LBB piping systems. The applicant stated that there is some limited use of Alloy 690 base material as safe ends in components connected to LBB piping, and there is some limited use of Alloy 52/152 weld material associated with these safe ends. However, the applicant noted that the base material for most of the LBB piping is 316LN stainless steel material. The applicant further stated that the material used in the AP1000 LBB piping is the same material currently used for LBB piping in operating nuclear power plants. Alloy 690 and Alloy 600 are not used as base material for LBB piping in the AP1000 design and are not commonly used in the LBB piping in current operating nuclear power plants. The applicant also stated that even though the material used in the LBB piping for the AP1000 design do not presently require an augmented ISI program, if ASME Code cases are developed and approved to address PWSCC concerns for dissimilar metal welds used in the AP1000 DCD, they will be evaluated and implemented.

The staff notes that in a final rule to amend 10 CFR 50.55a (73 FR [Federal Register] 52730) issued on September 10, 2008, a new requirement was added for licensees to augment their ISI program to use ASME Code Case N-722 for ISI of Alloy 600/182/82 materials to address PWSCC concerns. The applicant stated that there will be no Alloy 600/182/82 material used for new reactor construction of AP1000 plants. The staff notes that the final rule did not impose any additional requirements for augmented ISI of Alloy 690/152/52 materials. Based on the applicant's response discussed above and its commitment to evaluate and implement ASME Code cases that are developed and approved for augmented inspections of Alloy 690/152/52 material to address PWSCC concerns, the staff concludes the applicant's changes to COL Information Item 3.6-4 is consistent with current industry practice and NRC regulations as amended in 10 CFR 50.55a and is thus, acceptable.

Resolution of Standard Content Open Item 3.6-1

To address Open Item 3.6-1 in the BLN SER with open items, the VEGP applicant proposed in its letter dated April 23, 2010, an ITAAC for as-designed pipe rupture hazards analysis in ITAAC Table 3.8-# [where # is the next sequential number] and a revision to the proposed License Condition 2, Item 3.6-1 in Part 10 of the VEGP COL application. In addition, the applicant proposed to revise VEGP COL FSAR Section 3.6.4.1 and to add VEGP COL FSAR Section 14.3.3.# [where # is the next sequential number] related to pipe rupture hazards analysis.

Specifically, the proposed ITAAC includes a post-COL requirement related to the completion of the as-designed pipe rupture hazards analysis report. The proposed VEGP COL FSAR Section 3.6.4.1 states that the completed as-designed pipe rupture hazards analysis will be in accordance with the criteria outlined in AP1000 DCD Sections 3.6.1.3.2 and 3.6.2.5. The applicant stated that the completed as-designed pipe rupture hazards analysis report will be completed prior to installation of the piping and connected components and will be made available to the NRC staff. The applicant's proposed license condition that will require completion of the as-designed pipe rupture hazards analysis report prior to installation of the piping and connected components in their final location is proposed License Condition 2, Item 3.6-1. In the proposed VEGP COL FSAR Section 14.3.3.#, [where # is the next sequential

number] the applicant stated that the as-designed pipe rupture hazards analysis completed for the first standard AP1000 plant will be available to subsequent standard AP1000 plants under the "one issue, one review, one position" approach for closure.

The staff reviewed the applicant's April 23, 2010, response to BLN open items for Chapter 3, and has determined that the use of a plant-specific ITAAC to verify that the as-design pipe rupture hazards evaluation has been performed in accordance with the criteria outlined in AP1000 DCD Sections 3.6.1.3.2 and 3.6.2.5 is acceptable. The applicant's proposed license condition requiring completion of the as-designed pipe rupture hazards analysis report prior to installation of the piping and connected components in their final location, through the above discussed ITAAC, will allow the staff sufficient time to review the as-design pipe rupture hazards evaluation in a timely matter in order to identify and address any design issues. Therefore, the staff finds the response acceptable and concludes that Standard Content Open Item 3.6-1 has been satisfactorily resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as **Confirmatory Item 3.6-1**.

Resolution of Standard Content Confirmatory Item 3.6-1

Confirmatory Item 3.6-1 is an applicant commitment to revise its FSAR Section 3.6.4.1 and, Section 14.3.3.2, to verify the incorporation of the as-designed pipe rupture hazard analysis and add an ITAAC (Table 3.8-1) for the as-designed pipe rupture hazard analysis. The staff verified that the VEGP COL FSAR and part 10 of the application (ITAAC Table 3.8-1) were appropriately updated. As a result, Confirmatory Item 3.6-1 is now closed.

3.6.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the applicant proposes to include the following ITAAC for the pipe rupture hazards analysis:

- The licensee shall perform and satisfy the pipe rupture hazards analysis ITAAC defined in SER Table 3.6-1, "Piping Rupture Hazard Analysis."

For the reasons discussed in the technical evaluation section above, the applicant proposes to include the following license condition:

License Condition (3-1) – Prior to installation of piping and connected components in their final location, the licensee shall complete the as-designed pipe rupture hazards analysis in accordance with the criteria outlined in AP1000 DCD Sections 3.6.1.3.2 and 3.6.2.5.

3.6.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the pipe design against pipe break, pipe break locations and characteristics in safety-related piping, and LBB evaluation procedures and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of GDC 4 of Appendix A to 10 CFR Part 50. The staff based its conclusion on the following:

- STD COL 3.6-1 is acceptable because the applicant's proposed resolution to COL Information Item 3.6-1 in VEGP COL FSAR Section 3.6.4.1 meets the relevant guidelines of NUREG-0800 Sections 3.6.1 and 3.6.2 and 10 CFR 52.79(d)(3) and is, thus, acceptable. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of GDC 4 of Appendix A to 10 CFR Part 50.

- STD COL 3.6-4 is acceptable because the applicant's proposed resolution to COL Information Item 3.6-4 in Section 3.6.4.4 of the VEGP COL FSAR meets the relevant guidelines of NUREG-0800 Section 3.6.3 and is, thus, acceptable. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of GDC 4 of Appendix A to 10 CFR Part 50.

3.7 Seismic Design

Seismic design of the AP1000 seismic Categories I and II structures, systems, equipment, and components are based on the SSE. The operating basis earthquake (OBE) has been eliminated as a design requirement for the AP1000. Low-level seismic effects are included in the design of certain equipment potentially sensitive to a number of such events based on a percentage of the responses calculated for the SSE.

Criteria for evaluating the need to shut down the plant following an earthquake are established. For the purposes of the shutdown criteria the OBE for shutdown is considered to be one-third of the SSE.

Seismic Category I SSCs are designed to withstand the effects of the SSE event and to maintain the specified design functions. Seismic Category II and NS structures are designed or physically arranged (or both) so that the SSE could not cause unacceptable structural interaction with or failure of seismic Category I SSCs.

As part of the applicant's Limited Work Authorization (LWA), the staff reviewed, in Section 3.7.1 of NUREG-1923, the technical basis for seismic design provided in Appendix 2.5E of the VEGP ESP SSAR, Revision 5. The scope of the staff's review under NUREG-0800, Section 3.7 was limited to the evaluation of maximum seismic demands for use in sliding and overturning stability evaluations.

3.7.1 Seismic Design Parameters

3.7.1.1 *Introduction*

The input seismic design ground motion response spectra (GMRS) for the SSE in the free field at plant grade is addressed. The horizontal and vertical design GMRS for the AP1000 were developed based on the response spectra in Revision 1 of RG 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants," with consideration of high-frequency amplification effects.

The bases for the seismic design of safety-related SSCs and equipment include the following:

- Design GMRS
- Design ground motion time histories
- Percentage of critical damping values
- Supporting media for seismic Category I structures
- COL action items

3.7.1.2 *Summary of Application*

Section 3.7 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.7, of the AP1000 DCD, Revision 19. Section 3.7 of the DCD includes Section 3.7.1.

In addition, in VEGP COL FSAR Section 3.7, the applicant provided the following:

Supplemental Information

- VEGP SUP 3.7-3

The applicant provided supplemental information in VEGP SUP 3.7-3 by adding Section 3.7.1.1.1 to the VEGP COL FSAR, which addresses plant-specific GMRS. The portion of VEGP SUP 3.7-3 evaluated here is the technical basis used for the damping values selected by the applicant. The portion applicable to the evaluation of site-specific analyses for developing in-structure response spectra (ISRS) is reviewed in Section 3.7.2 of this SER.

3.7.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD and NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic design parameters are given in Section 3.7.1 of NUREG-0800.

3.7.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.7 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to seismic design parameters. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 3.7-3

The applicant provided supplemental information in VEGP SUP 3.7-3 by stating that the site-specific GMRS for VEGP, given in VEGP COL FSAR Chapter 2, are not entirely bounded by the certified seismic design response spectrum (CSDRS) ground acceleration level given in the AP1000 DCD and that there are exceedances above the CSDRS. VEGP COL FSAR Section 3.7.1.1.1 states that a site-specific seismic evaluation is performed to demonstrate that the AP1000 plant designed for the CSDRS is acceptable for the VEGP site. It is stated that the results from the VEGP site-specific analysis that demonstrate the acceptability of the VEGP site are given in VEGP ESP SSAR, Appendix 2.5E.

The VEGP COL FSAR cites VEGP ESP SSAR, Section 2.5E, Section 5.1, "2-D SASSI Analyses and Parameter Studies," (Report SVO-1000-S2R-802) in concluding that the 2-D analyses demonstrate that VEGP Units 3 and 4 seismic design is within the SSE design response spectra level of the CSDRS at VEGP's plant grade.

The VEGP site-specific GMRS are applied in the free-field at plant grade and the foundation input response spectra (FIRS) are developed at the foundation depth of 40 feet (ft) below final grade (-40 ft). There are exceedances above the CSDRS; therefore, a plant-specific seismic evaluation is performed to demonstrate that the AP1000 plant designed for the CSDRS is acceptable for the VEGP site.

As part of the LWA-1 review, the critical damping values used in the applicant's 2-D analyses were found by the staff to be acceptable in Section 3.7.1 of NUREG-1923 for sliding and overturning calculations. However, critical damping values can have an effect on the in-structure floor response used for equipment selection. The critical damping values for the NI structural GMRS-based response analysis may not be the same as the damping values utilized for the CSDRS analyses in the AP1000 DCD. In Table 1 of RG 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," Revision 1, the damping values are for structural stress states near code limits. As discussed in RG 1.61, Section 1.2, the GMRS response levels, when expected to be significantly less than the AP1000 DCD CSDRS-based response, may necessitate the use of smaller damping values corresponding to Table 2 of RG 1.61. The GMRS seismic response is indeed significantly less than the CSDRS seismic response as demonstrated in Figures 5.1-1 through 5.1-18 of the VEGP ESP SSAR. As stated in RG 1.61 for response spectra generation, it is necessary to utilize damping-compatible structural response.

To address this concern, the staff issued RAI 3.7.2-2 to request that the applicant provide a plant-specific technical basis for the use of damping values that are higher than the OBE values specified in RG 1.61.

In response to RAI 3.7.2-2, the applicant has performed a site-specific soil-structure interaction (SSI) analysis using a 3-D model that uses OBE damping values of 4 percent. At low frequencies, less than 1 Hertz (Hz), there are exceedances at a limited number of locations in the structure where the VEGP site-specific ISRS exceeds the AP1000 design ISRS. The impacts of these exceedances on the design of the supported SSCs have been evaluated; and the justification provided by the applicant insured that the AP1000 design has not been

compromised. The results of the evaluation are included in the VEGP COL FSAR as Appendix 3GG. This evaluation confirms that the AP1000 design is applicable to the VEGP site.

3.7.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.7.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the seismic design parameters, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidance in Section 3.7.1 of NUREG-0800. The staff based its conclusion on the following:

- VEGP SUP 3.7-3 is acceptable because the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDC 2; 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants"; 10 CFR Part 100 and the guidance in Section 3.7.1 of NUREG-0800.

3.7.2 Seismic System Analysis

3.7.2.1 *Introduction*

Seismic analysis methods and acceptance criteria for all seismic Category I SSCs are described. It includes a review of basic assumptions, procedures for modeling, seismic analysis methods, development of ISRS envelops, consideration of torsional effects, evaluation of overturning and sliding of seismic Category I structures, and determination of composite damping. The effects of SSI on the seismic responses of the NI structures are included in the review scope because the VEGP site is considered as a soft-soil site (e.g., shear wave velocity of 1,000 feet per second (fps) at foundation elevation). The review also covered design criteria and procedures for evaluating the interaction of NS Category II structures with seismic Category I structures and the effects of parameter variations on floor response spectra (FRS).

Specifically, the criteria and methods for the seismic analysis of safety-related SSCs and equipment include the following:

- Seismic analysis methods
- Natural frequencies and response loads
- Procedures used for analytical modeling
- SSI
- Development of FRS
- Three components of earthquake motion
- Combination of modal responses

- Interaction of NS Category II structures with seismic Category I SSCs
- Effects of parameter variations on FRS
- Use of constant vertical static factors
- Method used to account for torsional effects
- Methods for seismic analysis of dams
- Determination of seismic Category I structures overturning moments
- Analysis procedure for damping

3.7.2.2 *Summary of Application*

Section 3.7 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.7 of the AP1000 DCD, Revision 19. Section 3.7 of the DCD includes Section 3.7.2.

In addition, in VEGP COL FSAR Section 3.7.2, the applicant provided the following:

Supplemental Information

- VEGP SUP 3.7-3

The applicant provided supplemental information in VEGP SUP 3.7-3 by adding Section 3.7.1.1.1 to the VEGP COL FSAR, which addresses plant-specific GMRS. The portion of VEGP SUP 3.7-3 evaluated here is the site-specific analyses for developing ISRS.

- VEGP SUP 2.5-1

The applicant provided supplemental information in VEGP SUP 2.5-1 by adding Section 2.5.4.13. This section addresses the description of the design for a heavy lift derrick (HLD) counterweight and ring foundation. The portion of VEGP SUP 2.5-1 evaluated here is the technical basis used to assess the effects of the ring foundation on the VEGP site-specific SSI analyses. The evaluation of the effects of the counterweight and ring foundations is described in Section 3.7.2 of this SER.

AP1000 COL Information Items

- VEGP COL 3.7-1

The applicant provided additional information in VEGP COL 3.7-1 regarding seismic analysis of dams near the site, to address COL Action Item 3.7.2.13-1 identified in NUREG-1793, Appendix F, and COL Information Item 3.7-1 discussed in Section 3.7.5.1 of the AP1000 DCD.

- STD COL 3.7-3

The applicant provided additional information in STD COL 3.7-3 to address COL Action Item 3.7.5-3 identified in NUREG-1793, Appendix F, and COL Information Item 3.7-3 discussed in Section 3.7.5.3 of the AP1000 DCD. Since the information added by STD COL 3.7-3 is the subject of a proposed license condition (Part 10, License Condition 2, Item 3.7-3, see below), this COL item will not be discussed further in this SER.

- STD COL 3.7-4

The applicant provided additional information in STD COL 3.7-4 to address COL Action Item 3.7.5-1 identified in NUREG-1793, Appendix F, and COL Information Item 3.7-4 discussed in Section 3.7.5.4 of the AP1000 DCD. Since the information added by STD COL 3.7-3 is the subject of a proposed license condition (Part 10, License Condition 2, Item 3.7-4, see below), this COL item will not be discussed further in this SER.

License Conditions

- Part 10, License Condition 2, Item 3.7-3

The applicant has proposed a license condition requiring a seismic interaction review for as-built information. This review is performed in parallel with the seismic margin evaluation and will follow the methodology in Section 3.7.5.3 of the AP1000 DCD. The review is based on as-procured data, as well as the as-constructed condition. The as-built seismic interaction review is to be completed prior to fuel load.

- Part 10, License Condition 2, Item 3.7-4

The applicant has proposed a license condition requiring a seismic analysis for design changes, such as those due to as-procured or as-built changes in component mass, center of gravity, and support configuration based on as-procured equipment information. The reconciliation of seismic analysis of NI structures will be complete prior to fuel load.

3.7.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic system analysis are given in Section 3.7.2 of NUREG-0800.

3.7.2.4 *Technical Evaluation*

The NRC staff reviewed Section 3.7 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to seismic system analysis. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 3.7-3

The applicant provided supplemental information in VEGP SUP 3.7-3 by adding Section 3.7.1.1.1 to the VEGP COL FSAR, which addresses plant-specific GMRS. The portion of VEGP SUP 3.7-3 evaluated here is the site-specific analyses for developing ISRS.

The VEGP site-specific GMRS are applied in the free-field at plant grade and the FIRS are developed at the foundation depth (40 ft).

There are exceedances above the CSDRS; therefore, a plant-specific seismic evaluation is performed to demonstrate that the AP1000 plant designed for the CSDRS is acceptable for the VEGP site. The applicant, in VEGP COL FSAR Section 3.7.1.1.1 states that the 2-D site-specific analysis sufficiently demonstrates that the generic AP1000 DCD CSDRS analysis is adequate based on comparisons of in-structure amplified response spectra (ARS) generated by the 2-D generic AP1000 CSDRS (Appendix 3G, Section 3G.3) and the site-specific 2-D response analyses at critical selected nodes (see Table 5.1-1 of Site-Specific Seismic Evaluation Report SVO-1000-S2R-802).

The generic AP1000 DCD seismic analysis is based on detailed 3-D response analysis while the site-specific analyses are two-dimensional (horizontal and vertical responses). The site-specific report (SVO-1000-S2R-802) cites Westinghouse Technical Report, APP-GW-S2R-010, TR-3, "Extension of Nuclear island Seismic Analyses to Soil Sites." Section 6.1 of TR-3 states that using 2-D models is adequate and conservative for horizontal response comparisons; however, using the shell model (3-D) allows the development of design response spectra that reflect the seismic response across an elevation (floor) that is more realistic, and that in using the shell model more realistic vertical seismic response spectra are developed.

AP1000 DCD Section 2.5.2.1 states that 2-D system for analysis of soil structure interaction (SASSI) results should be compared to the 2-D CSDRS results in AP1000 DCD Appendix 3G; however, no 2-D-based vertical response spectra are given in Appendix 3G. In addition, this section concludes that if the results are not clearly enveloped then a 3-D analysis is indicated. Referring to the figures in Section 6.1 of TR-3, the vertical responses for the 2-D response analysis are significantly, and unconservatively, under-predicted in selected frequency ranges in the vertical (Z) direction when compared to the 3-D response analysis.

To address this issue, the staff issued RAI 3.7.2-1, requesting that the applicant justify the adequacy of the 2-D SSI models. In response, the applicant submitted a summary report entitled, "3-D SSI Analysis of AP1000 at Vogtle Site Using NI15 Model for VEGP Units 3 and 4," which provides a description of the VEGP site-specific 3-D SSI analysis. The details of the NI structural modeling are described in Section 5, "Structural Model." Section 5 states that the AP1000 structural model used for VEGP site-specific SSI analysis is a 3-D finite element model defined as NI15, developed by Westinghouse. The report stated that the NI15 was verified by Westinghouse by assuring that the mass distribution, the modal behavior and FRS results were consistent in ANSYS with Westinghouse's most detailed model, NI10, used for hard rock.

Upon review of the applicant's response, the staff issued an additional RAI, RAI 3.7.2-3, requesting that the applicant provide: 1) the details of the applicant's comparison of the NI15 and NI10 model results (referenced in Section 5 of the aforementioned report); 2) the details of the applicant's comparison of the NI15 and NI20 SASSI model results; and 3) whether the applicant's use of the NI15 model constitutes a departure from the AP1000 DCD. The applicant's responses were included in two separate Southern Nuclear Operating Company (SNC) letters, NRC ND-09-0331, dated March 2, 2009, which addressed RAI 3.7.2-1 and NRC ND-09-1040, dated July 1, 2009, which addressed RAI 3.7.2-3.

The applicant performed an additional, VEGP site-specific, SASSI SSI analysis using a refined 3-D model of the NI (referred to as the NI15 model) developed from the standard 3-D NI20

model used in the AP1000 DCD analyses. The refined model was intended to capture the high frequency range of response where the VEGP GMRS exceeds the AP1000 CSDRS given the soil profile at the VEGP site. Unlike the 2-D SSI analyses, which were considered to be inappropriate, the 3-D results were consistent with the approach used in the AP1000 DCD seismic analyses and provided an appropriate basis for comparison with the AP1000 DCD ISRS.

The analyses considered the variation in soil properties consistent with the NUREG-0800 requirements and incorporated the RG 1.61 OBE level structural damping of 4 percent. Additionally the adequacy of the SSI input motion was checked following the requirements in two Nuclear Energy Institute (NEI) documents, a draft white paper, "Consistent Site-Response/Soil-Structure Interaction Analysis and Evaluation," and the "White Paper in Support of New Plant Applications."

The results of the VEGP site-specific 3-D SSI analysis ISRS were compared with the enveloping 3-D CSDRS-based ISRS, which showed overall large margin at six key locations in the NI structures. The VEGP 3-D SSI analyses ISRS showed small exceedances in a narrow low frequency range at two locations high in the NI structure in the East-West direction. An evaluation of the structural and system components was performed to confirm that the minor exceedances at about 2 Hz at higher elevation have no impact on the design.

The applicant concluded that the site-specific three-dimensional SSI analysis confirmed that the AP1000 design is applicable to the VEGP site and added a summary report, "3-D SSI Analysis of AP1000 at Vogtle Site Using NI15 Model for VEGP Units 3 and 4," dated February 2009, to VEGP COL FSAR Section 3.7.1 as Appendix 3GG. Although, Interim Staff Guidance (ISG)-1, "Interim Staff Guidance on Seismic Issues Associated with High Frequency Ground Motion in Design Certification and Combined License Applications," requires that SSI analyses be performed to at least a frequency of 50 Hz, the review of the summary report showed that the SSI analyses was cut off at 15, 17, and 30 Hz for the lower bound, best estimate, and upper bound soil cases, respectively. In spite of the low cutoff frequency used in the analyses, the staff has made an assessment, based on experience and judgment, that the SSI analyses performed are sufficient to demonstrate that ISRS for the VEGP site-specific analyses are enveloped by the AP1000 DCD ISRS at high frequency. The summary report described the evaluation of the VEGP ISRS exceedances over the AP1000 DCD ISRS frequencies less than about 2 Hz. The considerations evaluated in making the judgment that the cut off frequency used will not change the conclusion of the summary report were based on the following:

(1) cutting off the analyses at frequencies as low as 15 Hz won't affect the computed low frequency regions of the ISRS;

(2) significant margin exists between the site-specific VEGP ISRS and the AP1000 DCD ISRS at high frequency;

(3) experience with SSI analyses at similar sites with similar footprint size and embedment indicate that the high frequency response is not significantly amplified for these type structures; and

(4) the upper bound, with frequencies computed to 30 Hz, about twice that of the lower bound and best estimate cases, shows little increase in ISRS at high frequency.

In addition to the response to RAI 3.7.2-1, the applicant responded to the three questions in RAI 3.7.2-3 by providing a comparison of the fixed base responses for each of the three models described, NI10, NI15, and NI20. The comparisons demonstrated dynamic equivalence between the models. Additionally, the applicant provided a basis for the use of site-specific evaluations that are permitted by Tier 1; thereby, justifying that the use of the NI15 model does not constitute a departure from the AP1000 DCD.

Though the staff considered the applicant's response to RAI 3.7.2-3 to be acceptable, because of the changes to the AP1000 NI20 SASSI model concerning the shield building design changes, the staff requested that the applicant verify that the modeling corrections have been adequately addressed by comparing the VEGP site-specific 3-D SSI results developed from the revised 3-D NI20 model, with the enveloping 3-D CSDRS-based ISRS.

The applicant provided a supplemental response to the staff concern in a letter dated October 15, 2010. The applicant stated that Westinghouse revised the NI20 SASSI model to incorporate the recent shield building design changes and made corrections to the NI20 SASSI model. Subsequently, Westinghouse reran the NI10 ANSYS and the NI20 SASSI models and developed a revised AP1000 CSDRS broadened envelope ISRS.

As a result to the changes to the AP1000 NI20 SASSI model and the revised AP1000 CSDRS broadened ISRS, the applicant updated its NI15 SASSI model to reflect those changes. The changes to the VEGP NI15 SASSI model to account for the modeling changes to the NI20 SASSI model include:

1. Updated the properties of the shield building walls and air-inlet.

2. Modeling corrections to the Westinghouse AP1000 NI20 SASSI model: beam to solid element connectivity and improve the stress distribution in the basemat. There were no issues with VEGP NI15 SASSI model because the NI15 connections were properly modeled between the solid element and the beam elements. The NI15 model used solid elements for the entire basemat, thus, there were no issues with the stress distribution of the basemat interface between the auxiliary building and the containment internal surface.

3. The NI20 SASSI model was revised to account for stiffness due to out-of-plane flexure where the walls, which are modeled as the shell elements, connect to the floors, which are modeled as solid elements. Accordingly, the VEGP NI15 SASSI model was revised by extending the wall shell elements the depth of one solid element to capture the effect of out-of-plane flexural stiffness.

The applicant reran the SASSI analyses using the updated VEGP NI15 SASSI model to generate revised VEGP ISRS at the six key locations for the VEGP soil profile cases: Lower bound, best estimate, and upper bound. The applicant provided detail analyses by comparing the 5 percent damped ISRS to the revised AP1000 CSDRS broadened envelope ISRS.

The staff observed that the revised AP1000 CSDRS broadened envelope ISRS at the six key locations has changed such that above 1 Hz there are no exceedances by the revised VEGP NI15 SASSI ISRS. Below 1 Hz, there were exceedances near 0.55 Hz, which have shown to have no impact on the AP1000 design.

The NRC staff concluded that the site-specific SSI analyses performed by the applicant to evaluate exceedances between the GMRS and the CSDRS demonstrated that the AP1000 DCD design is adequate for use at the VEGP site.

The applicant showed that the AP1000 DCD ISRS envelops the VEGP site-specific ISRS, with the exception of exceedances in the low frequency range higher up in the NI structure. The exceedances in the site-specific ISRS have been evaluated and justified that the minor exceedances would not impact the AP1000 DCD design. The staff concluded that the use of cutoff frequencies lower than those required by ISG-1 do not affect the conclusion that the AP1000 DCD ISRS are adequate for design at the VEGP site.

In its October 15, 2010, letter, the applicant provided a proposed revised VEGP COL FSAR Appendix 3GG, which shows the 5 percent damped VEGP ISRS compared to the revised AP1000 CSDRS broadened envelope ISRS at the six key locations. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as **Confirmatory Item 3.7-1**.

Resolution of VEGP Site-specific Confirmatory Item 3.7-1

Confirmatory Item 3.7-1 required the applicant to revise its FSAR Appendix 3GG to show the 5 percent damped VEGP ISRS as compared to the AP1000 CSDRS. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.7-1 is now closed.

- VEGP SUP 2.5-1

The applicant provided supplemental information in VEGP SUP 2.5-1 by adding Section 2.5.4.13. This section addresses the description of the design for a HLD counterweight and ring foundation. VEGP COL FSAR Figure 2.5-203 provides plan and elevation views showing the location of the HLD counterweight and ring foundation. The applicant states that the counterweight and ring foundations will be abandoned-in-place after construction.

In VEGP COL FSAR Section 3.7, the applicant states that the HLD counterweight is outside the defined excavations for Units 3 and 4 and thus will not significantly affect the site-specific seismic analyses. The staff reviewed VEGP COL FSAR Figure 2.5-203 to verify the dimensions and location of the counterweight foundation. The distance between the counterweight foundation and the AP1000 NI is 278 ft for Unit 4 and 300 ft for Unit 3. Further, the HLD counterweight foundation is 28 ft deep and has a 20 ft x 20 ft upper section and a 60.5 ft x 60.5 ft base section that are both outside of the safety-related (i.e., Category I and II) and nonsafety-related engineered granular backfill for Units 3 and 4. Based on this review, the staff finds that the HLD counterweight foundation has a minimum distance of 278 ft from the AP1000 NI (Unit 4) and is outside of the Units 3 and 4 safety-related backfill zones. Based on this review, the staff finds the applicant's justification for the counterweight foundation not affecting site-specific seismic analyses to be acceptable.

Using VEGP COL FSAR Figure 2.5-203, the staff performed a review of the ring foundation mass, geometry, and location relative to the Units 3 and 4 NI. The ring foundation has a mass of 16,600 kip, a width of 30 ft, an outside diameter of 321 ft, and an embedment depth of 8.5 ft. The distance between the ring foundation and the VEGP Unit 4 NI is 148 ft and 170 ft for Unit 3.

In VEGP COL FSAR Section 3.7, the applicant states that presence of the HLD ring foundation has no effect on the VEGP site-specific 3D SSI analyses of the NI presented in VEGP COL

FSAR Appendix 3GG. The applicant further states that the seismic analyses for VEGP and the AP1000 DCD does not consider the effects of adjacent structures (annex and turbine building), and concludes that the ring foundation would also not affect dynamic response. The staff's review of VEGP COL FSAR Appendix 3GG and AP1000 DCD Section 3.7.2 found that due to the large mass and stiffness of the AP1000 NI, the dynamic response of the NI under seismic loading will not be significantly affected by the dynamic response of adjacent structures with significantly less mass and stiffness.

The staff finds the applicant's justification for the ring girder foundation not affecting site-specific seismic analyses to be acceptable based on the following:

(a) The mass of the ring foundation is small when compared to the mass of the AP1000 NI (less than 10-percent).

(b) The ring foundation is located at a minimum distance of 148 ft from the AP1000 NI (Unit 4) and is outside of the safety-related backfill for Units 3 and 4.

AP1000 COL Information Item

- VEGP COL 3.7-1

The NRC staff reviewed the resolution to the COL information item related to the evaluation of existing and new dams included under Section 3.7.2.12 of the VEGP COL FSAR. VEGP COL 3.7-1 addresses the evaluation of existing and new dams whose failure could affect the site interface flood level specified in AP1000 DCD Section 2.4.1.2. The applicant references VEGP ESP SSAR Section 2.4.1.2.4 for the details of the evaluation. The applicant states that the U.S. Army Corps of Engineers has no current plans for the construction of additional reservoirs on the Savannah River. The staff already reviewed Section 2.4.1.2.4 of the VEGP ESP SSAR and found the information included therein to be acceptable as documented in NUREG-1923. Therefore, the NRC staff finds the information added to the VEGP COL FSAR by VEGP COL 3.7-1 to be acceptable.

License Conditions

- Part 10, License Condition 2, Item 3.7-3

The applicant has proposed a license condition requiring a seismic interaction review by the licensee for as-built information. This review is performed in parallel with the seismic margin evaluation. The review is based on as-procured data, as well as the as-constructed condition. The as-built seismic interaction review is to be completed prior to fuel load. The staff has reviewed and approved this review methodology in Section 3.7.5.3 in the AP1000 DCD. Therefore, the staff finds the proposed License Condition 2 acceptable.

- Part 10, License Condition 2, Item 3.7-4

The applicant has proposed a license condition requiring a seismic analysis for detail design changes, such as those due to as-procured or as-built changes in component mass, center of gravity, and support configuration based on as-procured equipment information. The reconciliation of seismic analysis of NI structures will be performed by the licensee and will be complete prior to fuel load.

Conducting the seismic interaction review and the seismic analysis for detail design changes based on as-procured data, as well as the as-constructed condition, does not alter the methods of seismic evaluation required to ensure the as-built design parameters are consistent with the standard design and have been reviewed by the staff as part of STD COL 3.7-4, as well as the information incorporated by reference from the AP1000 DCD. In addition, the NRC staff understands and agrees with the need to have as-procured data and the as-constructed condition in order to properly conduct these analyses.

3.7.2.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license conditions:

- License Condition (3-2) – Prior to initial fuel load, the licensee shall update the seismic interaction review in the AP1000 DCD Section 3.7.3.5 for as-built information. This review must be performed in parallel with the seismic margin evaluation. The review shall be based on as-procured data, as well as the as-constructed condition.

- License Condition (3-3) - Prior to initial fuel load, the licensee shall reconcile the seismic analyses described in Section 3.7.2 of the AP1000 DCD for detail design changes, such as those due to as-procured or as-built changes in component mass, center of gravity, and support configuration based on as-procured equipment information. The acceptability of deviations must be based on an evaluation consistent with the methods and procedure in Section 3.7 of the AP1000 DCD provided that the amplitude of the seismic floor response spectra (FRS), including the effect due to these deviations, does not exceed the design basis FRS by more than 10 percent.

3.7.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the seismic system analysis, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidance in Section 3.7.2 of NUREG-0800. The staff based its conclusion on the following:

- VEGP SUP 3.7-3 is acceptable because the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDC 2; 10 CFR Part 50, Appendix S; 10 CFR Part 100; and the guidance in Section 3.7.2 of NUREG-0800.

- VEGP COL 3.7-1 is acceptable because the staff has reviewed and accepted the information related to the evaluation of existing and new dams in Section 2.4.1.2.4 of NUREG-1923.

3.7.3 Seismic Subsystem Analysis

Seismic input motion, seismic analysis methods, and modeling procedure used for the analysis and design of AP1000 SC-I subsystems are described. In particular, this review focused on such subsystems as the miscellaneous steel platforms, steel frame structures, tanks, cable trays and supports, heating, ventilation, and air conditioning (HVAC) ductwork and supports, and conduit and supports.

Specifically, the criteria and methods for the seismic analysis of safety-related SSCs and equipment include the following:

- Seismic analysis methods
- Determination of number of earthquake cycles
- Procedures used for modeling
- Basis for selection of frequencies
- Equivalent static load method of analysis
- Three components of earthquake motion
- Combination of modal responses
- Analysis procedure for piping
- Vertical static factors
- Torsional effect of eccentric mass
- Seismic Category I buried piping systems and tunnels
- Interaction of other systems with seismic Category I systems
- Seismic analysis of reactor internals
- Analysis procedure for damping
- Analysis of seismic Category I tanks
- Time history analysis of piping systems

Section 3.7.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.7.3 of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.7.4 Seismic Instrumentation

3.7.4.1 *Introduction*

Installation of instrumentation that is capable of adequately measuring the effects of an earthquake at the plant site is addressed. The criteria for the seismic instrumentation include the following:

- Comparison with RG 1.12, "Nuclear Power Plant Instrumentation for Earthquakes," Revision 2

- Location and description of instrumentation

- Control room operator notification

- Comparison of measured and predicted responses

- Tests and inspections

3.7.4.2 *Summary of Application*

Section 3.7 of the VEGP COL FSAR, Revision 5 incorporates by reference Section 3.7 of the AP1000 DCD, Revision 19. Section 3.7 of the DCD includes Section 3.7.4. The advanced safety evaluation (ASE) with confirmatory items for Section 3.7.4 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse created a new COL information item (COL 3.7-2). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Section 3.7.4, the applicant provided the following:

AP1000 COL Information Items

- STD COL 3.7-2

In a letter dated October 15, 2010, the applicant proposed STD COL 3.7-2 in Section 3.7.4.4 of the VEGP COL FSAR to address the measurement of the post-seismic event gaps between the new fuel rack and walls of the new fuel storage pit, between the individual spent fuel racks, and from the spent fuel racks to the spent fuel pool walls.

- VEGP COL 3.7-2

The applicant provided additional information in VEGP COL 3.7-2 in Section 3.7.4.4 to resolve COL Information Item 3.7-2 (COL Action Item 3.7.5-2) on post-earthquake procedures to compare measured and predicted ground motions. In VEGP COL 3.7-2, the applicant also stated that post-earthquake operating procedures utilize the guidance of Electric Power Research Institute (EPRI) Reports NP-5930, TR-100082, and NP-6695, as modified and endorsed by the NRC in RG 1.166, “Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Postearthquake Actions” and RG 1.167, “Restart of a Nuclear Power Plant Shut Down by a Seismic Event.” A response spectrum check up to 10 Hz will be based on the foundation instrument. The cumulative absolute velocity (CAV) will be calculated based on the recorded motions at the free field instrument. If the OBE ground motion is exceeded or significant plant damage occurs, the plant must be shutdown in an orderly manner.

- VEGP COL 3.7-5

The applicant provided additional information in VEGP COL 3.7-5 in Section 3.7.4.2.1 to resolve COL Information Item 3.7-5 (COL Action Item 3.7.5-4) on free field triaxial acceleration sensors. In VEGP COL 3.7-5, the applicant stated that a free-field sensor will be located and installed within the protected area to record the ground surface motion representative of the site. It will be located on the ground surface of the engineered backfill, which supports the NI and adjacent structures. The applicant further stated that the free-field sensor will be located where the backfill vertically extends from the top of the Blue Bluff Marl to the ground surfaces, but horizontally at a distance where the possible effects on recorded ground motion associated with surface features, buildings, and components would be minimized.

Supplemental Information

- STD SUP 3.7-1

The applicant provided supplemental information in VEGP COL FSAR Section 3.7.4.1 to address the guidance of RG 1.12 by stating that administrative procedures define the maintenance and repair of the seismic instrumentation to keep the maximum number of instruments inservice during plant operation and shutdown.

- STD SUP 3.7-2

The applicant provided supplemental information in VEGP COL FSAR Section 3.7.4.5 to address the test and inspection requirements for the acceleration sensors. In this section, the applicant stated that installation and acceptance testing of the triaxial acceleration sensors described in DCD Section 3.7.4.2.1 is completed prior to initial startup. Installation and acceptance testing of the time-history analyzer described in DCD Section 3.7.4.2.2 is completed prior to initial startup.

3.7.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for seismic instrumentation are given in Section 3.7.4 of NUREG-0800.

The regulatory guidance documents for VEGP COL 3.7-2 and VEGP COL 3.7-5 are RG 1.166, RG 1.167, and RG 1.12, which requires installation of free field triaxial acceleration sensors and establishment of post earthquake procedures to comparing measured and predicted responses.

3.7.4.4 *Technical Evaluation*

The NRC staff reviewed Section 3.7.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information related to seismic instrumentation. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Items

- STD COL 3.7-2

As a result of the review in Sections 9.1.1.2 and 9.1.2.2 of the AP1000 DCD, STD COL 3.7-2 in Section 3.7.4.4 of the VEGP COL FSAR was identified to clarify the measurement of the post-seismic event gaps between the new fuel rack and walls of the new fuel storage pit, between the individual spent fuel racks, and from the spent fuel racks to the spent fuel pool wall. In a letter dated October 15, 2010, the applicant committed to specify the site-specific

procedures, following the guidance of EPRI Reports NP-5930, TR-10082, and NP-6695, for: 1) checking the gaps between the new fuel rack and walls of the new fuel storage pit, between the individual spent fuel racks, and from the spent fuel racks to the spent fuel pool walls following an earthquake; and 2) to take, if needed, appropriate corrective actions in the event of an earthquake such as repositioning the racks or analysis of the as-found condition. The staff considered the applicant response to be acceptable based on the applicant's commitment to use the post-earthquake procedures described in Section 3.7.5.2 of the AP1000 DCD, which comply with the requirements of Appendix S to 10 CFR Part 50. Therefore, the NRC staff considers STD COL 3.7-2 to be resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as **Confirmatory Item 3.7-2**.

Resolution of Standard Content Confirmatory Item 3.7-2

Confirmatory Item 3.7-2 is an applicant commitment to revise its FSAR to adjust the left margin annotations related to STD COL 3.7-2. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.7-2 is now closed.

- VEGP COL 3.7-2

The NRC staff reviewed VEGP COL 3.7-2 related to COL Information Item 3.7-2 (COL Action Item 3.7.5-2) included under Section 3.7.4.4 of the VEGP COL FSAR.

The applicant provided additional information in VEGP COL 3.7-2 to resolve COL Information Item 3.7-2. COL Information Item 3.7-2 states:

> Combined License applicants referencing the AP1000 certified design will prepare site-specific procedures for activities following an earthquake. These procedures will be used to accurately determine both the response spectrum and the cumulative absolute velocity of the recorded earthquake ground motion from the seismic instrumentation system. The procedures and the data from the seismic instrumentation system will provide sufficient information to guide the operator on a timely basis to determine if the level of earthquake ground motion requiring shutdown has been exceeded. The procedures will follow the guidance of EPRI Reports NP-5930, TR-100082, and NP-6695, as modified by the NRC staff.

The commitment was also captured as COL Action Item 3.7.5-2 in Appendix F of NUREG-1793, which states:

> The COL applicant will specify site-specific procedures for activities following an earthquake and those procedures will follow the guidance of Reports NP-5930, TR-100082, and NP-6695 promulgated by the Electric Power Research Institute (EPRI).

In VEGP COL 3.7-2, the applicant stated the following:

> Post-earthquake operating procedures utilize the guidance of EPRI Reports NP-5930, TR-100082, and NP-6695, as modified and endorsed by the NRC in Regulatory Guides 1.166 and 1.167. A response spectrum check up to 10Hz will be based on the foundation instrument. The cumulative absolute velocity will be calculated based on the recorded motions at the free field instrument. If the

operating basis earthquake ground motion is exceeded or significant plant damage occurs, the plant must be shutdown in an orderly manner.

The NRC staff reviewed the resolution to VEGP COL 3.7-2 related to comparison of measured and predicted seismic responses included under Section 3.7.4.4 of the VEGP COL FSAR. The applicant committed to specify site-specific procedures, which follow the guidance of EPRI Reports NP-5930, TR-10082, and NP-6695, for activities following an earthquake, which were endorsed by RGs 1.166 and 1.167. In RAI 3.7.4-1, issued to the BLN applicant, the staff asked the applicant to clarify if CAV will be used as one of the criteria to determine if a power plant should be shutdown should the OBE ground motion be exceeded or significant plant damage occurs. The BLN applicant responded by stating "As indicated in FSAR Subsection 3.7.4.4, use of the guidance of Regulatory Guide 1.166 and NP-5930 signifies that CAV is to be used as one of the post-earthquake criteria for determining whether the plant should be shutdown. In addition, BLN COL FSAR Appendix 1AA indicates conformance to the guidance of Regulatory Guide 1.166." The staff considered the applicant's response to be adequate because the BLN applicant confirmed that it will use the recommended criteria from the RG 1.166 to determine a potential plant shutdown, and the staff concludes that this RAI is closed. Furthermore, the BLN response to RAI 3.7.4-4 was endorsed as standard for VEGP by SNC letter dated December 17, 2008.

Based on the VEPG applicant's commitment to use the procedures accepted by NRC for post-earthquake activities and the clarification on the use of CAV in RAI 3.7.4-1, the NRC staff concludes that the applicant provided adequate information regarding the post earthquake activities and procedures to determine if a power plant needs to be shutdown and considers VEGP COL 3.7-2 resolved.

- VEGP COL 3.7-5

The applicant provided additional information in VEGP COL 3.7-5 to resolve COL Information Item 3.7-5 (COL Action Item 3.7.5-4) included under Section 3.7.4.2.1 of the VEGP COL FSAR. COL Information Item 3.7-5 states:

> The Combined License applicant will determine the location for the free-field acceleration sensor as described in [DCD] Subsection 3.7.4.2.1.

The commitment was also captured as COL Action Item 3.7.5-4 in Appendix F of NUREG-1793, which states:

> The COL applicant will determine the location for the free-field acceleration sensor.

In VEGP COL 3.7-5, the applicant stated the following:

> A free-field sensor will be located and installed to record the ground surface motion representative of the site. To be representative of this site in regards to seismic response of structures, systems, and components, the free-field sensor is located on the ground surface of the engineered backfill. The backfill directly supports the Nuclear Island and the adjacent structures and extends out from these structures a significant distance. The free field sensor is located where the backfill vertically extends from the top of the Blue Bluff Marl to the ground surface, but horizontally at a distance where possible effects on recorded ground

> motion associated with surface features, buildings, and components would be minimized. The trigger value is initially set at 0.01g.

The NRC staff reviewed the resolution to VEGP COL 3.7-5 related to triaxial acceleration sensors included under Section 3.7.4.2.1 of the VEGP COL FSAR. The applicant used the guidance in RGs 1.166 and 1.167 and supplemented information in the DCD with appropriate content, as required by Appendix S to 10 CFR Part 50. The applicant also committed to determining the location of the free field acceleration sensor and installing the sensor in a protected area. Based on the applicant's commitment to determine the location of the free-field acceleration sensor and the description of the location provided in STD COL 3.7-5, the staff concludes that the applicant presented sufficient information on the description and locations of field triaxial acceleration sensors and considers VEGP COL 3.7-5 resolved.

Supplemental information

- STD SUP 3.7-1

The applicant added the following supplemental information at the end of VEGP COL FSAR Section 3.7.4.1 to address RG 1.12:

> Administrative procedures define the maintenance and repair of the seismic instrumentation to keep the maximum number of instruments inservice during plant operation and shutdown in accordance with Regulatory Guide 1.12.

The NRC staff reviewed the resolution to STD SUP 3.7-1 using the guidance in RG 1.12 and in Appendix S to 10 CFR Part 50. Because of the equivalence of the applicant's proposed resolution to the administrative procedures, maintenance and repair plans of RG 1.12, the staff concludes the applicant has adequately resolved STD SUP 3.7-1.

- STD SUP 3.7-2

The applicant added the following supplemental information at the end of VEGP COL FSAR Section 3.7.4.4 to address comparison of measured and predicted responses:

> Installation and acceptance testing of the triaxial acceleration sensors described in DCD Subsection 3.7.4.2.1 is completed prior to initial startup. Installation and acceptance testing of the time-history analyzer described in DCD Subsection 3.7.4.2.2 is completed prior to initial startup.

The NRC staff reviewed the resolution to STD SUP 3.7-2, related to the timing of installation and acceptance testing of the triaxial acceleration sensors described in DCD Section 3.7.4.2.1 for the VEGP site. Because of the equivalence of the proposed resolution of STD SUP 3.7-2 to the general operability guidance for seismic equipment addressed in RG 1.12, RG 1.166 and RG 1.167, the staff concludes the applicant adequately resolved STD SUP 3.7-2.

3.7.4.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.7.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to seismic instrumentation, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL application is acceptable and meets the requirements of Appendix S to 10 CFR Part 50 and complies with the guidance provided in RGs 1.166, 1.167, and 1.12. The staff based its conclusions on the following:

- STD COL 3.7-2 is acceptable because the applicant has provided sufficient information for satisfying the requirements Appendix S to 10 CFR Part 50 by committing to address the measurement of the post-seismic event gaps between the new fuel rack and walls of the fuel storage pit and to take appropriate corrective actions.

- VEGP COL 3.7-2 is acceptable because the applicant is committed to use the procedures endorsed by RGs 1.166 and 1.167.

- VEGP COL 3.7-5 is acceptable because the applicant has provided sufficient information for satisfying the requirement Appendix S to 10 CFR Part 50 by committing to determining the location of the free field acceleration sensor and installing the sensor in the protected area.

- STD SUP 3.7-1 is acceptable because the applicant is committed to follow RG 1.12, to include developing administrative procedures to define the maintenance and repairing of the seismic instrumentation in order to keep the maximum number of instruments in service during plant operation and shutdown.

- STD SUP 3.7-2 is acceptable because the applicant has provided sufficient information for satisfying the requirement of Appendix S to 10 CFR Part 50 by committing to complete installation and acceptance testing of the seismic instrumentation prior to initial startup.

3.8 Design Of Category I Structures

3.8.1 Concrete Containment

This section is not applicable to the VEGP design, because AP1000 uses a steel containment.

3.8.2 Steel Containment

The steel containment in the AP1000 DCD provides the following information:

- Description of the containment
- Applicable codes, standard, and specifications
- Loads and load combinations
- Design and analysis procedures
- Structural acceptance criteria

- Materials, quality control, and special construction techniques
- Testing and ISI requirements

Section 3.8.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.8.2 of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.8.3 Concrete and Steel Internal Structures of Steel or Concrete Containment

Structures inside the containment are not part of the containment pressure boundary. They support the reactor coolant system components and related piping systems and equipment inside the containment. They also provide radiation shielding. The containment internal structures consist of the primary shield wall, reactor cavity, secondary shield walls, in-containment refueling water storage tank (IRWST), refueling cavity walls, operating floor, intermediate floors, and various platforms.

The containment internal structures are constructed by reinforced concrete and structural steel. At the lower elevations conventional concrete and reinforcing steel are used, except that permanent steel forms are used in some areas in lieu of removable forms based on constructability considerations. These steel form modules (liners) consist of steel plates reinforced with steel angle stiffeners and tee sections. The angles and the tee sections are on the concrete side of the plate. Welded studs, or similar embedded steel elements, are attached to the back of the permanent steel form where surface attachments to the plate transfer loads into the concrete. Where these surface attachments are seismic Category I, the portion of the steel form module transferring the load into the concrete is classified as seismic Category I.

Section 3.8.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.8.3 of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.8.4 Other Seismic Category I Structures

3.8.4.1 *Introduction*

The AP1000 DCD defines other seismic Category I structures as the shield building and the auxiliary building.

3.8.4.2 *Summary of Application*

Section 3.8 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.8 of the AP1000 DCD, Revision 19. Section 3.8 of the DCD includes Section 3.8.4.

In addition, in VEGP COL FSAR Section 3.8.4.3, the applicant provided the following:

Supplemental Information

- VEGP SUP 3.8-2

The applicant provided supplemental information in VEGP SUP 3.8-2, addressing the loads and load combinations. The applicant states that the application of the 48-hour probable maximum winter precipitation (PMWP) and the 100-year return period ground level snowpack in the roof design of safety-related structures is addressed in VEGP ESP SSAR Section 2.3.1.3.4.

3.8.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for other seismic Category I structures are given in Section 3.8.4 of NUREG-0800.

3.8.4.4 *Technical Evaluation*

The NRC staff reviewed Section 3.8.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to other seismic Category I structures. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 3.8-2

The NRC staff reviewed the resolution of the supplemental information item related to the 100-year return period ground level snowpack and finds that Section 2.3.1.3.4 of the VEGP ESP SSAR states that the 48-hour PMWP is about 147 pounds per square foot (lb/ft^2), and that the roof design of safety-related structures with respect to that design basis (147 lb/ft^2) would be described in the COL application. VEGP COL FSAR Section 2.3.1.3.4 states that:

(1) the AP1000 DCD design basis snow load for the roof was 63 lb/ft^2;

(2) the roof will not deflect enough to hold water under the snow load; therefore, ponding of rain water with pre-existing snow pack conditions will not occur; and

(3) the physical arrangement of the AP1000 sloped roof is designed such that the 100-year snow pack will not prevent the winter probable maximum precipitation (PMP) water from draining off the sloped roof system.

Based on its review of the information provided in VEGP COL FSAR Section 2.3.1.3.4, the staff finds that:

(1) the applicant has not adequately addressed the 147 lb/ft^2 PMWP design basis for VEGP while using the AP1000 DCD, which has a roof design basis of 63 lb/ft^2, as stated by the applicant;

(2) no evidence indicating that the AP1000 DCD roofs will not have a ponding problem; and

(3) the AP1000 DCD roofs are relatively flat and thus the rain water is not easily drained off from the roofs.

To address this concern, the staff issued RAI 3.8.4-1 to request that the applicant provide:

(1) the required design basis in lb/ft^2 for the VEGP roof;

(2) the magnitude of the maximum roof deflection under the roof design load for the 100-year snow pack and precipitation extremes at VEGP, and demonstrating no roof ponding problems; and

(3) the evidence that the roofs in the AP1000 DCD was so designed that all the winter PMP water will drain off from the roof.

In response to RAI 3.8.4-1, the applicant stated that the required design basis for the VEGP roof is the same as the design basis for all AP1000 roofs, which is based on a 75 pounds per square foot (lb/ft^2) ground snow load and 63 lb/ft^2 roof design basis.

The staff reviewed the winter precipitation roof loads for the VEGP site in SER Section 2.3.1.4, as part of its evaluation of VEGP SUP 2.3-1. In the evaluation of VEGP SUP 2.3-1, the staff utilized the guidance in DC/COL-ISG-7, “Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures,” to clarify the staff’s position on identifying winter precipitation events as site characteristics and site parameters for determining normal and extreme winter precipitation loads on the roofs of seismic Category I structures. In ISG-7, the staff states that an appropriate source for the 100-year return period snowpack is American Society of Civil Engineers (ASCE 7-05), and also provides guidance for converting snowpack depth to a snow load. In SER Section 2.3.1.4, the staff found acceptable the applicant's design snowpack of 10 lb/ft^2, and also found acceptable the applicant's design extreme frozen winter precipitation event of 17.2 lb/ft^2. Both loads are significantly less than roof design basis of 63 lb/ft^2 for all AP1000 roofs.

In addition, the applicant referenced ASCE 7-98, “Minimum Design Loads for Buildings and Other Structures," which states that in Section 8.4, “Ponding Instability,” that the roof slopes of ¼ in/ft or greater are not subject to ponding and do not need to be analyzed for ponding. The applicant stated that all NI buildings have a minimum slope of 2 percent, and, therefore, the AP1000 NI roof design meets the ASCE 7-98 requirements since ¼ in/ft equates to 2 percent slope. Therefore, the applicant concludes that NI roofs are not subject to ponding.

The staff' review of the applicant's position that NI roofs are not subject to ponding included examining the effects of the minimum slope of 2 percent on the potential for ponding, in conjunction with margin between the applicant's design extreme frozen winter precipitation event of 17.2 lb/ft^2 and the AP1000 design basis roof snow load site parameter value of 63 lb/ft^2.

The difference between the design roof load and the extreme frozen winter precipitation event is 45.8 lb/ft^2, which is equivalent to approximately 5 in. of water. The staff finds it reasonable that a slope of 2 percent will not result in the accumulation of this amount of water ponding on the building roofs. Therefore, the staff concludes that the design loading value of 63 lb/ft^2 used for the NI roofs at the VEGP site is acceptable.

Based on the above discussion, the staff considers RAI 3.8.4-1 closed and finds VEGP SUP 3.8-2 to be acceptable.

3.8.4.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.8.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to other seismic Category I structures, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A. The staff based its conclusion on the following:

- VEGP SUP 3.8-2 is acceptable because the applicant has demonstrated compliance with 10 CFR Part 50, Appendix A, GDCs 1, 2, 4 and 5, "Sharing of Structures, Systems, and Components," for roof loads and load combinations due to precipitation.

3.8.5 Foundations

3.8.5.1 *Introduction*

The foundation for the NI structures supports the containment building, the shield building, and the auxiliary building, and is a cast-in-place, reinforced concrete structure. The staff reviewed VEGP COL FSAR Section 3.8.5 as part of the applicant's LWA request. The LWA-2 request involved the construction of foundation preparation elements, such as installation of reinforcing steel, sumps and drain lines and other embedded items in the NI foundation base slab, placement of concrete for the NI foundation base slab.

3.8.5.2 *Summary of Application*

Section 3.8 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.8 of the AP1000 DCD, Revision 19 and Section 3.8.5 of the VEGP ESP SSAR, Revision 5. Section 3.8 of the DCD includes Section 3.8.5. The ASE with confirmatory items for Section 3.8.5 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse created two new COL information items (COL 3.9-5 and COL 3.9-6). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Section 3.8.5, the applicant provided the following:

Tier 2 Departure

- VEGP DEP 3.4-1

The AP1000 DCD Revision 18 states that, for applicants who choose to use the sprayed-on waterproofing membrane system for foundations, the waterproofing material will consist of 100-percent solid materials based on polymer-modified asphalt or polyurea. However, the applicant proposed a Tier 2 departure. Specifically, the applicant stated that the material chosen for VEGP Units 3 and 4 ESP SSAR is an elastomeric membrane material utilizing Methyl Methacrylate resins as the base material.

Supplemental Information

- VEGP SUP 3.8-1

The applicant provided supplemental information in VEGP SUP 3.8-1, addressing the depth of overburden and depth of embedment.

- VEGP SUP 3.8-3

The applicant provided supplemental information in VEGP SUP 3.8-3, addressing a description of the safety-related backfill, which supports Category I structures.

ESP Variance

- VEGP ESP VAR 1.6-2

This ESP variance (VAR) item proposed two changes to the VEGP ESP SSAR associated with VEGP ESP SSAR Section 3.8.5. The first paragraph of VEGP ESP SSAR Section 3.8.5, which pertains to AP1000 DCD, Revision 15, is not incorporated by reference. The first sentence of the second paragraph of VEGP ESP SSAR Section 3.8.5.1.1 is replaced with the following: "For VEGP Units 3 and 4, the Sprayed-on Waterproofing Membrane is the selected option presented in the DCD."

AP1000 COL Information Items

- VEGP COL 2.5-17

In a letter dated July 1, 2010, the applicant proposed identifying as VEGP COL 2.5-17 the information in Section 3.8.5.1 that addresses the type of waterproofing system to be used for the below grade, exterior walls exposed to flood and groundwater under seismic Category I structures.

- STD COL 3.8-5

In a letter dated August 17, 2010, the applicant proposed STD COL 3.8-5, adding new Sections 3.8.3.7, 3.8.4.7, and 3.8.5.7 to the VEGP COL FSAR, addressing the construction inspection program related to seismic Category I and II structures.

- STD COL 3.8-6

In a letter dated October 1, 2010, the applicant proposed STD COL 3.8-6, adding a new Section 3.8.6.6 to the VEGP COL FSAR, addressing the construction procedure program related to safety-related Category I structures.

Limited Work Authorization

In Part 6, "LWA Request," Revision 1, of the VEGP COL application, the applicant requested certain activities be allowed under a LWA as part of the COL application, in accordance with 10 CFR 50.10(d), “Request for limited work authorization.” This LWA request involves installing reinforcing steel, sumps and drain lines and other embedded items in the NI foundation base slab, and placement of concrete for the NI foundation base slab.

ITAAC

- ESP Permit ITAAC

The applicant incorporated ITAAC (waterproof membrane) identified in VEGP ESP SSAR Section 3.8.5.

License Condition

- Part 10, License Condition 6

In its letter dated October 1, 2010, the applicant proposed to add another line item to proposed License Condition 6, addressing the availability to NRC inspectors of the schedule for the implementation of construction and inspection procedures related to concrete activities.

3.8.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD and in NUREG-1923.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for foundations are given in Section 3.8.5 of NUREG-0800.

3.8.5.4 *Technical Evaluation*

The NRC staff reviewed Section 3.8.5 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff’s review confirmed that the information in the application and incorporated by reference addresses the required information relating to foundations. The results of the NRC staff’s evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Tier 2 Departure and AP1000 COL Information Item

- VEGP DEP 3.4-1
- VEGP COL 2.5-17

The performance requirements to be met by the COL applicants for the waterproofing system are described in Section 3.4.1.1.1 of the AP1000 DCD. The AP1000 DCD, Revision 18 states that for applicants who choose to use the sprayed-on waterproofing membrane system for foundations, the waterproofing material will consist of 100-percent solid materials based on polymer-modified asphalt or polyurea. However, the applicant proposed a Tier 2 departure. Specifically, the applicant stated that the material chosen for the VEGP Units 3 and 4 ESP SSAR is an elastomeric membrane material utilizing Methyl Methacrylate resins as the base material.

AP1000 DCD, Revision 15 did not specify or allow the type of material planned to be used for the LWA; therefore, the applicant in its ESP SSAR specified an alternate material (an elastomeric membrane material utilizing Methyl Methacrylate resins as the base material. This material was reviewed and approved by the staff during the ESP phase. In AP1000 DCD, Revision 17, the performance requirements for waterproof membrane were added such that it covered the information included in the ESP SSAR. However, the AP1000 DCD, Revision 18 introduced a change to the description of the waterproof membrane options that created inconsistency between VEGP COL FSAR and the ESP SSAR. Therefore, the applicant proposed a Tier 2 departure from the AP1000 DCD, Revision 18. The waterproofing material chosen for the VEGP Units 3 and 4 ESP SSAR was an elastomeric membrane material utilizing Methyl Methacrylate resins as the base material. The chosen waterproofing material membrane material will serve as an architectural aid to limit the infiltration of subsurface water for seismic Category I structures below grade, consistent with that provided by the DCD design. It will also provide for adequate transfer of horizontal seismic shear forces consistent with existing DCD design. As stated earlier, the use of this material was reviewed and approved by the staff during the ESP phase. As a result, the staff considers VEGP COL 2.5-17 and VEGP DEP 3.4-1 are resolved.

Supplemental Information

- VEGP SUP 3.8-1

The information added by VEGP SUP 3.8-1 to the VEGP COL FSAR states that the depth of overburden and depth of embedment are given in VEGP ESP SSAR Section 2.5.4.5. In Section 2.5.4.5.1 of the VEGP ESP SSAR, the applicant states the VEGP plant grade for Units 3 and 4 will be at Elevation (El.) 220 ft above mean sea level (msl) and that the base of the NI foundations for the new units will be about El. 180 ft msl. This level corresponds to a depth of approximately 40 ft below final grade (below El. 220 ft msl). In Section 2.5.4.4 of NUREG-1923, the staff concluded that depth of overburden and depth of embedment chosen by the applicant were acceptable. Since this depth of embedment is the same depth of the AP1000 DCD foundation, the NRC staff considers VEGP SUP 3.8-1 to be resolved.

- VEGP SUP 3.8-3

The information added by VEGP SUP 3.8-3 to the VEGP COL FSAR states that the description of the safety-related backfill, which supports Category I structures, is given in VEGP ESP SSAR Section 2.5.4.5. In Section 2.5.4.4 of NUREG-1923, the staff concluded that the description of the safety-related backfill provided by the applicant was acceptable. Therefore, the NRC staff considers VEGP SUP 3.8-3 to be resolved.

ESP Variance

- VEGP ESP VAR 1.6-2

The applicant incorporated by reference Section 3.8.5 of the VEGP ESP SSAR at the end of AP1000 DCD Section 3.8.5.1, with variance VEGP ESP VAR 1.6-2. The variance replaces the first sentence of the second paragraph of VEGP ESP SSAR Section 3.8.5.1.1 with the following: "For VEGP Units 3 and 4, the Sprayed-on Waterproofing Membrane is the selected option presented in the DCD." Section 3.4.1.1.1.1, "Waterproofing," of the AP1000 DCD describes three alternative approaches for limiting the infiltration of subsurface water for seismic Category I structures below grade. The staff reviewed the sprayed-on waterproofing membrane approaches provided in AP1000 DCD Section 3.4.1.1.1.1 and found, in Section 3.8.5 of NUREG-1793 and its supplements, the waterproofing materials and performance requirements to be acceptable based on the use of the applicable industry standards and industry practices. The applicant provided an acceptable waterproofing system that meets the requirement described in Section 3.4.1.1.1.1 of the AP1000 DCD. Therefore, the NRC staff considers VEGP ESP VAR 1.6-2 to be resolved.

AP1000 COL Information Items

- STD COL 3.8-5

In a letter dated August 17, 2010, the applicant proposed STD COL 3.8-5, adding new Sections 3.8.3.7, 3.8.4.7, and 3.8.5.7 to the VEGP COL FSAR, addressing the construction inspection program related to seismic Category I and II structures. The construction inspection program will be consistent with the maintenance rule (10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants") and the guidance in RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," in addressing maintenance requirements for the seismic Category I and seismic Category II structures. The staff concludes that the applicant has provided an acceptable construction inspection program that meets the requirement described in Section 3.8.4.8 of the AP1000 DCD. Therefore, the NRC staff considers STD COL 3.8-5 to be resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as **Confirmatory Item 3.8-2**.

Resolution of Standard Content Confirmatory Item 3.8-2

Confirmatory Item 3.8-2 is an applicant commitment to revise its FSAR Table 1.8-202, Table 1.9-201, Appendix 1AA, Section 3.8.3.7, Section 3.8.4.7, Section 3.8.5.7, Section 3.8.6.5, and Section 17.6 to address STD COL 3.8-5. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.8-2 is now closed.

- STD COL 3.8-6

In a letter dated October 1, 2010, the applicant proposed STD COL 3.8-6, adding a new Section 3.8.6.6 to the VEGP COL FSAR, addressing the construction procedure program related to safety-related Category I structures. The construction procedures program addresses the pre- and post-concrete placement, and use of construction mock-ups for the SC modules. The staff concludes that the applicant has provided an acceptable construction procedures program that meets the requirement described in Section 3.8.4.8 of the AP1000 DCD. Therefore, the NRC staff considers STD COL 3.8-6 to be resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as **Confirmatory Item 3.8-3**.

Resolution of Standard Content Confirmatory Item 3.8-3

Confirmatory Item 3.8-3 is an applicant commitment to revise its FSAR Table 1.8-202 and Section 3.8.6.6 to address STD COL 3.8-6. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.8-3 is now closed.

LWA Related to Foundation Base Slab

In Part 6 of the VEGP COL application, Revision 1, the applicant submitted details for performing work within the scope of the LWA request in accordance with 10 CFR 50.10(d). The scope of the applicant's LWA request involves: 1) the installation of reinforcing steel, sumps and drain lines and other embedded items in the NI foundation base slab; and 2) the placement of concrete for the NI foundation base slab.

In the LWA request, the applicant stated that the installation of the rebar and other embedded items will be above the mudmats and inside of the mechanically stabilized earth wall, which will serve as the permanent formwork for the NI foundation base slab. Additionally, the applicant stated the design of the NI foundation base slab reinforcing and concrete are in accordance with applicable codes and standards described in the Westinghouse AP1000 DCD Tier 2, Section 3.8, "Design of Category I Structures," and that no additional ITAAC are planned for the rebar and other embedded items and the concrete placement.

The staff used Section 3.8.5 of NUREG-0800 in its review of the applicant's LWA request that addresses the applicant's LWA request to construct the NI foundation base slab. The staff reviewed the applicant proposed scope of work: 1) the installation of reinforcing steel, sumps and drain lines and other embedded items in the NI foundation base slab; and 2) the placement of concrete for the NI foundation base slab for the purpose of safety analyses (i.e., the NI foundation base slab design and the site-specific seismic analysis). The applicant stated that the applicable safety analysis for the requested activities is addressed in the AP1000 DCD, the VEGP ESP SSAR, the VEGP COL FSAR and NUREG-1923. On the basis of its review of the applicable safety analysis as discussed above, the staff finds the applicant proposed scope of work to be acceptable. The staff's bases for accepting the applicant's proposed request was based on the applicant meeting the relevant requirements in 10 CFR 50.55(a), in that the foundation base slab is designed in accordance with American Concrete Institute (ACI)-349, "Code Requirements for Nuclear Safety Related Concrete Structures," as described in the Westinghouse AP1000 DCD Tier 2 Section 3.8, "Design of Category I Structures." Additionally, as part the AP1000 standard design review, the staff found the detailed design of the foundation base slab and method of construction to be consistent with NUREG-0800 Section 3.8.5 and, therefore, acceptable. The staff's review is described in the AP1000 SER, Section 3.8.5.

Consequently, the staff concludes that the LWA request is consistent with the applicable requirements of 10 CFR 50.10(d) for the installation of the NI foundation base slab, including placement of concrete.

ITAAC

- ESP Permit ITAAC

To address ESP ITTAC related waterproof membrane, the applicant proposed, in Part 10 of the COL application, certain ITAAC (Waterproof Membrane). Specifically, the applicant stated that the ITAAC identified in VEGP ESP SSAR Section 3.8.5 is incorporated by reference. The staff reviewed the VEGP ESP SSAR Section 3.8.5 and accepted the waterproof membrane ITAAC, as documented in the SER for the VEGP ESP and LWA applications. To complete the ITAAC, the applicant will conduct testing to confirm that the mudmat-waterproofing interface beneath the NI basemat has a minimum coefficient of friction to resist sliding of 0.7. However, because at this time the applicant has not yet completed the previously-approved waterproof membrane ITAAC and thus has not closed the waterproof membrane ITAAC, this ESP ITAAC will be included as ITAAC in the COL License condition

License Condition

- Part 10, License Condition 6

In its letter dated October 1, 2010, the applicant proposed to add another line item to proposed License Condition 6, addressing the availability to NRC inspectors of the schedule for the implementation of construction and inspection procedures related to concrete activities. Specifically, the applicant has proposed to add a new standard item to proposed License Condition 6 to read (where # is the next appropriate letter):

> #. the implementation of construction and inspection procedures for concrete filled steel plate modules activities before and after concrete placement, use of construction mock-ups, and inspection of modules before and after concrete placement as discussed in DCD Subsection 3.8.4.8.

The applicant's proposed new standard item related to concrete construction and inspection procedures will allow the staff sufficient time to inspect the procedures. Therefore, the staff finds the addition of this line item to proposed License Condition 6 acceptable.

Evaluation of Additional Information Submitted by Applicant

In a letter dated May 13, 2011, the applicant revised the proposed license condition regarding the implementation of construction and inspection procedures for steel concrete composite (SC) construction activities for seismic Category I NI modules (including shield building SC). The staff found these changes acceptable because they clarified the applicant commitment regarding construction procedure.

3.8.5.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the applicant proposed to include the following license condition:

- License Condition (3-4) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of Office of New Reactor (NRO) a schedule that supports planning for and conduct of NRC inspections of the implementation of construction and inspection procedures for steel concrete composite (SC) construction activities for seismic Category I nuclear island modules (including shield building SC) before and after concrete placement, and inspection of such construction before and after concrete placement. The schedule shall be updated every six months until 12 months before scheduled fuel loading, and every month thereafter until the procedures have been fully implemented.

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following ITTAC

- The licensee shall perform and satisfy the Waterproof Membrane ITAAC defined in Table 3.8-1, “Waterproof Membrane ITAAC.”

3.8.5.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff’s review confirmed that the applicant addressed the required information relating to foundations, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff’s technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements and in NUREG-1923.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A. The staff based its conclusion on the following:

- VEGP SUP 3.8-1 is acceptable because the applicant addressed the relevant information that meets the guidance in Section 2.5.4.5 of NUREG-1923. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDCs 1, 2, 4, and 5.

- VEGP SUP 3.8-3 is acceptable because the applicant addressed the relevant information that meets the guidance in Section 2.5.4.4 of NUREG-1923. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDCs 1, 2, 4, and 5.

- VEGP ESP VAR 1.6-2 is acceptable because the applicant addressed the relevant information that meets the guidance in Section 3.8.5 of NUREG-1923. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDCs 1, 2, 4, and 5.

- VEGP DEP 3.4-1 and VEGP COL 2.5-17 are acceptable because the applicant addressed the relevant information that meets the guidance in Section 3.8.5 of NUREG-1923 and Section 3.4.1.1.1.1 of the AP1000 DCD. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDCs 1, 2, 4, and 5

- STD COL 3.8-5 and STD COL 3.8-6 are acceptable because the applicant addressed the relevant information that meets the guidance in Sections 3.8.6.5 and 3.8.4.8 of the AP1000 DCD. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDCs 1, 2, 4, 5, RG 1.160 and 10 CFR 50.65.

3.9 Mechanical Systems and Components

Structural integrity and functional capability of various safety-related mechanical components are described. The design is not limited to ASME Code components and supports, but is extended to other components such as control rod drive mechanisms (CRDMs), certain reactor internals, and any safety-related piping designed to industry standards other than the ASME Code. The design includes issues as load combinations, allowable stresses, methods of analysis, summary of results, and preoperational testing. The evaluation of this section is focused on determining whether there is adequate assurance of a mechanical component performing its safety-related function under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events.

3.9.1 Special Topics for Mechanical Components

In Section 3.9.1, "Special Topics for Mechanical Components," design transients and methods of analysis are described for all seismic Category I components, component supports, core support (CS) structures, and reactor internals designated as Class 1, 2, 3 and CS under ASME Code, Section III, and those not covered by the ASME Code. Also included are the assumptions and procedures used for the inclusion of transients in the design and fatigue evaluation of ASME Code Class 1 and CS components and the computer programs used in the design and analysis of seismic Category I components and their supports, as well as experimental and inelastic analytical techniques.

Section 3.9 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.9.1, "Special Topics for Mechanical Components," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.9.2 Dynamic Testing and Analysis of Systems, Structures and Components

The criteria, testing procedures, and dynamic analyses employed to ensure the structural and functional integrity of piping systems, mechanical equipment, reactor internals, and their supports (including supports for conduit and cable trays, and ventilation ducts) under vibratory loadings, are addressed in this section. The loadings include those due to fluid flow (and especially loading caused by adverse flow conditions, such as flow instabilities over standoff pipes and branch lines in the steam system) and postulated seismic events.

Section 3.9 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.9.2, "Dynamic Testing and Analysis of Systems, Structures and Components," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.9.3 ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures

3.9.3.1 *Introduction*

The structural integrity and functional capability of pressure-retaining components, their supports, and CS structures are ensured by designing them in accordance with ASME Code, Section III, or other industrial standards. The loading combinations and their respective stress limits, the design and installation of pressure-relief devices, and the design and structural integrity of ASME Code Class 1, 2, and 3 components and component supports are included.

The criteria for the SSC design include the following considerations:

- Loading combinations, design transients, and stress limits
- Pump and valve operability assurance
- Design and installation criteria of Class 1, 2, and 3 pressure-relieving devices
- Component and piping supports

3.9.3.2 *Summary of Application*

Section 3.9 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.9 of the AP1000 DCD, Revision 19. Section 3.9 of the DCD includes Section 3.9.3. The ASE with confirmatory items for Section 3.9.3 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse created a new COL information item (COL 3.9-7). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Section 3.9.3, the applicant provided the following:

AP1000 COL Information Items

- STD COL 3.9-2

The applicant provided additional information in STD COL 3.9-2 (COL Information Item 3.9-2) that addresses reconciliation of the as-built piping design, to be completed by the COL holder after the construction of the piping systems and prior to fuel load. Evaluation of this particular COL Information Item is provided in Section 3.12 of this SER.

- STD COL 3.9-3

The applicant provided additional information in STD COL 3.9-3 (COL Information Item 3.9-3) that describes snubber design and testing, snubber installation requirements, and snubber preservice and inservice examination and testing.

- STD COL 3.9-5

The applicant provided additional information in STD COL 3.9-5 (COL Information Item 3.9-5) that addresses pressurizer surge line monitoring. Evaluation of this particular COL information item is provided in Section 3.12 of this SER.

- STD COL 3.9-7

In a letter dated April 23, 2010, the applicant proposed to add a new STD COL 3.9-7 to address COL Information Item 3.9-7. This COL item provides additional information on the process to be used to complete the piping design and ITAAC added to verify the design. Evaluation of this particular COL information item is provided in Section 3.12 of this SER.

Supplemental Information

- STD SUP 3.9-3

The applicant provided supplemental information in STD SUP 3.9-3 to describe snubber design and testing and snubber installation requirements.

3.9.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the ASME Code Class 1, 2, and 3 components, component supports, and CS structures are given in Section 3.9.3 of NUREG-0800.

3.9.3.4 *Technical Evaluation*

The NRC staff reviewed Section 3.9.3 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the functional design of ASME Code Class 1, 2, and 3 components and component supports and CS structures. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4

COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. There is a discussion of a difference between the BLN and VEGP FSARs following the standard content material. This standard content material is identified in this SER by use of italicized, double-indented formatting.

The following portion of this technical evaluation section is reproduced from Section 3.9.3.4 of the BLN SER:

AP1000 COL Information Items

- *STD COL 3.9-3 and STD SUP 3.9-3*

AP1000 DCD, Section 3.9.8.3, "Snubber Operability Testing," states that COL applicants referencing the AP1000 design will develop a program to verify operability of essential snubbers as outlined in Section 3.9.3.4.3, "Snubbers Used as Component and Piping Supports," and Section 3.9.3.4.4, "Inspection, Testing, Repair and/or Replacement of Snubbers." In the BLN COL FSAR, the applicant states in Section 3.9.8.3, "Snubber Operability Testing," that STD COL 3.9-3 is addressed in BLN COL FSAR Section 3.9.3.4.4, which incorporates by reference AP1000 DCD Section 3.9.3.4.4, with supplemental snubber information added to the end of the existing Section 3.9.3.4.4.

As indicated in the BLN COL FSAR, STD COL 3.9-3 contains a wide range of supplemental information on snubber design and testing requirements, snubber installation requirements, and snubber preservice and inservice examination and testing. It was not clear to the staff, however, whether STD COL 3.9-3 had provided the required information called for by AP1000 DCD, Section 3.9.8.3. In RAI 3.9.3-1, the staff requested that the applicant address the following: (1) clarify what was meant by "snubber operability testing" when the applicant prepared the COL information; (2) discuss whether the entire STD COL 3.9-3 represents BLN's plant-specific, updated snubber requirements, not already covered in AP1000 DCD, Section 3.9.3; (3) clarify whether all or part of STD COL 3.9-3 is related to snubber operability testing; (4) for the portions of STD COL 3.9-3 which are not related to snubber operability testing, explain why they are included as part of the COL item; (5) discuss all the pertinent codes and standards on which STD COL 3.9-3 is based to assure snubber operability; and

(6) discuss the need to modify the content and the physical placement of STD COL 3.9-3 in the BLN COL FSAR.

In its response, the applicant explained that information presented in BLN COL FSAR Section 3.9.3.4.4 regarding snubber testing includes information specific to qualification and installation tests and examinations for snubbers included in the inservice testing (IST) program and preservice examination and testing programs; and information specifically related to snubber inservice examination and testing. The applicant acknowledges, therefore, that not all information added by STD COL 3.9-3 is related specifically to snubber "operability testing." The applicant also noted that BLN COL FSAR Section 3.9.3.4.4 has been subjected to a revision responding to a separate staff RAI on snubber IST programs. Details of the applicant's responses to the RAI are provided in the following:

(1) For the purpose of STD COL 3.9-3, operability testing encompasses the preservice and inservice examinations and testing required by the ASME Code for Operation and Maintenance (OM) for Nuclear Power Plants (ASME OM Code), Subsection ISTD, "Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Nuclear Power Plants" as described in BLN COL FSAR Section 3.9.3.4.4.c and Section 3.9.3.4.4.d (as revised in applicant's response to RAI 3.9.6-3).

(2) In order to provide a complete description of the snubber operability testing program, that is, the preservice and IST programs for snubbers, additional information was provided in BLN COL FSAR Section 3.9.3.4.4 as indicated in the applicant's letter to the NRC in response to RAI 3.9.6-3. Previously, only snubber preservice examination and testing had been described in BLN COL FSAR Section 3.9.3.4.4.c.

(3) As noted above, some of the information provided in the original BLN COL FSAR Section 3.9.3.4.4 relates to snubber qualification testing and examinations and snubber installation verification requirements. These activities are considered precursors to the snubber operability testing that will be conducted in accordance with the ASME OM Code, Subsection ISTD.

(4) The information not specifically related to STD COL 3.9-3 operability testing, i.e., Sections 3.9.3.4.4.a and 3.9.3.4.4.b, should have been labeled as standard supplemental information, using the left margin annotation STD SUP 3.9-3.

(5) Snubber operability testing is to be conducted during implementation of the preservice and ISI and testing programs in accordance with the requirements of the ASME OM Code, Subsection ISTD. As indicated in the first paragraph of BLN COL FSAR Section 3.9.3.4.4, the description of the program provided in the BLN COL FSAR is based on the 2001 Edition through the 2003 Addenda of the ASME OM Code. However, the initial IST program for snubbers will incorporate the latest

Edition and Addenda of the ASME OM Code approved in 10 CFR 50.55a(f) on the date 12 months before initial fuel load.

(6) BLN COL FSAR Section 3.9.3.4.4 will be revised as indicated in the Application Revision section of this response to segregate the snubber operability testing from the remaining portions of the section (i.e., the snubber design and qualification testing, and the snubber installation requirements) and to include the appropriate left margin annotation. In addition, to maintain consistency, to the extent possible, with other industry COL applications, Section 3.9.3.4.4.a is revised to clarify and expand on snubber qualification examination and testing. Finally, minor editorial changes are made to the Section 3.9.3.4.4.c changes provided in the applicant's letter to the NRC in response to RAI 3.9.6-3. Additionally, changes will be made to the introductory (roadmap) paragraph for BLN COL FSAR Section 3.9.3.4.4 indicating it is a new subsection to follow DCD Section 3.9.3.4.3.

The staff found that above responses provided by the applicant to be adequate in clarifying that the information for snubber operability testing originally provided in STD COL 3.9-3 was primarily intended for preservice and inservice examination and testing. The staff also found that the supplemental information provided under a new STD SUP 3.9-3, for snubber design and qualification testing, and the snubber installation requirements includes a better description for snubber design and qualification testing, and is more consistent with other industry COL applications. The staff confirmed that Revision 1 has incorporated all the changes as required. RAI 3.9.3-1 is closed.

Clarification of BLN SER Standard Content

Based on the staff's review of the standard content, there were two minor changes of an editorial nature that were found not to affect the staff's conclusion. The first paragraph discussed in Item (5) above was moved in the final VEGP COL FSAR such that it is appropriately included with the write up specific to STD COL 3.9-3. The introductory (roadmap) paragraph was not changed as described following Item (6) above because the AP1000 DCD was modified to include a paragraph numbered "3.9.3.4.4." As a result, the new text was added to an existing section as opposed to being a standalone section.

Resolution of Difference Between FSARs

In Section 3.9.3.4.4 of the BLN COL FSAR, the BLN applicant stated that a list of snubbers on systems, which experience sufficient thermal movement to measure cold to hot position, is included as part of the testing program after piping analysis has been completed. In Section 3.9.3 of the VEGP COL FSAR, the VEGP applicant provides Table 3.9-201 with this list of snubbers. The addition of a list of snubbers on systems which experience sufficient thermal movement to measure cold to hot position to the VEGP COL FSAR is acceptable to the staff.

3.9.3.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

3.9.3.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to ASME Code Class 1, 2, and 3 components, component supports and CS structures, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR Part 52, "Licenses, certifications, and approvals for nuclear power plants." The staff based its conclusion on the following:

- STD COL 3.9-3 and STD SUP 3.9-3 are acceptable because the applicant addressed the relevant information that meets the guidance in Section 3.9.3 of NUREG-0800. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDCs 1 and 4.

3.9.4 Control Rod Drive System

The control rod drive system (CRDS) consists of the control rods and the related mechanical components that provide the means for mechanical movement. As discussed in GDC 26, "Reactivity Control System Redundancy and Capability," and GDC 27, "Combined Reactivity Control Systems Capability," the CRDS provides one of the independent reactivity control systems. The rods and the drive mechanism are capable of reliably controlling reactivity changes either under conditions of anticipated operational occurrences, or under postulated accident conditions. A positive means for inserting the rods is always maintained to ensure appropriate margin for malfunction, such as stuck rods. Because the CRDS is a safety-related system and portions of the CRDS are a part of the RCPB, the system is designed, fabricated, and tested to quality standards commensurate with the safety-related functions to be performed. This provides an extremely high probability of accomplishing the safety-related functions either in the event of anticipated operational occurrences or in withstanding the effects of postulated accidents and natural phenomena such as earthquakes, as discussed in GDC 1, 2, 14, and 29, "Protection Against Anticipated Operational Occurrences," and 10 CFR 50.55a.

Section 3.9 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.9.4, "Control Rod Drive System (CRDS)," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.9.5 Reactor Pressure Vessel Internals

AP1000 reactor internals consist of two major assemblies - the lower internals and the upper internals. The reactor internals provide the protection, alignment and support for the core, control rods, and gray rods to provide safe and reliable reactor operation. In addition, the reactor internals help to accomplish the following: direct the main coolant flow to and from the fuel assemblies; absorb control rod dynamic loads, fuel assembly loads, and other loads and transmit these loads to the reactor vessel; support instrumentation within the reactor vessel;

provide protection for the reactor vessel against excessive radiation exposure from the core; and position and support reactor vessel radiation surveillance specimens.

Section 3.9 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.9.5, "Reactor Pressure Vessel Internals," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.9.6 Inservice Testing of Pumps and Valves (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints")

3.9.6.1 *Introduction*

In this section, the NRC staff describes its review of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints as required by the NRC regulations in 10 CFR Part 52 and 10 CFR 50.55a for VEGP Units 3 and 4. RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," discusses the Commission's position provided in SECY-05-0197, "Review of Operational Programs in a Combined License Application and General Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria" that operational programs should be fully described in COL applications to avoid the need to specify ITAAC for those programs. The applicant relies on the VEGP COL FSAR with its incorporation by reference of the AP1000 DCD and supplemental information to fully describe the IST and motor-operated valve (MOV) testing operational programs in support of the COL application for VEGP Units 3 and 4.

3.9.6.2 *Summary of Application*

Section 3.9 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.9 of the AP1000 DCD, Revision 19. Section 3.9 of the DCD includes Section 3.9.6.

In addition, in VEGP COL FSAR Section 3.9.6, the applicant provided the following:

AP1000 COL Information Item

- STD COL 3.9-4

The applicant provided additional information in several sections of VEGP COL FSAR Section 3.9.6 in response to STD COL 3.9-4 to supplement the AP1000 DCD provisions to fully describe the IST and MOV testing programs for VEGP Units 3 and 4. For example, the VEGP COL FSAR supplements the provisions in the AP1000 DCD with respect to the Edition and Addenda of the ASME OM Code applicable to the description of the IST program for VEGP Units 3 and 4, determination of the MOV testing frequency, operability testing of power-operated valves (POVs) other than MOVs, performance of check valve exercise tests, and plans to apply alternatives to the ASME OM Code. Under STD COL 3.9-3, the applicant supplemented the AP1000 DCD provisions for design, installation, preservice examination and testing, and inservice examination and testing of dynamic restraints (snubbers) in VEGP COL FSAR Section 3.9.3.4.4, "Inspection, Testing, Repair, and/or Replacement of Snubbers."

The AP1000 DCD addresses the functional design and qualification of mechanical equipment to be used at an AP1000 nuclear power plant in several DCD sections. For example, Section 3.9.3.2, "Pump and Valve Operability Assurance," states that criteria are developed to assess the functional capability of required components to operate. Section 3.9.3.2.2, "Valve Operability," indicates that operational tests will be performed to verify that valves open and close prior to installation. This section also specifies cold hydro tests, hot functional tests, periodic ISIs, and periodic inservice operations to be performed in situ to verify the functional capability of the valves. Section 5.4.8, "Valves," includes provisions regarding design and qualification, and preoperational testing of valves within the scope of those systems, and refers to these activities for other safety-related valves. Section 5.4.8.3, "Design Evaluations," specifies that the requirements for qualification testing of power-operated active valves are based on ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." Section 5.4.9, "Reactor Coolant System Pressure Relief Devices," includes provisions for design, testing, and inspection of relief devices in the reactor coolant system. Section 5.4.10, "Component Supports," includes provisions for design, testing, and inspection of component supports in the reactor coolant system. The VEGP COL FSAR incorporates by reference these specific sections in the AP1000 DCD.

With respect to flow-induced vibration (FIV) of plant components, AP1000 DCD Section 3.9.2, "Dynamic Testing and Analysis," describes tests to confirm that piping, components, restraints, and supports have been designed to withstand the dynamic effects of steady-state FIV and anticipated operational transient conditions. Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," states that the purpose of the expansion, vibration and dynamic effects testing is to verify that the safety-related, high energy piping and components are properly installed and supported such that, in addition to other factors, vibrations caused by steady-state or dynamic effects do not result in excessive stress or fatigue to safety-related plant systems. The VEGP COL FSAR incorporates by reference these sections in the AP1000 DCD.

AP1000 DCD, Section 3.9.3.4.4, "Inspection, Testing, Repair, and/or Replacement of Snubbers," specifies that a program for inservice examination and testing of dynamic supports (snubbers) to be used in the AP1000 reactor will be prepared in accordance with the requirements of the ASME OM Code, Subsection ISTD, "Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Nuclear Power Plants." Section 3.9.3.4.4 indicates that details of the snubber inservice examination and testing program, including test schedules and frequencies, will be reported in the ISI and testing plan included in the IST Program required by Section 3.9.8.3, "Snubber Operability Testing." Section 3.9.8.3 states that COL applicants referencing the AP1000 design will develop a program to verify operability of essential snubbers. The VEGP COL FSAR provides supplemental information for Section 3.9.3.4.4 regarding snubbers. For example, VEGP COL FSAR Section 3.9.3.4.4 includes provisions for snubber design and testing with specifications that snubber qualification and production testing will satisfy the applicable sections of the ASME *Boiler and Pressure Vessel Code* (B&PV Code); the ASME OM Code; and ASME Standard QME-1-2007. VEGP COL FSAR Section 3.9.3.4.4 also describes the inservice examination and testing of safety-related snubbers in accordance with the requirements of the ASME OM Code, Subsection ISTD. The description includes specifications for initial and subsequent examination intervals, visual examination attributes, IST methods and intervals, establishment of snubber test groups, response to examination and test results, snubber repair and replacement, post-maintenance examination and testing, and establishment and monitoring of snubber service life. VEGP COL FSAR Table 3.9-201, "Safety Related Snubbers," provides

a list of safety-related snubbers to be installed at VEGP, including the snubber identification number and the associated system or component.

AP1000 DCD, Section 3.9.6, "Inservice Testing of Pumps and Valves," provides a general description of the IST Program to be developed for AP1000 reactors. Table 3.9-16, "Valve Inservice Test Requirements," in AP1000 DCD, lists valves within the scope of the IST Program provided in support of the AP1000 DC, and indicates the valve tag number, valve and actuator type, safety-related missions, safety functions, ASME Code Class and IST Category, and IST type and frequency. VEGP COL FSAR Section 3.9.6 incorporates by reference AP1000 DCD, Section 3.9.6 with supplemental information in several areas. For example, the applicant states that the description of the IST Program for VEGP Units 3 and 4 is based on the ASME OM Code, 2001 Edition through 2003 Addenda. The applicant also indicates that the initial IST Program will incorporate the latest Edition and Addenda of the ASME OM Code approved in 10 CFR 50.55a(f) on the date 12 months before initial fuel load. In the VEGP COL FSAR, the applicant describes the periodic testing program for POVs other than MOVs that incorporates lessons learned based on nuclear power plant operating experience and research programs for MOV performance. The applicant also indicates its plan to apply Revision 1 to ASME OM Code Case OMN-1, "Alternative Rules for the Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light Water Reactor Power Plants," as an alternative to the quarterly MOV stroke-time testing provisions in the ASME OM Code, and to satisfy the supplemental requirements specified in 10 CFR 50.55a(b)(3)(ii) to ensure that MOVs continue to be capable of performing their design-basis safety functions. The VEGP COL FSAR does not identify any additional plant-specific valves to be included in the IST Program beyond those listed in AP1000 DCD, Table 3.9-16.

License Conditions

- Part 10, License Condition 3, Items G2 and G5

The applicant proposed a license condition providing the implementation milestones for the Preservice Testing Program and MOV Testing Program.

- Part 10, License Condition 6

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs including the Preservice Testing Program and MOV Testing Program.

3.9.6.3 *Regulatory Basis*

The regulatory basis of the design-related information incorporated by reference is addressed in the FSER related to the DCD.

The regulatory basis for the NRC staff's review of the VEGP COL FSAR is provided by 10 CFR Parts 50 and 52. Specifically, the NRC regulations in 10 CFR 52.79(a) require that the COL application include information at a level sufficient to enable the Commission to reach a final conclusion on all safety matters that must be resolved by the Commission before COL issuance. For example, paragraph (4) in 10 CFR 52.79(a) requires that a COL application include the design of the facility with specific reference to the GDC in Appendix A to 10 CFR Part 50, which establish the necessary design, fabrication, construction, testing, and performance requirements for SSCs that provide reasonable assurance that the facility can be

operated without undue risk to the health and safety of the public. Paragraph (11) in 10 CFR 52.79(a) requires that a COL application provide a description of the programs and their implementation necessary to ensure that the systems and components meet the requirements of the ASME BPV Code and the ASME OM Code in accordance with 10 CFR 50.55a. Paragraph (29)(i) in 10 CFR 52.79(a) requires that a COL application provide plans for conduct of normal operations, including maintenance, surveillance, and periodic testing of SSCs. Paragraph (37) in 10 CFR 52.79(a) requires that a COL application provide the information necessary to demonstrate how operating experience insights have been incorporated into the plant design.

RG 1.206 provides guidance for a COL applicant in preparing and submitting its COL application in accordance with the NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that need to be included in the FSAR for a COL application to allow a reasonable assurance finding of acceptability. In particular, a COL applicant should fully describe the IST, MOV testing, and other operational programs as defined in Commission Paper SECY-05-0197 to avoid the need for ITAAC for the implementation of those programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms for scope and level of detail to allow a reasonable assurance finding of acceptability. Further, operational programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the SRM for SECY-05-0197, dated February 22, 2006.

The NRC staff followed Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints," of NUREG-0800 in its review of the VEGP COL application. The staff also compared the VEGP COL FSAR information with the guidance provided in RG 1.206. Appendix 1AA, "Conformance with Regulatory Guides," indicates that the COL application conforms to RG 1.206 without exceptions related to the IST Program. In addition, Table 1.9-202, "Conformance with SRP Acceptance Criteria," in the VEGP COL FSAR indicates that the COL application conforms to NUREG-0800, Section 3.9.6.

3.9.6.4 *Technical Evaluation*

The NRC staff reviewed Section 3.9.6 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to functional design, qualification and IST programs for pumps, valves, and dynamic restraints. The results of the NRC staff's evaluation of the design-related information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements. The results of the staff's review of the material in the AP1000 DCD related to the IST operational program for pumps, valves, and dynamic restraints are in this SER section.

In its letter dated December 17, 2008, Southern Nuclear Operating Company (SNC) listed the RAIs prepared by the NRC staff on the BLN Units 3 and 4 COL application. In that letter, SNC endorsed the responses, including proposed changes to the FSAR, submitted by the Tennessee Valley Authority (TVA) on 16 RAIs related to the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints as applicable to the VEGP COL application. In letters dated December 14, 2009, and January 12, March 1, and May 14, 2010,

SNC described its plans to resolve open items identified in the "SER with open items on the standard content information" prepared by the NRC staff on the description of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints in the BLN Units 3 and 4 COL application. The NRC staff has reviewed the SNC letters and Revision 2 to the VEGP COL FSAR to determine whether the description of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints in the VEGP COL application with its incorporation by reference of the AP1000 DCD meets the regulatory requirements to provide reasonable assurance that those components at VEGP will be capable of performing their safety functions if these programs are developed and implemented consistent with the description in the VEGP COL FSAR and AP1000 DCD.

The staff reviewed the information in the VEGP COL FSAR, and the staff's review of the standard content open item is provided.

AP1000 COL Information Item

- STD COL 3.9-4

The NRC staff reviewed STD COL 3.9-4 related to COL Information Item 3.9-4 included in AP1000 DCD Tier 2, Section 3.9.8.4. COL Information Item 3.9-4 states:

> Combined License applicants referencing the AP1000 design will develop an inservice test program in conformance with the valve inservice test requirements outlined in subsection 3.9.6 and Table 3.9-16. For power-actuated valves, the requirements for operability testing shall be based on subsection 3.9.6.2.2. This program will include provisions for nonintrusive check valve testing methods and the program for valve disassembly and inspection outlined in subsection 3.9.6.2.3. The Combined License applicant will complete an evaluation as identified in subsection 3.9.6.2.2 to determine the frequency of power-operated valve operability testing.

The information item for COL applicants to develop an IST Program was specified as COL Action Item 3.9.6.4-1 in Appendix F of NUREG-1793, which states:

> The COL applicant will provide an inservice test (IST) program that complies with the inservice testing requirements for valves.

In STD COL 3.9-4, the applicant states that this COL item is addressed in Sections 3.9.6, 3.9.6.2.2, 3.9.6.2.3, 3.9.6.2.4, 3.9.6.2.5, and 3.9.6.3 for the VEGP COL application.

In this section of the SER, the NRC staff describes its review of the VEGP COL FSAR with the incorporation by reference of the AP1000 DCD for an acceptable description of the functional design, qualification, and IST programs, including the MOV Testing Program, for VEGP Units 3 and 4 to provide reasonable assurance that the safety-related components within the scope of the VEGP IST Program will be capable of performing their safety functions in accordance with the NRC regulations and the ASME Code requirements.

AP1000 DCD Tier 2, Section 3.9.6.1, "Inservice Testing of Pumps," specifies that the AP1000 reactor design does not include pumps with safety functions with the exception of the coastdown of the reactor coolant pumps. As determined in NUREG-1793, the NRC staff considers the IST Program scope for the AP1000 design with respect to pumps to be

acceptable. Therefore, the NRC staff did not include pumps in the review of the IST Program for safety-related components at VEGP Units 3 and 4.

VEGP COL FSAR Section 3.9.6 states that the description of the IST Program for VEGP Units 3 and 4 is based on the ASME OM Code, 2001 Edition through 2003 Addenda, and that the limitations and modifications set forth in 10 CFR 50.55a will be incorporated. The NRC regulations in 10 CFR 50.55a incorporate by reference the ASME OM Code, 2001 Edition through 2003 Addenda, with certain limitations and modifications. Therefore, the NRC staff considers the application of the ASME OM Code, 2001 Edition through 2003 Addenda, as incorporated by reference in the NRC regulations with applicable limitations and modifications, to be acceptable for the VEGP IST Program description in support of the VEGP COL application. As specified in 10 CFR 50.55a, a COL licensee is required to incorporate in its IST Program the latest Edition and Addenda of the ASME OM Code approved in 10 CFR 50.55a(f) on the date 12 months before initial fuel load.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Table 3.9-16, "Valve Inservice Test Requirements," that includes the valve type, safety-related missions, safety functions, the ASME Code IST category, and IST type and frequency. The NRC staff considers this table to be sufficient in describing the IST Program in support of the VEGP COL application. Following the issuance of the VEGP COL, the guidance in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," can be used to develop the VEGP IST Program, including the specific information to be included in the IST Program documentation and tables for NRC inspection.

On March 26 and 27, 2008, the NRC staff held a public meeting to discuss the NRC's review of the description of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints in COL applications referencing the AP1000 certified design and the AP1000 DC amendment application. At the public meeting, Westinghouse stated that it would make information available on the functional design and qualification of safety-related valves and dynamic restraints within the scope of the AP1000 DCD in design and procurement specifications that will be applicable to AP1000 COL applications. On October 14 and 15, 2008, the NRC staff conducted an audit of design and procurement specifications for pumps, valves, and dynamic restraints to be used for the AP1000 reactor at the Westinghouse office in Monroeville, Pennsylvania. In a memorandum dated November 6, 2008, the NRC staff documented the results of the onsite review with specific open items. For example, the staff found that Westinghouse had included ASME Standard QME-1-2007 in its design and procurement specifications for AP1000 components. ASME QME-1-2007 incorporates lessons learned from valve testing and research programs performed by the nuclear industry and the NRC Office of Nuclear Regulatory Research. Also, AP1000 DCD Tier 2 has been revised in Section 5.4.8.3 to specify that the provisions for qualification testing of power-operated active valves will be based on ASME QME-1-2007. In September 2009, the NRC issued RG 1.100, "Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," Revision 3, which accepts the use of ASME QME-1-2007, with certain staff positions, for the functional design and qualification of safety-related pumps, valves, and dynamic restraints. In a letter dated January 26, 2010, Westinghouse provided its planned response to the audit follow-up items. In a letter dated December 14, 2009, SNC stated, in response to Standard Content Open Item 3.9-1 in the "SER with open items" on the BLN COL application, that it had not identified any specific actions for the VEGP COL application based on the audit open items. The NRC staff discussion of the audit of the design and procurement specifications for pumps, valves, and dynamic restraints to

be used for the AP1000 reactor is in the SER on the AP1000 DC amendment application. Therefore, the staff considers Standard Content Open Item 3.9-1 resolved.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Section 3.9.3.4, "Component and Piping Supports," and adds a new Section 3.9.3.4.4, "Inspection, Testing, Repair and/or Replacement of Snubbers." VEGP COL FSAR Section 3.9.3.4.4 specifies that snubber design and testing will satisfy the applicable sections of the ASME BPV Code, ASME OM Code, and ASME QME-1-2007. Further, VEGP COL FSAR Section 3.9.3.4.4 describes the snubber inservice examination and testing program for VEGP Units 3 and 4. For example, the FSAR specifies that the inservice examination and testing of safety-related snubbers will be conducted in accordance with the requirements of the ASME OM Code, Subsection ISTD. The inservice visual examination will be performed to identify physical damage, leakage, corrosion, degradation, indication of binding, misalignment or deformation, and potential defects generic to a particular design. Snubbers will be tested in service to determine operational readiness during each fuel cycle, beginning no sooner than 60 days before the start of the refueling outage. Defined test plan groups will be established and snubbers in each group will be tested each fuel cycle according to an established sampling plan. Unacceptable snubbers will be adjusted, modified, or replaced. Service life for snubbers will be established, monitored, and adjusted in accordance with ASME OM Code, ISTD-6000, "Service Life Monitoring," and ASME OM Code, Appendix F, "Dynamic Restraints (Snubbers) Service Life Monitoring Methods." In addition, VEGP COL FSAR Table 3.9-201 provides a list of safety-related snubbers to be installed at VEGP, including the snubber identification number and the associated system or component. Revision 3 to RG 1.100 accepts with certain conditions the use of ASME QME-1-2007 for the functional design and qualification of dynamic restraints. The NRC staff finds that the provisions in the VEGP COL FSAR, together with the AP1000 DCD, provide an acceptable description of the inservice examination and testing program for dynamic restraints that support a finding that the program, when developed and implemented, will satisfy the 10 CFR 50.55a regulatory requirements.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Section 3.9.6.2.2, "Valve Testing," with supplemental information. Table 3.9-16 in AP1000 DCD lists the valves in the IST Program for the AP1000 design. VEGP COL FSAR Section 3.9.6.2.2 includes provisions for (a) the establishment of reference values; (b) the prohibition of preconditioning that undermines the purpose of IST activities; (c) comparison of stroke time to the reference value except for fast-acting valves for which a stroke-time limit of 2 seconds is assigned; (d) determination of valve obturator movement during valve exercise tests; (e) testing of solenoid-operated valves; (f) preoperational testing of check valves; (g) acceptance criteria for check valve tests; (h) use of nonintrusive techniques for check valve tests; (i) test conditions for check valve tests; (j) post-maintenance testing for check valves; (k) check valve disassembly and testing; and (l) re-establishment of reference values following maintenance. The VEGP COL FSAR also includes provisions for valve disassembly and inspection; valve preservice tests; and valve replacement, repair, and maintenance in Sections 3.9.6.2.3 to 3.9.6.2.5. The NRC staff finds that these provisions in the VEGP COL FSAR are consistent with Subsection ISTC of the ASME OM Code incorporated by reference in 10 CFR 50.55a, and therefore, are acceptable.

In its letter dated March 1, 2010, SNC provided its planned response for VEGP to Standard Content Open Item 3.9-2 on POV operability tests discussed in the "SER with open items" on the BLN COL application. The NRC staff review of the response by SNC to the three issues in this open item is discussed below.

First, SNC states in its letter dated March 1, 2010, that TVA had indicated in its response to BLN RAI 3.9.6-8 that the BLN COL FSAR would be revised to indicate that MOV testing will apply the provisions of ASME OM Code Case OMN-1 (Revision 1) and the guidance in the Joint Owners Group (JOG) MOV Periodic Verification Program including the applicable NRC safety evaluation (and its supplement) for periodic verification of the design-basis capability of safety-related MOVs. SNC did not consider additional changes to the VEGP COL FSAR to be necessary. The NRC staff finds that the VEGP COL FSAR with its incorporation by reference of the AP1000 DCD (including the planned DCD changes) will address the use of JOG MOV Periodic Verification Program. As the AP1000 IST Program applies the JOG MOV Periodic Verification Program, SNC will need to confirm that MOVs provided by the valve supplier and their application at VEGP Units 3 and 4 are within the scope of the JOG program. The planned use of ASME OM Code Case OMN-1 (Revision 1) is addressed below in this SER section.

Second, SNC provides in its letter dated March 1, 2010, a planned revision to the VEGP COL FSAR that specifies the use of Revision 1 to ASME OM Code Case OMN-1 as an alternative to the quarterly MOV stroke-time testing provisions in the ASME OM Code. In the letter, SNC notes that RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," accepts the use of Revision 0 to ASME OM Code Case OMN-1 with three conditions. SNC considers Revision 1 to ASME OM Code Case OMN-1 to represent a superior alternative to Revision 0 to ASME OM Code Case OMN-1 by addressing the conditions on the use of the Code case specified in RG 1.192. In a telephone discussion on April 13, 2010, the NRC staff requested that SNC address the specific provisions in RG 1.192 in justifying the use of Revision 1 to ASME OM Code Case OMN-1 as an alternative to the MOV stroke-time provisions in the ASME OM Code pursuant to 10 CFR 50.55a(a)(3)(i).

In a letter dated May 14, 2010, SNC modified its response to Standard Content Open Item 3.9-2 to provide a planned revision to the VEGP COL FSAR in Section 3.9.6.3 in support of the request to apply Revision 1 to Code Case OMN-1 as an alternative to the quarterly IST stroke-time provisions in the ASME OM Code. The NRC staff has accepted the application of ASME OM Code Case OMN-1 (Revision 0) in RG 1.192 with certain conditions. In the planned VEGP COL FSAR revision, SNC has addressed those conditions as they apply to the requested use of ASME OM Code Case OMN-1 (Revision 1) at VEGP Units 3 and 4. In particular, the VEGP COL FSAR revision specifies that the IST Program will incorporate the provisions in RG 1.192 by providing that the adequacy of the diagnostic test interval for each MOV will be evaluated and adjusted as necessary, but not later than 5 years or three refueling outages (whichever is longer) from the initial implementation of the Code case. The planned VEGP COL FSAR revision also states that the potential increase in core damage frequency (CDF) and risk associated with extending high-risk MOV test intervals beyond quarterly will be determined to be small and consistent with the intent of the Commission's Safety Goal Policy Statement. The VEGP COL FSAR also specifies this provision as consistent with the conditions specified in RG 1.192 for application of ASME OM Code Case OMN-11, "Risk-Informed Testing of Motor-Operated Valves," which has been incorporated into Revision 1 to ASME OM Code Case OMN-1. The planned VEGP COL FSAR revision specifies that risk insights will be applied using MOV risk ranking methodologies accepted by the NRC on a plant-specific or industry-wide basis, consistent with the conditions in the applicable safety evaluations. The planned VEGP COL FSAR revision also indicates that the benefits for performing any particular test will be balanced against the potential adverse effects placed on the valve or system caused by this testing. The VEGP COL FSAR indicates that use of Revision 1 to ASME OM Code Case OMN-1 will be appropriate for the ASME OM Code 2001 Edition with the 2003 Addenda that is the basis for the description of the VEGP Units 3 and 4 IST Program in support of the COL application. The NRC staff finds that the provisions to be specified in the VEGP COL FSAR for

the use of Revision 1 to ASME OM Code Case OMN-1 satisfy the conditions specified in RG 1.192 for the use of Revision 0 to ASME OM Code Case OMN-1. The staff considers Revision 1 in ASME OM Code Case OMN-1 to continue to provide an acceptable technical approach for MOV diagnostic testing as an alternative to quarterly MOV stroke-time testing, and that the changes from Revision 0 to Revision 1 reflect improvements for user application and incorporation of ASME OM Code Case OMN-11. Pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the use of ASME OM Code Case OMN-1 (Revision 1) requested by SNC as an alternative to the quarterly MOV stroke-time testing provisions in the ASME OM Code for VEGP Units 3 and 4 on the basis that the proposed alternative provides an acceptable level of quality and safety and therefore, Standard Content Open Item 3.9-2 is resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as **Confirmatory Item 3.9-1**.

Resolution of Standard Content Confirmatory Item 3.9-1

Confirmatory Item 3.9-1 is an applicant commitment to revise its FSAR Table 1.9-201, Section 3.9.6.3, Section 3.9.6.2.2, and Section 3.9.9, to address IST of valves. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-1 is now closed.

Third, SNC in its March 1, 2010, submittal provides several planned changes to the VEGP COL FSAR to clarify the provisions that would be redundant when combined with the valve testing provisions in the AP1000 DCD. The NRC staff considers the proposed changes to the VEGP COL FSAR to be acceptable because these provisions are incorporated by reference as part of the AP1000 DCD. The incorporation of the planned VEGP COL FSAR changes will be tracked as part of **Confirmatory Item 3.9-2**.

Resolution of Standard Content Confirmatory Item 3.9-2

Confirmatory Item 3.9-2 is an applicant commitment to revise its FSAR. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-2 is now closed.

In light of the weaknesses in the IST provisions in the ASME OM Code for quarterly MOV stroke-time testing, the NRC issued Generic Letter (GL) 96-05, “Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves,” to request that nuclear power plant licensees establish programs to assure the capability of safety-related MOVs to perform their design-basis functions on a periodic basis. Further, the NRC revised 10 CFR 50.55a to require that nuclear power plant licensees supplement the quarterly MOV stroke-time testing provisions specified in the ASME OM Code with a program to ensure that MOVs continue to be capable of performing their design-basis safety functions. In its letter dated March 1, 2010, SNC provided its response to Standard Content Open Item 3.9-3 related to MOV testing in the “SER with open items” on the BLN COL application. The NRC staff review of the response by SNC to the six issues in this open item is discussed below:

First, SNC notes the planned use of Revision 1 to ASME OM Code Case OMN-1 as part of the IST Program to be developed for VEGP. As discussed above in this SER section, the NRC staff authorized the use of Revision 1 to ASME OM Code Case OMN-1 at VEGP Units 3 and 4.

Second, SNC states that the MOV Testing Program at VEGP will implement the JOG MOV Periodic Verification Program as described in the VEGP COL FSAR and AP1000 DCD. As indicated above, the NRC staff finds that the VEGP COL FSAR with its incorporation by

reference of the AP1000 DCD (including the planned DCD changes) will address the use of the JOG MOV Periodic Verification Program. Other necessary changes to the VEGP COL FSAR regarding MOV testing are discussed in this SER section.

Third, SNC indicates that MOV output capability will be determined using the provisions of ASME OM Code Case OMN-1. The NRC staff has reviewed ASME OM Code Case OMN-1 as part of its acceptance in RG 1.192, and has determined that the Code case provides acceptable provisions for diagnostic testing to determine the output capability of MOVs.

Fourth, SNC describes MOV testing using the guidance in the JOG MOV Periodic Verification Program and Revision 1 to ASME OM Code Case OMN-1 to periodically determine the capability of MOVs to perform under design-basis conditions. The NRC staff has reviewed the JOG MOV Periodic Verification Program as part of its acceptance in an NRC safety evaluation dated September 25, 2006 with a supplement dated September 18, 2008, and has reviewed ASME OM Code Case OMN-1 as part of its acceptance in RG 1.192. From those evaluations, the staff has determined that the JOG MOV Periodic Verification Program and ASME OM Code Case OMN-1 will demonstrate continued MOV capability to open and close under design-basis conditions. As discussed above in this SER section, the NRC staff authorized the use of Revision 1 to ASME OM Code Case OMN-1 at VEGP Units 3 and 4.

Fifth, SNC notes that the initial test frequency of POVs will be based on the ASME OM Code or applicable ASME OM Code cases. For example, the VEGP COL FSAR specifies that the IST frequency will be determined as specified by ASME OM Code Case OMN-1. Further, the JOG MOV Periodic Verification Program with the NRC safety evaluation and its supplement includes provisions for MOV test frequencies based on risk ranking and functional margin with a maximum diagnostic test interval of 10 years. The staff considers these provisions in the VEGP COL FSAR and the AP1000 DCD for POV test frequency to incorporate lessons learned from MOV testing and research programs, and therefore, to be acceptable.

Sixth, SNC describes provisions for successful completion of MOV testing at VEGP in its March 1, 2010, letter, and provides several planned changes to the VEGP COL FSAR. For example, SNC provides a planned FSAR change to specify the use of ASME OM Code Case OMN-1, Revision 1. SNC also plans to revise the FSAR to specify that the design-basis capability testing of MOVs will apply guidance from GL 96-05 and the JOG MOV Periodic Verification Program. SNC will revise the FSAR to note the need to consider degraded voltage, control switch repeatability, and load-sensitive MOV behavior in ensuring that MOVs have adequate capability margin, in addition to the consideration of age-related degradation. SNC provides a proposed addition to the description of the MOV test frequency determination in the FSAR that will specify that maximum torque and/or thrust (as applicable) achieved by the MOV (allowing sufficient margin for diagnostic equipment inaccuracies and control switch repeatability) must not exceed the allowable structural and undervoltage motor capability limits for the individual parts of the MOV. SNC provides a proposed addition to the description of POV operability testing that specifies that successful completion of the preservice testing and IST of MOVs, in addition to MOV testing as required by 10 CFR 50.55a, will demonstrate that the following criteria are met for each valve tested: (i) valve fully opens and/or closes as required by its safety function; (ii) adequate margin exists and includes consideration of diagnostic equipment inaccuracies, degraded voltage, control switch repeatability, load-sensitive MOV behavior, and margin for degradation; and (iii) maximum torque and/or thrust (as applicable) achieved by the MOV (allowing sufficient margin for diagnostic equipment inaccuracies and control switch repeatability) does not exceed the allowable structural and undervoltage motor capability limits for the individual parts of the MOV. In its letter dated

May 14, 2010, SNC provided an additional planned revision to the VEGP COL FSAR that clarifies the application of the JOG MOV Periodic Verification Program (including the applicable NRC safety evaluation and its supplement on the JOG program) in response to NRC staff comments provided during the telephone discussion on April 13, 2010. The NRC staff considers the planned changes to the VEGP COL FSAR to resolve Standard Content Open Item 3.9-3. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as **Confirmatory Item 3.9-3**.

Resolution of Standard Content Confirmatory Item 3.9-3

Confirmatory Item 3.9-3 is an applicant commitment to revise its FSAR Section 3.9.6.2.2 to address MOV testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-3 is now closed.

In addition to incorporating by reference AP1000 DCD Tier 2, Section 3.9.6.2.2, the VEGP COL FSAR includes a paragraph titled "Other Power-Operated Valve Operability Tests," that states that POVs other than active MOVs are exercised quarterly in accordance with ASME OM Code, Subsection ISTC, unless justification is provided in the IST Program for testing these valves at other Code-mandated frequencies. Lessons learned from the resolution of weaknesses in the design, qualification, and testing of MOVs are also applicable to other POVs used at nuclear power plants. In discussing the MOV lessons learned applicable to other POVs in Regulatory Issue Summary (RIS) 2000-03, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions," the NRC staff determined that the current regulations provide adequate requirements to ensure design-basis capability of safety-related POVs. For example, the staff noted that licensees are required by 10 CFR 50.65 (Maintenance Rule) to monitor the performance of SSCs in a manner sufficient to provide reasonable assurance that the SSCs are capable of fulfilling their intended functions. VEGP COL FSAR Section 3.9.6.2.2 provides a description of operability testing for POVs other than MOVs to be implemented at VEGP. For example, the FSAR states that subsequent to verification of the design-basis capability of POVs as part of the design and qualification program, POVs that perform an active safety function will be tested after installation to ensure valve setup is acceptable to perform their required functions consistent with valve qualification. This testing will document the baseline performance of the valves and will include measurement of critical parameters with consideration of uncertainties associated with the performance of these tests and use of the test results. Additional periodic testing will be performed as part of the air-operated valve (AOV) program based on the JOG AOV program discussed in RIS 2000-03 with specific reference to NRC staff comments on that program. The AOV program will also include the attributes for a successful POV periodic verification program described in RIS 2000-03 by incorporating lessons learned from nuclear power plant operations and research programs as they apply to the periodic testing of AOVs and other POVs in the IST Program. The FSAR specifies AOV program attributes including valve categorization based on safety significance and risk ranking, AOV setpoints based on current vendor information or valve qualification diagnostic testing, periodic static testing to identify potential degradation, use of sufficient diagnostics to collect relevant data to verify that the valve meets functional requirements, specification of test frequency and evaluation based on data trends, post-maintenance procedures to ensure baseline testing will be re-performed as necessary when high-risk valve performance could be affected, inclusion of lessons learned from other valve programs, and retention and periodic evaluation of AOV test documentation.

The NRC staff has reviewed the VEGP COL FSAR, including the incorporation by reference of the AP1000 DCD, to determine whether it addresses the lessons learned from MOV operating

experience and research programs in describing the program for the periodic verification of the design-basis capability of POVs other than MOVs. In its letters dated December 14, 2009, and March 1, 2010, SNC provided a response to Standard Content Open Item 3.9-4 related to other POV operability testing in the "SER with open items" on the BLN COL application. In particular, SNC provided planned changes to the VEGP COL FSAR to clarify the potential need for periodic dynamic testing of POVs other than MOVs based on the design qualification results or valve operating experience. The planned FSAR change will also clarify that post-maintenance procedures will be implemented for all safety-related POVs consistent with the QA requirements in 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," regardless of their specific risk ranking. SNC also provided a proposed change to the VEGP COL FSAR specifying that the attributes of the AOV testing program, to the extent that they apply to and can be implemented on other safety-related POVs (such as electro-hydraulic valves) will be applied to those other POVs. The NRC staff considers that the planned revision to the VEGP COL FSAR, when combined with the AP1000 DCD provisions incorporated by reference, will adequately describe the periodic testing program for POVs other than MOVs to be used at VEGP and resolves Standard Content Open Item 3.9-4. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as **Confirmatory Item 3.9-4**.

Resolution of Standard Content Confirmatory Item 3.9-4

Confirmatory Item 3.9-4 is an applicant commitment to revise its FSAR Section 3.9.6.2.2 to address POV testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-4 is now closed.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Section 3.9.6.3, "Relief Requests," with a discussion of the planned use of ASME OM Code Case OMN-1, Revision 1. The applicant stated that use of Revision 1 to ASME OM Code Case OMN-1 will require request for relief, unless it is approved by the NRC in RG 1.192 or incorporated into the ASME OM Code on which the IST Program is based and that Code Edition is incorporated by reference in 10 CFR 50.55a. As discussed above in this SER section, the NRC staff authorized the use of Revision 1 to the ASME OM Code Case OMN-1 at VEGP Units 3 and 4.

AP1000 DCD Tier 2, Section 3.9.2, "Dynamic Testing and Analysis," describes tests to confirm that piping, components, restraints, and supports have been designed to withstand the dynamic effects of steady-state FIV and anticipated operational transient conditions. Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," in AP1000 DCD Tier 2, Chapter 14, "Initial Test Program," states that the purpose of the expansion, vibration and dynamic effects testing is to verify that safety-related, high energy piping and components are properly installed and supported such that, in addition to other factors, vibrations caused by steady-state or dynamic effects do not result in excessive stress or fatigue to safety-related plant systems. Nuclear power plant operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance on reactor coolant, steam, and feedwater systems. In its letter dated January 12, 2010, SNC provided its response for VEGP to Standard Content Open Item 3.9-5 related to FIV in the "SER with open items" on the BLN COL application. In its response, SNC stated that it intended to use the overall Initial Test Program to demonstrate that the plant has been constructed as designed and the systems perform consistent with design requirements. SNC referenced the provisions in the AP1000 DCD for vibration monitoring and testing to be implemented at VEGP. For example, the applicant notes that AP1000 DCD Tier 2, Section 3.9.2.1, "Piping Vibration, Thermal Expansion and Dynamic Effects," specifies that the preoperational test program for ASME BPV

Code, Section III, Class 1, 2, and 3 piping systems simulates actual operating modes to demonstrate that components comprising these systems meet functional design requirements and that piping vibrations are within acceptable levels. SNC indicates that the planned vibration testing program described in AP1000 DCD Tier 2, Sections 14.2.9 and 14.2.10, with the preservice and IST programs described in AP1000 DCD Tier 2, Sections 3.9.3.4.4 and 3.9.6, will confirm component installation in accordance with design requirements, and address the effects of steady-state (flow-induced) and transient vibration to ensure the operability of valves and dynamic restraints in the IST Program. The NRC staff considers the response by SNC clarifies its application of the provisions in the AP1000 DCD to ensure that potential adverse flow effects will be addressed at VEGP. Therefore, the staff considers Standard Content Open Item 3.9-5 to be resolved for the VEGP COL application.

Subsection ISTC-5260, "Explosively Actuated Valves," in the ASME OM Code specifies that at least 20 percent of the charges in explosively actuated valves shall be fired and replaced at least once every 2 years. If a charge fails to fire, the ASME OM Code states that all charges with the same batch number shall be removed, discarded, and replaced with charges from a different batch. In light of the updated design and safety significance of squib valves in new reactors, the need for improved surveillance activities for squib valves is being considered by the nuclear industry, ASME, and U.S. and international nuclear regulators. In RAI 3.9.6-1, the NRC staff requested that SNC describe its plans for addressing the surveillance of squib valves that will provide reasonable assurance of the operational readiness of those valves to perform their safety functions in support of the VEGP COL application. In a letter dated May 27, 2010, SNC submitted a planned revision to VEGP COL FSAR Section 3.9.6 to specify that industry and regulatory guidance will be considered in the development of the IST Program for squib valves. The FSAR will also state that the IST Program for squib valves will incorporate lessons learned from the design and qualification process for these valves such that surveillance activities provide reasonable assurance of the operational readiness of squib valves to perform their safety functions. The NRC staff finds that the planned changes to the VEGP COL FSAR are sufficient to describe the IST Program for squib valves for incorporating the lessons learned from the design and qualification process in developing surveillance activities that will provide reasonable assurance of the operational readiness for squib valves to perform their safety functions. Therefore, the NRC staff considers the planned changes to the VEGP COL FSAR to resolve this RAI acceptable. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as **Confirmatory Item 3.9-5**.

Resolution of Standard Content Confirmatory Item 3.9-5

Confirmatory Item 3.9-5 is an applicant commitment to revise its FSAR Section 3.9.6.2.2 to address squib valve testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-5 is now closed.

Technical Specifications

In its letter dated December 14, 2009, SNC provided a response to an open item related to Part 4, "Technical Specifications," (Standard Content Open Item 3.9-6) in the "SER with open items" on the BLN COL application. In its response, SNC stated that Part 4 of the VEGP COL application will be revised to ensure that Technical Specifications and Technical Specification Bases are consistent with the ASME OM Code, 2001 Edition through the 2003 Addenda. Therefore the NRC staff considers the planned changes to the VEGP COL application in Part 4 to resolve Standard Content Open Item 3.9-6. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as **Confirmatory Item 3.9-6**.

Resolution of Standard Content Confirmatory Item 3.9-6

Confirmatory Item 3.9-6 is an applicant commitment to revise its FSAR Section 3.9.6.2.2 to address the ASME OM Code. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-6 is now closed.

License Conditions

- Part 10, License Condition 3, Items G2 and G5

The applicant proposed a license condition providing the implementation milestones for the Preservice Testing Program and MOV Testing Program.

- Part 10, License Condition 6

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs including the Preservice Testing Program and MOV Testing Program.

These license conditions are consistent with the policy established in SECY-05-0197 and are, thus, acceptable.

3.9.6.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license conditions:

License Conditions

- License Condition (3-5) - Prior to initial fuel load, the licensee shall implement the pre-service testing and the MOV testing programs.

- License Condition (3-6) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspections of the IST program (including preservice and MOV testing). The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the inservice testing program (including preservice testing and the MOV testing) has been fully implemented.

3.9.6.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the IST Program, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's evaluation of the design-related information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements. The results of the staff's review of the material in the AP1000 DCD related to the IST operational program for pumps, valves, and dynamic restraints are in this SER section.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidance in Section 3.9.6 of NUREG-0800 and in RG 1.206. The staff based its conclusion on the following:

- STD COL 3.9-4, regarding the operational program for pumps, valves, and dynamic restraints is acceptable because the requirements of 10 CFR 52.79(a) are satisfied.

3.9.7 Integrated Head Package

AP1000 DCD, Section 3.9.7, describes the integrated head package (IHP). The IHP combines several components in one assembly to simplify refueling the reactor. The IHP includes a lifting rig, seismic restraints for CRDM, support for reactor head vent piping, cable bridge, power cables, cables for in-core instrumentation, cable supports, and shroud assembly. The IHP provides the ability to rapidly disconnect cables, including the CRDM power cables, digital rod position indication cables, and in-core instrument cables from the components.

Section 3.9 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 3.9.7, "Integrated Head Package" of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

3.10.1 Introduction

Seismic and dynamic qualification of seismic Category I equipment includes the following types:

- Safety-related active mechanical equipment that performs a mechanical motion while accomplishing a system safety-related function. Examples include pumps, valves, and valve operators.

- Safety-related, nonactive mechanical equipment whose mechanical motion is not required while accomplishing a system safety-related function, but whose structural integrity must be maintained in order to fulfill its design safety-related function.

- Safety-related instrumentation and electrical equipment and certain monitoring equipment.

Mechanical and electrical equipment (including instrumentation and controls), and where applicable, their supports classified as seismic Category I must demonstrate that they are capable of performing their intended safety-related functions under the full range of normal and accident (including seismic) loadings. This equipment includes devices associated with systems essential to safe shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or are otherwise essential in preventing significant release of radioactive material to the environment or in mitigating the consequences of accidents.

The criteria for the seismic and dynamic qualification include the following considerations:

- Adequacy of seismic and dynamic qualification input motions.
- Methods and procedures for qualifying electrical equipment, instrumentation, and mechanical components.
- Methods and procedures for qualifying supports of electrical equipment, instrumentation, and mechanical components.
- Documentation.

3.10.2 Summary of Application

Section 3.10 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.10 of the AP1000 DCD, Revision 19.

Section 3.10 of the VEGP COL FSAR does not include any COL information items or supplemental information related to AP1000 DCD, Section 3.10.

3.10.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic and dynamic qualification of mechanical and electrical equipment are given in Section 3.10 of NUREG-0800.

3.10.4 Technical Evaluation

The NRC staff reviewed Section 3.10 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the seismic and dynamic qualification program. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL

FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 3.10-1) to resolve. The resolution of the item is addressed in this SER.

Implementation Program

In RAI 3.10-1, dated August 7, 2008, the applicant was requested to provide an implementation program, including milestones and completion dates with appropriate information submitted with sufficient time for staff review and approval prior to installation of the equipment, not prior to fuel loading, in accordance with Section C.I.3.10.4 of RG 1.206.

In its response, the applicant stated that details of the implementation milestones for the seismic and dynamic qualification program are not currently available, and are not expected to be available until after a detailed construction schedule of the plant has been developed. Appropriate scheduling information will be provided, when available, to the NRC as necessary to support timely completion of their inspection and audit functions. Additionally, seismic and dynamic qualification is the subject of ITAAC, and 10 CFR 52.99(a) does not require that a schedule for implementing ITAAC be provided to the NRC until one year after issuance of the COL.

The NRC staff determined that the applicant's response to RAI 3.10-1 is not adequate because, in accordance with Section C.I.3.10.4 of RG 1.206, if the results of seismic and dynamic qualification is not available at the time of the COL application, the applicant is expected to submit the following before the issuance of the combined license: (1) descriptions of the implementation program such as identification of seismic qualification methods (Testing or Analysis) for each type of equipment; and (2) milestones for when the different aspects of the seismic qualification program will be complete - dates or condition should be such that the NRC staff will be able to audit the qualification results prior to the installation of the equipment (not before fuel loading as part of the ITAAC program). This is ***Open Item 3.10-1.***

Resolution of Open Item 3.10-1

In its responses dated February 5, 2010 and April 2, 2010, the VEGP applicant submitted a table providing the planned methods of seismic qualification for safety-related, seismic Category I equipment types listed in AP1000 DCD, Chapter 3, Table 3.2-3. Furthermore, the applicant stated that the seismic qualification packages will be available to the NRC as necessary to support timely completion of its inspection and audit functions. Because not all packages are expected to be completed within a year of the issuance of the COL (or at the start

of construction as defined in 10 CFR 50.10(a), whichever is later), a schedule for the availability of the seismic qualification packages will be included with the schedule information for closure of ITAAC (as required by 10 CFR 52.99(a)). The staff finds the applicant's response acceptable, and Open Item 3.10-1 is closed. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as **Confirmatory Item 3.10-1**.

Resolution of Standard Content Confirmatory Item 3.10-1

Confirmatory Item 3.10-1 is an applicant commitment to revise its FSAR to address seismic qualification for Category I equipment. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.10-1 is now closed.

3.10.5 Post Combined License Activities

There are no post-COL activities related to this section.

3.10.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the seismic and dynamic qualification program, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff compared the information in the application to the relevant NRC regulations, the acceptance criteria in Section 3.10 of NUREG-0800. The staff's review confirmed, pending resolution of the confirmatory item, that the applicant has adequately addressed the information relating to the seismic qualification of equipment in accordance with the requirements of GDC 2, GDC 4, GDC 14, "Reactor Coolant Pressure Boundary."

3.11 Environmental Qualification of Mechanical and Electrical Equipment

3.11.1 Introduction

The objective of environmental qualification (EQ) is to reduce the potential for common failure due to specified environmental and seismic events, and to demonstrate that equipment within the scope of the EQ Program is capable of performing its intended design safety function under all conditions including environmental stresses resulting from design bases events. The information presented includes identification of the equipment required to be environmentally qualified and, for each item of equipment, the designated functional requirements, definition of the applicable environmental parameters, and documentation of the qualification process employed to demonstrate the required environmental capability. During plant operation, the licensee implements the EQ Program, which specifies the replacement frequencies of affected safety-related equipment in harsh environments, and nonsafety-related equipment whose failure under the postulated environmental conditions could prevent satisfactory performance of the safety functions of the safety-related equipment, and certain post-accident monitoring equipment. The seismic qualification of mechanical and electrical equipment is presented in Section 3.10. The portions of post-accident monitoring equipment required to be environmentally qualified are identified in AP1000 DCD Table 7.5-1.

RG 1.206 discusses the Commission's position provided in SECY-05-0197 that operational programs should be fully described in COL applications to avoid the need to specify ITAAC for those programs. The applicant relies on the VEGP COL application with its incorporation by reference of the AP1000 DCD and supplemental information to fully describe the EQ and other related operational programs in support of the COL application for VEGP Units 3 and 4.

3.11.2 Summary of Application

Section 3.11 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 3.11 of the AP1000 DCD, Revision 19. Section 3.11 of the AP1000 DCD describes the EQ Program for electrical and mechanical equipment to be used in the AP1000 certified design.

AP1000 COL Information Item

- STD COL 3.11-1

In VEGP COL FSAR Section 3.11.5, "Combined License Information Item For Equipment Qualification File," the applicant provided additional information to address COL Information Item 3.11-1 (COL Action Item 3.11.2-1) regarding administrative control of the EQ Program for VEGP Units 3 and 4.

License Conditions

- Part 10, License Condition 3, Item G1

The applicant proposed a license condition providing the implementation milestone for the EQ Program.

- Part 10, License Condition 6

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs including the EQ Program.

3.11.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the EQ of mechanical and electrical equipment are given in Section 3.11 of NUREG-0800.

The applicable regulatory requirements for the Operational EQ Program are as follows:

10 CFR 52.79(a)(10) requires that a COL application provide a description of the program, and its implementation, required by 10 CFR 50.49(a) for the EQ of electric equipment important to safety and the list of electric equipment important to safety that is required by 10 CFR 50.49(d).

10 CFR 52.79(a)(29)(i) requires that a COL application provide plans for conduct of normal operations, including maintenance, surveillance, and periodic testing of SSCs.

RG 1.206 provides guidance for a COL applicant in preparing and submitting its COL application in accordance with the NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that need to be included in the FSAR for a COL application to allow a reasonable assurance finding of acceptability. In particular, a COL applicant should fully describe EQ and other operational programs as defined in Commission Paper SECY-05-0197 to avoid the need for ITAAC for the implementation of those programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms for scope and level of detail to allow a reasonable assurance finding of acceptability. Further, operational programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the SRM for SECY-05-0197, dated February 22, 2006.

3.11.4 Technical Evaluation

The NRC staff reviewed Section 3.11 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the EQ of mechanical and electrical equipment. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 3.11-1) to resolve. The resolution of the item is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 3.11.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 3.11-1*

The COL information item for the EQ file in Section 3.11.5 of the AP1000 DCD, states:

> *Westinghouse Electric Company LLC will act as the agent for the COL holder during the equipment design phase, equipment selection and procurement phase, equipment qualification phase, plant construction phase, and ITAAC inspection phases.*
>
> *The COL holder will define the process and procedures for which the equipment qualification files will be accepted from Westinghouse and how the files will be retained and maintained in an auditable format for the period that the equipment is installed and/or stored for future use in the nuclear power plant.*

This commitment was also captured as COL Action Item 3.11.2-1 in the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *Pursuant to 10 CFR 50.49(j), the COL applicant shall keep the list and information in the file current and retain the file in auditable form for the entire period during which the covered item is installed in the nuclear power plant or is stored for the future use to permit verification that each item of electrical equipment important to safety (1) is qualified for its application, and (2) meets its specified performance requirements. To conform with 10 CFR 50.49, electrical equipment for PWRs referencing the AP1000 design should be qualified according to the criteria in Category I of NUREG-0588 and Revision 1 of RG 1.89.*

This commitment was also listed as COL Action Item 3.11.2-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant is responsible for maintaining the equipment qualification file during the equipment selection and procurement phase.*

In STD COL 3.11-1, the applicant describes under "Combined License Information Item for Equipment Qualification File," that the COL holder is responsible for the maintenance of the equipment qualification file. The NRC staff reviewed STD COL 3.11-1 related to equipment qualification file included under Section 3.11.5 of the BLN COL. The NRC staff's evaluation is as follows.

Section 3.11.5 of the BLN COL FSAR states that the COL holder is responsible for the maintenance of the equipment qualification file upon receipt from the reactor vendor. EQ files developed by the reactor vendor are maintained as

applicable for equipment and certain post-accident monitoring devices that are subject to a harsh environment. The files are maintained for the operational life of the plant.

The Environmental Qualification Master Equipment List (EQMEL) identifies the electrical and mechanical equipment or components that must be environmentally qualified for use in a harsh environment. The BLN COL FSAR states that the EQMEL and a summary of equipment qualification results are maintained as part of the equipment qualification file for the operational life of the plant. Administrative programs are in place to control revision to the EQ files and the EQMEL. When adding or modifying components in the EQ Program, EQ files are generated or revised to support qualification. The EQMEL is revised to reflect these new components. Plant modifications and design basis changes are subject to change process reviews, e.g., reviews in accordance with 10 CFR 50.59 or Section VIII of Appendix D to 10 CFR Part 52, in accordance with appropriate plant procedures. Any changes to the EQMEL that are not the result of a modification or design basis change are subject to a separate review that is accomplished and documented in accordance with plant procedures.

Based on the above, the NRC staff concludes that the COL applicant would keep the equipment qualification file and information in the file current and retain the file in an auditable form for the entire period during which the covered item is installed in the nuclear power plant or is stored for the future use to permit verification that each item of electrical equipment important to safety: (1) is qualified for its application; and (2) meets its specified performance requirements. This is consistent with 10 CFR 50.49(j) and acceptable.

In addition, the staff requested additional information related to specific implementation of this program, which is discussed below.

BLN COL FSAR Section 3.11 incorporates by reference AP1000 DCD Tier 2 Section 3.11.2.2, "Environmental Qualification of Mechanical Equipment," in the AP1000 DCD, which references Appendix 3D, "Methodology for Qualifying AP1000 Safety-Related Electrical and Mechanical Equipment." In RAI 3.11-1, the NRC staff requested that the applicant describe in more detail the EQ Program for safety-related mechanical equipment to be used at BLN Units 3 and 4. In its response, the applicant stated that the EQ Program will be performed as described in Section 3.11 and Appendix 3D of the AP1000 DCD, by reference as stated in the BLN COL FSAR. The EQ Program will be implemented through design specifications, equipment procurement documents, and equipment qualification procedures. Equipment qualification specifications and equipment design specifications will be developed based on the AP1000 EQ requirements. The incorporation of the AP1000 DCD, Section 3.11 and Appendix 3D into the BLN COL FSAR also includes future maintenance, surveillance, and replacement activities to maintain EQ over the life of the BLN plant through operational programs and procedures. AP1000 DCD, Table 3.11-1 provides a listing of the safety-related mechanical equipment, its location, and the environment to be considered in the EQ Program. AP1000 DCD, Appendix 3D, describes: (1) qualification methodology for the critical safety-related nonmetallic sub-components; (2) thermal and radiation information for the nonmetallic components used in safety-related mechanical equipment;

(3) plant normal, abnormal, and accident environmental parameters; and (4) documentation requirements. On October 14 and 15, 2008, the NRC staff conducted an onsite review of design and procurement specifications, including EQ, for pumps, valves, and dynamic restraints to be used for the AP1000 reactor at the Westinghouse offices in Monroeville, PA. The staff found that Westinghouse had included ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," in its design and procurement specifications for AP1000 components, including ASME QME-1, Appendix QR-B, "Guide for Qualification of Nonmetallic Parts." At the conclusion of the onsite review, the staff provided comments on the AP1000 design procurement specifications, and Westinghouse indicated that those comments would be addressed in a future revision to the specifications. The staff also identified several items that remain open from the onsite review that are specified in Section 3.9.6 of the SER on the AP1000 DCD revision. As noted in Section 3.9.6 of the BLN COL FSAR, the NRC staff documented the results of the on-site review with follow-up items in a memorandum dated November 6, 2008, (ML083110154). ***This is Open Item 3.11-1.***

Section 3D.6.2.3, "Analysis of Safety-Related Mechanical Equipment," in the AP1000 DCD, Appendix 3D, summarizes the EQ of safety-related mechanical equipment by analysis methods, but does not discuss implementation of the EQ approach. In RAI 3.11-2, the NRC staff requested that the applicant discuss the implementation of the EQ approach, including the application of industry standards, prescribed in Section 3D.6.2.3 in Appendix 3D to Chapter 3 in the AP1000 DCD. In its response to this RAI, the applicant stated that equipment qualification specifications and equipment design specifications have been developed based on the AP1000 DCD EQ requirements. The applicant stated that these procurement documents reference ASME QME-1 and Institute of Electrical and Electronic Engineers (IEEE) Standard 323 for the EQ of active safety-related mechanical equipment. As noted above, the NRC staff conducted an onsite review of the Westinghouse design and procurement specifications for the AP1000 components on October 14 and 15, 2008. The issues in this RAI are being addressed under ***Open Item 3.11-1****. Therefore, RAI 3.11-2 is closed.*

AP1000 DCD, Appendix 3D, Section 3D.6.3, "Operating Experience in the Equipment Qualification Program," states that the COL applicant will provide documentation of the EQ methodology where seismic experience data are used. In RAI 3.11-3, the NRC staff requested that the applicant discuss the documentation of the EQ methodology where seismic experience data are used. In its response to this RAI, the applicant stated that Westinghouse would revise the AP1000 DCD to resolve this issue. Revision 17 to the AP1000 DCD, Appendix 3D, Section 3D.6.3 specifies that qualification by experience is not employed in the AP1000 equipment qualification program as a method of qualification. The applicant revised the BLN COL FSAR to reflect the revision to the AP1000 DCD. Therefore, RAI 3.11-3 is resolved.

The section titled "In-Service Vibration" in Section B.4.5, "External Stresses," in Attachment B, "Aging Evaluation Program," to Appendix 3D to Chapter 3 in the AP1000 DCD, states that inservice pipe and FIV may be significant for line-mounted equipment. As a consequence, the section states that an additional vibration aging step is included in the aging sequence. Operating

experience has revealed that FIV from acoustic resonance and hydraulic loading can adversely impact safety-related mechanical equipment at nuclear power plants. The COL applicant will demonstrate the performance of this additional vibration aging step specified in the AP1000 DCD in the EQ of safety-related mechanical equipment to be used at BLN Units 3 and 4. This technical issue is addressed in Section 3.9.6 of this SER.

License Conditions

Section 3, "Operational Program Implementation," in Part 10 of the BLN COL application provides proposed license conditions for operational program implementation. One specified license condition is that the EQ Program will be implemented prior to initial fuel loading. In addition, Section 6 in Part 10 provides a proposed license condition for operational program readiness that requires the licensee to submit a schedule no later than 12 months after COL issuance that supports planning and conducting NRC inspections of operational programs with periodic updating. These license conditions are consistent with the policy established in SECY-05-0197 and are, thus, acceptable.

Resolution of Standard Content Open Item 3.11-1

Standard Content Open Item 3.11-1 resulted from the identification of items that remained open from the October 14 and 15, 2008, onsite review at Westinghouse offices of design and procurement specifications, including EQ, for pumps, valves, and dynamic restraints to be used for the AP1000 reactor. As noted in Section 3.9.6.4 of the BLN COL FSAR, the NRC staff documented the results of the onsite review with follow-up items in a memorandum dated November 6, 2008. In a letter dated December 14, 2009, the VEGP applicant stated that it had not identified any specific actions for the VEGP COL application based on the audit open items. The NRC staff's discussion of the audit of the EQ specifications, which includes the issues in RAI 3.11-2 addressed to the BLN applicant, is in NUREG-1793 and its supplements. Therefore, Standard Content Open Item 3.11-1 is resolved for the VEGP COL application.

Supplemental Review of Operational Aspects of the EQ Program

As discussed in RG 1.206 and Commission Paper SECY-05-0197, COL applicants must fully describe their operational programs to avoid the need for ITAAC regarding those programs. In addition to the initial EQ of electrical and mechanical equipment, the NRC staff reviewed the VEGP COL FSAR Section 3.11 with its incorporation by reference of the AP1000 DCD and supplemental information for operational aspects of the EQ Program. For example, AP1000 DCD Tier 2, Appendix 3D, Section 3D.7, "Documentation," states that information regarding maintenance, refurbishment, or replacement of the equipment will be included in the equipment qualification package if necessary to provide confidence in the equipment's capability to perform its safety function. Further, Section 3D.7.1, "Equipment Qualification Data Package," states that equipment qualification data packages will specify preventive maintenance that is required to support qualification or the qualified life, including maintenance or periodic activities assumed as part of the qualification program or necessary to support qualification. With respect to safety-related mechanical equipment, AP1000 DCD Tier 2, Section 3D.6.2.3.8, "Equipment Qualification Maintenance Requirements," specifies that maintenance requirements resulting from EQ activities will be based on: (1) qualification evaluation results (for example, periodic replacement of age-susceptible parts before the end of their qualified life); (2) equipment qualification-related maintenance activities derived from the qualification report; and (3) vendor

recommended equipment qualification maintenance, if required, in order to maintain qualification. The staff finds that the VEGP COL applicant provides an acceptable description of the transition from the initial to the operational aspects of the EQ Program in support of the VEGP COL application through the VEGP COL FSAR with its incorporation by reference of the AP1000 DCD Tier 2, Section 3.11. The NRC staff will evaluate the implementation of the EQ Program through inspections conducted during plant construction and operation. The NRC inspection activities will include consideration of: (1) evaluation of EQ results for design life to establish activities to support continued EQ; (2) determination of surveillance and preventive maintenance activities based on EQ results; (3) consideration of EQ maintenance recommendations from equipment vendors; (4) evaluation of operating experience in developing surveillance and preventive maintenance activities for specific equipment; (5) development of plant procedures that specify individual equipment identification, appropriate references, installation requirements, surveillance and maintenance requirements, post-maintenance testing requirements, condition monitoring requirements, replacement part identification, and applicable design changes and modifications; (6) development of plant procedures for reviewing equipment performance and EQ operational activities, and for trending the results to incorporate lessons learned through appropriate modifications to the EQ Program; and (7) development of plant procedures for the control and maintenance of EQ records.

Based on the above discussion, the NRC staff finds the information added to the VEGP COL application as part of STD COL 3.11-1 to be acceptable.

License Conditions

- Part 10, License Condition 3, Item G1

The applicant proposed a license condition providing the implementation milestone for the EQ Program.

- Part 10, License Condition 6

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs including the EQ Program.

These license conditions are consistent with the policy established in SECY-05-0197 and are, thus, acceptable.

3.11.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license conditions:

- License Condition (3-7) - Prior to initial fuel load, the licensee shall implement the Environmental Qualification Program.

- License Condition (3-8) - No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspections of the Environmental Qualification Program. The schedule shall be updated every six months until 12 months before scheduled fuel loading, and

every month thereafter until the Environmental Qualification Program has been fully implemented.

3.11.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the EQ Program, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidance in Section 3.11 of NUREG-0800 and in RG 1.206. The staff based its conclusion on the following:

- STD COL 3.11-1, regarding the administrative control of the EQ Program for VEGP Units 3 and 4, is acceptable because the requirements of 10 CFR 52.79(a)(10) and 10 CFR 52.79(a)(29)(i) are satisfied.

3.12 Piping Design (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.12, "Piping Design Review")

3.12.1 Introduction

This section covers the design of the piping system and piping support for seismic Category I, Category II, and nonsafety systems. It also discusses the adequacy of the structural integrity, as well as the functional capability, of the safety-related piping system, piping components, and their associated supports. The design of piping systems should ensure that they perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events. This includes pressure-retaining piping components and their supports, buried piping, instrumentation lines, and the interaction of NS Category I piping and associated supports with seismic Category I piping and associated supports. This section covers the design transients and resulting loads and load combinations with appropriate specified design and service limits for seismic Category I piping and piping support, including those designated as ASME Code Class 1, 2, and 3.

3.12.2 Summary of Application

Chapter 3 of the VEGP COL FSAR, Revision 5, incorporates by reference Chapter 3 of the AP1000 DCD, Revision 19. Sections 3.7 and 3.9 of the AP1000 DCD address Section 3.12, "ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and their Associated Supports" of NUREG-0800. The ASE with confirmatory items for Section 3.12.2 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse created a new COL information item (COL 3.9-7). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Sections 3.7 and 3.9, the applicant provided the following:

Supplemental Information

- VEGP SUP 3.7-3

VEGP SUP 3.7-3 adds a new Section 3.7.1.1.1 to demonstrate that the AP1000 plant designed for the CSDRS is acceptable for the VEGP site.

AP1000 COL Information Items

- STD COL 3.9-2

The applicant provided additional information in STD COL 3.9-2 to address COL Information Item 3.9-2, which states that design specifications and design reports for the ASME Code, Section III piping will be available for the NRC's review and that reconciliation of these documents is completed after construction and prior to fuel load.

- STD COL 3.9-5

The applicant provided additional information in STD COL 3.9-5 to address COL Information Item 3.9-5, which provides a description for pressurizer surge line monitoring.

- STD COL 3.9-7

In a letter dated April 23, 2010, the applicant proposed to add new STD COL 3.9-7 to the VEGP COL FSAR. This COL item provides additional information on the process to be used to complete the piping design and ITAAC added to verify the design.

License Condition

- Part 10, License Condition 2, Item 3.9-7

In a letter dated April 23, 2010, the applicant proposed a license condition addressing the as-designed piping analysis completion schedule.

ITAAC

In a letter dated April 23, 2010, the applicant has proposed ITAAC requiring the completion of a design report referencing the as-designed piping calculation packages, including the ASME Code, Section III piping analysis, support evaluations and piping component fatigue analysis for Class 1 piping using the methods and criteria outlined in AP1000 DCD Table 3.9-19.

3.12.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the AP1000 DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the pipe and support analysis are given in Section 3.12 of NUREG-0800.

3.12.4 Technical Evaluation

The NRC staff reviewed Section 3.9 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the piping design review. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Due to the significant amount of new information provided by both the VEGP applicant and Westinghouse on the piping design issues since the development of the BLN SER for Section 3.12, the NRC staff decided not to use the BLN SER material as a starting point for the evaluation of these issues.

AP1000 COL Information Items

- STD COL 3.9-2

COL Information Item 3.9-2 states that design specifications and design reports for the ASME Code, Section III piping will be available for the NRC's review and that reconciliation of the piping is completed prior to fuel load in accordance with an ITAAC in AP1000 DCD Tier 1, Section 2. The discussion on STD COL 3.9-7 below addresses design specifications and design reports.

The staff acknowledged that an ITAAC in the AP1000 DCD Tier 1 addresses verification of this aspect of the design and that COL Information Item 3.9-2 has been addressed.

- STD COL 3.9-5

The staff reviewed STD COL 3.9-5 (surge line thermal monitoring) and determined that the proposed program did not provide sufficient information for the staff to determine reasonable assurance for safety. The staff issued RAI 3.12-2 to ask the applicant to provide additional information including a test abstract including stating the standard operating conditions in Chapter 14 that identifies the objective, prerequisites, test method, data required, and acceptance criteria for surge line thermal monitoring that complies with NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification." In this RAI, the staff also noted that:

> For subsequent SCOLs, the design is such that assumptions are made that the layout will be the same such that monitoring of the follow-on plants is not required. However, all plants are required to comply with NRC Bulletin 88-11. Given that the heatup and cooldown procedures have not been developed and the affect on the plant, even with similar layout, will be different depending on the procedures used, subsequent plants will need to verify that they will be using the same heatup and cooldown procedures as the monitored plant to comply with NRC Bulletin 88-11.

In a letter dated July 2, 2010, the applicant provided its response to address the staff's concern. In the response, the applicant stated that VEGP COL FSAR Section 3.9.3.1.2 would be revised to add the following paragraph:

> Subsequent AP1000 plants (after the first AP1000 plant) confirm that the heatup and cooldown procedures are consistent with the pertinent attributes of the first AP1000 plant surge line monitoring. In addition, changes to the heatup and cooldown procedures consider the potential impact on stress and fatigue analyses consistent with the concerns of NRC Bulletin 88-11.

In this letter, the applicant also added a new Section 14.2.9.2.22 to provide a test abstract. The test abstract included the purpose, prerequisites, general test methods, and acceptance criteria.

In a subsequent letter dated August 6, 2010, the applicant provided additional information for the location of test instruments. In the response, the applicant stated that VEGP COL FSAR Section 3.9.3.1.2 would be revised to add the following paragraph:

> In addition to the existing permanent plant temperature instrumentation, temperature and displacement monitoring will be included at critical locations on the surge line. The additional locations utilized for monitoring during the hot functional testing and the first fuel cycle (see Subsection 14.2.9.2.22) are selected based on the capability to provide effective monitoring.

The staff reviewed the RAI responses and concluded the position is acceptable to comply with NRC Bulletin 88-11. On this basis, the proposed program for surge line thermal monitoring is acceptable. The incorporation of the planned changes to the VEGP COL FSAR detailed in the applicant's July 2, 2010, and August 6, 2010, letters will be tracked as **Confirmatory Item 3.12-1**.

Resolution of Standard Content Confirmatory Item 3.12-1

Confirmatory Item 3.12-1 is an applicant commitment to revise its FSAR Table 1.9-204 and Sections 3.9.3.1.2 and 3.9.8.5 for surge line monitoring testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.12-1 is now closed.

- STD COL 3.9-7

In letter dated April 23, 2010, the applicant proposes that the as-designed piping analysis is made available for NRC review. Additionally in this letter, License Condition 2, Item 3.9-7, proposed by the applicant, calls for the design to be made available for review prior to installation of the piping and adding a site-specific ITAAC in Table 3.8-# [where # is the next sequential number] of Part 10 of the VEGP COL application for verification of the ASME Code design reports. In this letter, the applicant also proposed adding Section 14.3.3.# where # is the next sequential number] to the VEGP COL FSAR, describing the process to be followed to address closure of the piping DAC during the construction period, to complete the review of the piping design including an ITAAC to review the design, and an ITAAC to review reconciliation of the design after it is built.

The staff reviewed the applicant's proposed approach of including ITAAC for verification of the design and reconciliation of the design, and a license condition to address timing of when the initial design verification would occur. The approach, including the ITAAC and the license

condition, is acceptable to the staff as it allows verification that the methodology described in the AP1000 DCD and VEGP COL FSAR and the general requirements of the ASME Code, as specified in 10 CFR 50.55a, were met.

Proposed VEGP COL FSAR Section 14.3.3.# [where # is the next sequential number] also states that "The piping design completed for the first standard AP1000 plant will be available to subsequent standard AP1000 plants under the "one issue, one review, one position" approach for closure." Westinghouse letter dated August 17, 2010, as supplemented by letter dated August 23, 2010, stated that the ASME Code Class 1, 2 and 3 piping systems will be evaluated as part of the piping DAC for hard rock site to address hard rock site seismic issue. The standard AP1000 plant will have analysis that addresses both CSDRS and hard rock high frequency GMRS effect. Therefore, the one issue, one review, one position approach applies and the staff finds this acceptable for piping analysis.

The incorporation of the planned changes to the VEGP COL application detailed in the applicant's April 23, 2010, letter and in response to hard rock seismic issues will be tracked as **Confirmatory Item 3.12-2**.

Resolution of Standard Content Confirmatory Item 3.12-2

Confirmatory Item 3.12-2 is an applicant commitment to revise its FSAR Table 1.8-202, Section 3.9.8.2, Section 3.9.8.7, and Section 14.3.3.3 for pipe analysis and add an ITAAC (Table 3.8-2) for verification of the ASME Code design reports. The staff verified that the VEGP COL FSAR and Part 10 of the application (ITAAC Table 3.8-2) were appropriately updated. As a result, Confirmatory Item 3.12-2 is now closed.

Supplemental Information

- VEGP SUP 3.7-3

This item discussed GMRS exceedances above the CSDRS. The input for the piping analysis is the ISRS. The applicant has performed its site-specific seismic evaluation and concluded that the ISRS is still enveloped by the CSDRS. The detailed evaluation is documented in Section 3.7.2 of this SER. On this basis, the staff finds GMRS exceedances is acceptable for piping design using CSDRS.

3.12.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the applicant proposes to include the following ITAAC for the as-design piping analysis:

- The licensee shall perform and satisfy the piping design analysis ITAAC in SER Table 3.12-1.

For the reasons discussed in the technical evaluation section above, the applicant proposes to include the following license condition:

- License Condition (3-9) – Prior to installation of piping and connected components in their final location, the licensee shall complete the as-designed piping analysis for the piping lines chosen to demonstrate all aspects of the piping design as identified in FSAR

Section 3.9.8 and shall inform the Director of NRO of the availability of the piping design information and design reports for the piping packages.

3.12.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to piping design, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL application is acceptable and meets the NRC regulations. The staff based its conclusion on the following:

- STD COL 3.9-2 and STD COL 3.9-7 are acceptable because ITAAC have been put in place to allow staff to verify the VEGP COL FSAR, 10 CFR 50.55a, and the ASME Code are met prior to fuel load.

- STD COL 3.9-5 is acceptable because it is consistent with pressurizer surge line monitoring discussed in 10 CFR Part 52, Appendix D, "Design Certification Rule for the AP1000 Design."

Table 3.6.2-1. Pipe Rupture Hazards Analysis ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
Systems, structures, and components (SSCs), that are required to be functional during and following a design basis event shall be protected against or qualified to withstand the dynamic and environmental effects associated with analyses of postulated failures in high and moderate energy piping.	Inspection of the as-designed pipe rupture hazard analysis report will be conducted. The report documents the analyses to determine where protection features are necessary to mitigate the consequence of a pipe break. Pipe break events involving high-energy fluid systems are analyzed for the effects of pipe whip, jet impingement, flooding, room pressurization, and temperature effects. Pipe break events involving moderate-energy fluid systems are analyzed for wetting from spray, flooding, and other environmental effects, as appropriate.	An as-designed pipe rupture hazard analysis report exists and concludes that the analysis performed for high and moderate energy piping confirms the protection of systems, structures, and components required to be functional during and following a design basis event.

Table 3.8.5-1. Waterproof Membrane Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The friction coefficient to Resist sliding is 0.7 or higher	Testing will be performed to confirm that the mudmat-waterproofing-mudmat interface beneath the Nuclear Island basemat has a minimum coefficient of friction to resist sliding of 0.7.	A report exists and documents that the as-built waterproof system (mudmat-waterproofing-mudmat interface) has a minimum coefficient of friction of 0.7 as demonstrated through material qualification testing.

Table 3.12-1. Piping Design ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The ASME Code, Section III piping is designed in accordance with the ASME Code, Section III requirements.	Inspection of the ASME Code Design Reports (NCA-3550) and required documents will be conducted for the set of lines chosen to demonstrate compliance.	The ASME Code Design Report(s) (NCA-3550) (certified, when required by the ASME Code) exist and conclude that the design of the piping for lines chosen to demonstrate all aspects of the piping design complies with the requirements of the ASME Code section.

4.0 REACTOR

4.1 Introduction

This chapter describes the design of the AP1000 reactor and reactor core, including the reactor internals, control rod drive and core support structural materials, fuel system design (fuel rods and fuel assemblies), the nuclear design, the thermal-hydraulic design, and reactivity control systems functional design. It also specifies the principal design criteria with which the mechanical design, the physical arrangement of the reactor components, and the capabilities of reactor control, protection, and emergency cooling systems (when applicable) must comply.

4.2 Summary of Application

Chapter 4 of the Vogtle Electric Generating Plant (VEGP) Combined License (COL) Final Safety Analysis Report (FSAR), Revision 5, incorporates by reference Chapter 4 of the AP1000 Design Control Document (DCD), Revision 19.

In addition, in VEGP COL FSAR Section 4.4, the applicant provided the following:

AP1000 COL Information Item

- STD COL 4.4-2

The applicant provided additional information in Standard (STD) COL 4.4-2 to address COL Information Item 4.4-2. This item states that, upon selection of the actual instrumentation, the instrumentation uncertainties of the operating parameters shall be calculated and the validity of the design-limit departure from nucleate boiling ratio (DNBR) values shall be confirmed.

License Condition

Part 10, License Condition 2, Item 4.4-2

The license condition will require the completion of the actions described in STD COL 4.4-2 prior to initial fuel load.

4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design."

In addition, the relevant requirements of the Commission regulations for the thermal-hydraulic design and the associated acceptance criteria are identified in Section 4.4 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)."

To resolve the confirmatory item, the NRC staff also used the requirements of Title 10 of the *Code of Federal Regulations* (CFR) 10 CFR 50.72, "Immediate notification requirements for operating nuclear power reactors," and 10 CFR 50.73, "Licensee event report system," using the guidance of NUREG-1022, "Event Reporting Guidelines; 10 CFR 50.72 and 50.73."

4.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Chapter 4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[19] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to the reactor internals, control rod drive and core support structural materials, fuel system design (fuel rods and fuel assemblies), the nuclear design, the thermal-hydraulic design, and reactivity control systems functional design. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this safety evaluation report (SER) provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the design certification (DC) and used this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the Bellefonte Nuclear Plant (BLN), Units 3 and 4 COL application were equally applicable to the VEGP Unit 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was a confirmatory item (Confirmatory Item 4.4-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

[19] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

The following portion of this technical evaluation section is reproduced from Section 4.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 4.4-2*

The NRC staff reviewed STD COL 4.4-2 related to COL Information Item 4.4-2 and related COL Action Item 4.4-1 (from Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793)), included under Section 4.4 of the BLN COL FSAR, Revision 1. STD COL 4.4-2 states:

> *Following selection of the actual plant operating instrumentation and calculation of the instrumentation uncertainties of the operating plant parameters as discussed in DCD Subsection 7.1.6, the design limit DNBR values will be calculated. The calculations will be completed using the revised thermal design procedure (RTDP) with these instrumentation uncertainties and confirm that either the design limit DNBR values as described in DCD Section 4.4 remain valid or that the safety analysis minimum DNBR bounds the new design limit DNBR values plus DNBR penalties, such as rod bow penalty. This will be completed prior to fuel load.*

License Condition

Part 10, License Condition 2, Item 4.4-2

The applicant provided a license condition in Part 10 of the BLN COL application, "Proposed Combined License Conditions," which will require the completion of the actions described in STD COL 4.4-2 prior to initial fuel load.

As reported in FSER Section 4.4 related to the DCD, expected instrument uncertainties are included in the methodology used by the applicant in calculating the design limit DNBR values. The final validation of the design limit DNBR values will be based on the actual uncertainties for instrumentations not yet procured. The quantification of instrument uncertainties includes activities that require procurement and installation of the instruments, including evaluation of changes in sensor design and location, and that can only be completed after installation of the instruments. Confirmation of instrument uncertainties after completion of the installation does not alter the methods of evaluation used to establish setpoints in the technical specifications, since the design limit DNBR values were based on the plant specifications for instrumentation uncertainties. The design limit DNBR values are expected to remain valid through plant procurement.

The NRC staff concluded in FSER Section 4.4 that the methodology for calculating the design limit DNBR values complied with the relevant regulatory requirements. The staff further concluded that it was acceptable to complete the final verification of the design limit DNBR values when the as-built specifications are available.

Therefore, the staff concludes that the supplemental information described in FSAR Section 4.4 meets COL Information Item 4.4-2 described in AP1000 DCD Subsection 4.4.7.2, complies with COL Action Item 4.4-1, and is acceptable.

The staff also finds the applicant's proposed license condition that will require completing this analysis prior to fuel load acceptable, since the applicant has committed to confirm that either the design limit DNBR values remain valid, or that the safety analysis minimum DNBR bounds the new design DNBR values plus DNBR penalties, such as rod bow penalty.

Conformance to Regulatory Guide 1.133, Revision 1

In BLN COL FSAR Section 1.9, "Compliance with Regulatory Criteria," Section 1.9.1, "Regulatory Guides," the applicant adds Appendix 1AA, which provides an evaluation of the degree of compliance with Division 1 regulatory guides (RGs) as applicable to the content of this FSAR, or to the site-specific design, construction and/or operational aspects, and Table 1.9-201, which identifies the appropriate regulatory guide to FSAR cross-reference. In Appendix 1AA, the applicant provides an evaluation of its loose-part detection program for compliance with RG 1.133, Revision 1, May 1981, "Loose Part Detection Program for the Primary System of Light-Water-Cooled Reactors." It states that conformance of the design aspects is as stated in the DCD. It also documents conformance with the programmatic and/or operational aspects described in paragraphs C.3a and C.6 of RG 1.133, Revision 1.

RG 1.133, Revision 1, describes a method acceptable to the NRC staff for implementing regulatory requirements with respect to detecting a potentially safety-related loose part in light-water-cooled reactors during normal operation. The AP1000 design includes a digital metal impact monitoring system, which is a non-safety-related system provided for monitoring the reactor coolant system for metallic loose parts. AP1000 DCD Section 4.4.6.4 documents the conformance of this monitoring system to RG 1.133. BLN COL FSAR Appendix 1AA documents its conformance to the design aspects described in DCD Section 4.4.6.4, and also states it conforms to Regulatory Position C.3a, regarding manual mode of data acquisition for detection of loose parts and Regulatory Position C.6, regarding notification to NRC of confirmation of the presence of a loose part.

The NRC staff noted that RG 1.133, Revision 1, was not included in Revision 1 of FSAR Table 1.9-201 for a cross-reference to the appropriate FSAR section, although an evaluation of compliance with RG 1.133 is provided in Appendix 1AA. In response to Request for Additional Information (RAI) 1-7, the applicant added RG 1.133, Revision 1, to Table 1.9-201, as part of Revision 1 to the FSAR. In addition, the response to RAI 1-7 was supplemented by adding a conformance discussion for regulatory guide positions related to the procedures and training program (positions 4g, 4h, 4i and 4j) in the proposed revision to BLN FSAR Appendix 1AA, "Conformance with Regulatory Guides." The proposed change to BLN FSAR is acceptable subject to a formal revision to BLN FSAR. Accordingly, this is ***Confirmatory Item 4.4-1****. With the conformance of the*

programmatic and operational aspects of regulatory positions, the staff concludes that the applicant's loose parts detection program will conform to RG 1.133, Revision 1.

Resolution of Standard Content Confirmatory Item 4.4-1

The staff notes that RAI 1-11 was mistakenly identified as RAI 1-7 in the standard content SER as it relates to the conformance discussion for RG 1.133. The RAI number related to conformance is 1-11. The staff also notes that the BLN SER did not address Position C.6 of RG 1.133.

Confirmatory Item 4.4-1, as modified by the discussion above, is related to the applicant's conformance with the RG 1.133 Positions C.4g, 4h, 4i, 4j, and 6 as documented in Appendix 1AA of the VEGP COL FSAR. The staff's review of the VEGP COL FSAR indicates that the VEGP COL FSAR Appendix 1AA was updated to include all the information identified in the Confirmatory Item 4.4-1 except for Position C.6.

The response to RAI 1-11 included a conformance discussion for RG 1.133, Position C.6, "Notification of a Loose Part." Position C.6 refers to RG 1.16, "Reporting of Operating Information." The applicant took an exception to this position because this RG had been withdrawn. The staff considered this justification to be inadequate. Although the staff agreed it was no longer relevant to refer to RG 1.16, there remained a need to address reporting requirements. In response to this staff concern, the applicant proposed a revision to Appendix 1AA of its FSAR. In a letter dated January 8, 2010, the applicant stated that it would follow reporting requirements in accordance with requirements of 10 CFR 50.72 and 10 CFR 50.73 using guidance of NUREG-1022. The staff considers the applicant's position adequately addresses reporting requirements for loose part notification and therefore considers the exception acceptable. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 4.4-1 is now closed.

4.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license condition):

- License condition (4-1) - Prior to initial fuel load, the licensee shall calculate the instrumentation uncertainties of the actual plant operating instrumentation to confirm that either the design limit DNBR values remain valid or that the safety analysis minimum DNBR bounds the new design limit DNBR values plus DNBR penalties, such as rod bow penalty.

4.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the application addressed the required information relating to the reactor internals, control rod drive and core support structural materials, fuel system design (fuel rods and fuel assemblies), the nuclear design, the thermal-hydraulic design, and reactivity control systems functional design and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this chapter. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable. The staff based its conclusion on the following:

- STD COL 4.4-2 is acceptable because it specifies a commitment on the part of the applicant to confirm the validity of the calculations of the design limit DNBR values, which are based on the plant specifications for instrumentation uncertainties. The confirmation of plant instrument uncertainties will be completed when the as-built specifications are available. The methodology for this calculation was previously approved by the staff in NUREG-1793

5.0 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

5.1 Introduction

The reactor coolant system (RCS) consists of two heat transfer circuits, each with a steam generator, two reactor coolant pumps and a single hot leg and two cold legs for circulating reactor coolant. In addition, the system includes the pressurizer, interconnecting piping/valves and instrumentation for operational control and safeguards actuation. All RCS equipment is located in the reactor containment. The RCS is designed to transfer heat generated by the reactor core, located in the reactor vessel (RV), to the secondary side of the steam generators for plant power generation.

Section 5.1 of the Vogtle Electric Generating Plant (VEGP) Combined License (COL) Final Safety Analysis Report (FSAR), Revision 5, incorporates by reference, with no departures or supplements, Section 5.1 of Revision 19 of the AP1000 Design Control Document (DCD). The Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[20] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793, "Final Safety Evaluation Report [FSER] Related to Certification of the AP1000 Standard Design," and its supplements.

5.2 Integrity of Reactor Coolant Pressure Boundary

5.2.1.1 *Compliance with 10 CFR 50.55a*

5.2.1.1.1 Introduction

Title 10 of the *Code of Federal Regulations* (CFR) 10 CFR 50.55a incorporates by reference the American Society of Mechanical Engineers (ASME) *Boiler & Pressure Vessel Code* (BPV Code) and ASME Code for Operation and Maintenance for Nuclear Power Plants (OM Code), including Editions and Addenda for ASME Class 1, 2, and 3 components, required for component design, construction, inservice inspection (ISI), and inservice testing (IST).

AP1000 DCD, Tier 2, Table 3.2-1 classifies the pressure-retaining components of the reactor coolant pressure boundary (RCPB) as ASME BPV Code, Section III, Class 1 components. These Class 1 components are designated quality group (QG) A in conformance with Regulatory Guide (RG) 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Revision 3.

5.2.1.1.2 Summary of Application

Section 5.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.2 of the AP1000 DCD, Revision 19. Section 5.2 of the DCD includes Section 5.2.1.1.

[20] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification (DC).

In addition, in VEGP COL FSAR Section 5.2.1.1, the applicant provided the following:

AP1000 COL Information Item

- STD COL 5.2-1

The applicant provided additional information in Standard (STD) COL 5.2-1 to address COL Action Item 5.2.1.1-1 identified in NUREG-1793, Appendix F, "Combined License Action Items" and COL Information Item 5.2-1 discussed in Section 5.2.6.1, "ASME Code and Addenda," of the AP1000 DCD. The portion of STD COL 5.2-1 evaluated here applies to ASME BPV Code reconciliation. The portion applicable to Code cases is reviewed in Section 5.2.1.2 of this safety evaluation report (SER).

In particular, VEGP COL FSAR in Section 5.2.1.1 states:

> If a later Code edition/addenda than the Design Certification Code edition/addenda is used by the material and/or component supplier, then a code reconciliation to determine acceptability is performed as required by the ASME Code, Section III, NCA-1140. The later Code edition/addenda must be authorized in 10 CFR 50.55a or in a specific authorization as provided in 50.55a(a)(3). Code Cases to be used in design and construction are identified in the DCD; additional Code Cases for design and construction beyond those for the design certification are not required.
>
> Inservice inspection of the reactor coolant pressure boundary is conducted in accordance with the applicable edition and addenda of the ASME Boiler and Pressure Vessel Code Section XI, as described in Subsection 5.2.4. Inservice testing of the reactor coolant pressure boundary components is in accordance with the edition and addenda of the ASME OM Code as discussed in Subsection 3.9.6 for pumps and valves, and as discussed in Subsection 3.9.3.4.4 for dynamic restraints.

5.2.1.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the ASME BPV Code reconciliation are given in Section 5.2.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

The applicable regulatory requirements for the NRC staff's review of STD COL 5.2-1 are provided in 10 CFR 50.55a, as it relates to the establishment of the minimum quality standards for the design, fabrication, erection, construction, testing, and inspection of RCPB components and other safety-related fluid systems of pressurized-water reactor (PWR) nuclear power plants by compliance with appropriate editions of published industry codes and standards. The regulatory basis is also provided in 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 1, "Quality Standards and Records," as it relates to requirements that nuclear power plant structures, systems, and components (SSCs) important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

5.2.1.1.4 Technical Evaluation

The NRC staff reviewed Section 5.2.1.1 of the VEGP COL FSAR and the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to integrity of the RCPB. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the Bellefonte Nuclear Plant (BLN), Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items to resolve. **There was a change to the AP1000 DCD and NUREG-1793 referenced in the standard content material. This change is discussed in this SER.**

The following portion of this technical evaluation section is reproduced from Section 5.2.1.1.4 of the BLN SER:

> *AP1000 COL Information Item*
>
> - *STD COL 5.2-1*
>
> *The NRC staff reviewed STD COL 5.2-1 related to ASME BPV Code reconciliation included under Section 5.2.1.1 of the BLN COL FSAR.*
>
> *The regulations in 10 CFR 50.55a(a)(3) provide requirements to authorize alternatives to the regulations in 10 CFR 50.55a, while 10 CFR 50.55a(f)(6)(i) and 10 CFR 50.55(g)(6)(i) provide requirements to grant requests for relief from impractical ASME Code requirements. In addition, NUREG-1793,*

Section 5.2.1.1 provides a discussion on the need for allowing changes to the ASME Code Edition and Addenda during plant construction to ensure consistency between design and construction requirements.

Section 5.2.1.1 of the NRC staff's NUREG-1793 states:

> *DCD Tier 2, Section 5.2.1.1, states that the baseline code used to support the AP1000 DCD is ASME Code, Section III, 1998 Edition, up to and including the 2000 Addenda. However, the ASME Code, Section III, 1989 Edition, 1989 Addenda will be used for Articles NB-3200, NB-3600, NC-3600, and ND-3600 in lieu of the later edition and addenda. The use of these editions and addenda meets the requirements of 10 CFR 50.55a(b) and the associated modifications in 10 CFR 50.55a(b)(1)(iii) and is, thus, acceptable. Any proposed change to the use of the ASME Code editions or addenda by a Combined License (COL) applicant will require NRC approval prior to implementation.*

The issue was also captured as COL Action Item 5.2.1.1-1 in Appendix F of NUREG-1793. The NRC staff states in Section 5.2.1.1 of NUREG-1793:

> *The COL applicant should ensure that the design is consistent with the construction practices (including inspection and examination methods) of the ASME Code edition and addenda, as endorsed in 10 CFR 50.55a. DCD Tier 2, Section 5.2.6.1, "ASME Code and Addenda," contains a commitment that the COL applicant will address consistency of the design with the construction practices (including inspection and examination methods) of the later ASME Code edition and addenda. The staff finds this to be an acceptable commitment. This is COL Action Item 5.2.1.1-1.*

Specifically, the AP1000 DCD in Section 5.2.6.1 identified a COL information item stating:

> *The Combined License applicant will address in its application the portions of later Code editions and addenda to be used to construct components that will require NRC staff review and approval. The Combined License applicant will address consistency of the design with the construction practices (including inspection and examination methods) of the later ASME Code edition and addenda added as part of the Combined License application. The Combined License applicant will address the addition of ASME Code cases approved subsequent to design certification.*

The staff reviewed conformance of BLN's resolution to COL Action Item 5.2.1.1-1 to the guidance in NUREG-0800, Section 5.2.1.1, "Compliance with the Codes and Standards Rule, 10 CFR 50.55a." ASME Code, Section III, NCA-1140, "Use of Code Editions, Addenda, and Cases," states that specific provisions within an

Edition or Addenda later than those established in the design specifications may be used, provided that all the related requirements are met. NCA-1140(a)(1) also states:

> *Under the rules of this Section [Section III], the Owner or his designee shall establish the Code Edition and Addenda to be included in the Design Specifications. All items of a nuclear power plant may be constructed to a single Code Edition and Addenda, or each item may be constructed to individually specified Code Editions and Addenda.*

Accordingly, a COL applicant should establish whether it plans to use a single Code Edition and Addenda consistent with the certified design or to use individually specified Code Editions and Addenda. If individually specified Code Editions and Addenda are used, then differences between those Editions and Addenda are required to be reconciled consistent with requirements in the ASME BPV Code, Section III, NCA-1140.

The NRC staff found that Revision 0 to the BLN COL FSAR did not address NCA-1140 in describing the use of later Code Editions and Addenda. Therefore, in request for additional information (RAI) 5.2.1.1-1, the staff requested that the applicant explain the methodology for the ASME BPV Code reconciliation consistent with NCA-1140.

In its response to RAI 5.2.1.1-1 (this also applies to RAI 5.2.1.2-1 and RAI 5.2.1.1-3), the COL applicant described a revision to the FSAR to address this issue. Revision 1 to BLN COL FSAR Section 5.2.1.1, specifies that the methodology used to ensure consistency of design and construction practices when using later Section III Code Editions and Addenda would conform to the provisions of NCA-1140, and that all related requirements of the Code case(s) would be met. The use of NCA-1140 addresses the provisions to be followed for reconciliation of later Editions/Addenda of the ASME BPV Code. As a result, RAI 5.2.1.1-1 and RAI 5.2.1.2-1 are closed.

Revision 0 of the BLN COL FSAR referred to the use of ASME BPV Code, Section XI, as part of the reconciliation process if a later-Code year/Addenda than the DC Code year/Addenda is used by the material and/or component supplier. In RAI 5.2.1.1-3, the staff requested that the applicant provide justification for the use of ASME BPV Code, Section XI, which addresses ISI at operating nuclear power plants, in the reconciliation process for new reactor designs.

In its response to RAI 5.2.1.1-3 (referring to the response to RAI 5.2.1.1-1), the applicant noted that ASME BPV Code, Section III components are being designed using the baseline ASME BPV Code defined in DCD Section 5.2.1.1. Design specifications for component and material procurement will specify the ASME BPV Code to be used for design and construction to be that identified in the DCD. The applicant also noted that the reference in FSAR Section 5.2.1.1 to the ASME BPV Code, Section XI reconciliation process for repair and replacement was inappropriate for the original design and construction. Therefore, the applicant stated that this reference would be corrected.

Revision 1 to the BLN COL FSAR in Section 5.2.1.1 removes the reference to ASME BPV Code, Section XI, and states, if a later Code Edition/Addenda than the DC Code Edition/Addenda is used by the material and/or component supplier, then a Code reconciliation to determine acceptability is performed as required by the ASME Code, Section III, NCA-1140. The staff finds that Revision 1 to the BLN COL FSAR meets the requirements of 10 CFR 50.55a. As a result, RAI 5.2.1.1-3 is closed.

Revision 0 of the BLN COL FSAR referenced Revision 16 of the AP1000 DCD. AP1000 DCD, Revision 16 required the use of the 1989 Edition, 1989 Addenda for NB-3200, NB-3600, NC-3600 and ND-3600 for construction of components and piping. In RAI 5.2.1.1-5, the NRC staff requested that the applicant identify components that are designed and constructed using the 1989 ASME BPV Code and discuss whether these components will meet the requirements of the 1998 Edition through and including the 2000 Addenda ASME BPV Code, which is the Code of record for the AP1000 DCD. In its response to RAI 5.2.1.1-5, the applicant indicated that in a letter dated May 16, 2008, Westinghouse submitted a document (APP-GW-GLE-005) to address the limitation on the use of ASME Section III Code for seismic design in accordance with 10 CFR 50.55a(b)(1)(iii) as related to the use of the above four articles. The AP1000 DCD was accordingly changed in Revision 17 to limit the use of the 1989 Edition, 1989 Addenda to piping design only. Since BLN COL FSAR, Revision 1 incorporated by reference Revision 17 of AP1000 DCD, no components will be constructed using the 1989 Edition, 1989 Addenda Code and they will be used for piping design only. As a result, RAI 5.2.1.1-5 is closed.

AP1000 DCD, Section 5.2.1.1 discusses the application of ASME BPV Code, Section III, for the design and fabrication of RCPB components. In RAI 5.2.1.1-2, the NRC staff requested that the applicant discuss the application of other sections of the ASME BPV Code and the ASME Code for Operation and Maintenance of Nuclear Power Plants (OM Code) not specified in the AP1000 DCD, Section 5.2.1.1. In its response to RAI 5.2.1.1-2, provided in a letter dated July 25, 2008, the applicant discussed other sections in the AP1000 DCD and the BLN COL FSAR that reference the ASME BPV Code and the ASME OM Code. In response to RAI 5.2.1.1-2, the applicant stated that BLN COL FSAR Section 5.2.1.1 would be revised to address this issue. Revision 1 to the BLN COL FSAR in Section 5.2.1.1, specifies that ISI of the RCPB will be conducted in accordance with the applicable Edition and Addenda of the ASME BPV Code, Section XI, as described in BLN COL FSAR Section 5.2.4, "Inservice Inspection and Testing of Class 1 Components." The BLN COL FSAR, Revision 1 also specifies that IST of the RCPB components will be performed in accordance with the applicable Edition and Addenda of the ASME OM Code as discussed in BLN COL FSAR Section 3.9.6, "Inservice Testing of Pumps and Valves," and as discussed in BLN COL FSAR Section 3.9.3.4.4, "Inspection, Testing, Repair and/or Replacement of Snubbers." Revision 1 to the BLN COL FSAR clarified the application of other sections of the ASME BPV Code and the ASME OM Code in the design, construction, and operation of BLN Units 3 and 4. As a result, RAI 5.2.1.1-2 is closed.

As discussed in NUREG-1793, use of the ASME BPV Code for the AP1000 reactor is Tier 1 information while the specific Edition and Addenda are

designated Tier 2 because of the continually evolving design and construction practices (including inspection and examination techniques) of the ASME BPV Code. The NRC staff finds that the design and construction of ASME BPV Code Class 1, 2, and 3 components and their supports will conform to the appropriate ASME BPV Code Editions and Addenda and, thus, meet the relevant NRC regulations governing the use of codes and standards. The use of Editions and Addenda of the ASME BPV Code, Section III issued subsequent to the AP1000 design code of record may be used provided the Edition and Addenda are incorporated by reference in the regulations, and NRC staff approval is obtained as required for Tier 2* changes to the AP1000 DC information. Generic NRC approval of the Tier 2* changes related to use of later Editions and Addenda during construction may be obtained by a COL applicant through NCA-1140(a)(1) for components other than piping. Further, the staff finds that quality standards used will be commensurate with the importance of the safety function of all safety-related components because the ASME BPV Code, Section III that is incorporated by reference into the NRC regulations will be used by the COL licensee to ensure consistency with design, construction, and inspection requirements. The staff finds this to be an acceptable basis for satisfying the requirements of GDC 1. Finally, STD COL 5.2-1 states that any proposed alternatives to the ASME BPV Code must be authorized by the NRC pursuant to 10 CFR 50.55a(a)(3). This meets the regulations and is, therefore, acceptable.*

Correction to the Standard Content Evaluation Text

The section of the technical evaluation above, which discusses the Tier 2* information is no longer valid. Westinghouse, in a proposed revision of its DCD, changed the Edition and Addenda of the ASME BPV Code from a Tier 2* designation to Tier 2. This change is evaluated in a supplement to NUREG-1793.

This change does not impact the conclusions of the BLN or VEGP evaluations.

5.2.1.1.5 Post Combined License Activities

There are no post-COL activities related to this section.

5.2.1.1.6 Conclusion

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to codes and standards, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR 50.55a and GDC 1. The staff based its conclusion on the following:

- STD COL 5.2-1, as related to ASME Code reconciliation, is acceptable because the design and construction of ASME BPV Code Class 1, 2, and 3 components and their supports will conform to the appropriate ASME BPV Code Editions and Addenda and,

thus, meet the relevant NRC regulations in 10 CFR 50.55a governing the use of codes and standards. Further, the staff finds that quality standards used will be commensurate with the importance of the safety function of all safety-related components and is an acceptable basis for satisfying the requirements of GDC 1. Also, STD COL 5.2-1 states that any proposed alternatives to the ASME BPV Code must be authorized by the NRC pursuant to 10 CFR 50.55a(a)(3).

5.2.1.2 *Applicable Code Cases (Related to RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.1.2, "Compliance with Applicable ASME Code Cases")*

5.2.1.2.1 Introduction

This section addresses the ASME Code cases to be used at VEGP. In general, a Code case is developed by ASME based on inquiries from the nuclear industry associated with Code clarification, modification or alternative to the Code. All Code cases will remain valid and available for use until annulled by the ASME BPV Standards Committee. ASME Code cases acceptable to the NRC staff are published in RG 1.84, "Design and Fabrication Code Case Acceptability, ASME Section III, Division 1"; RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1"; and RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code"; in accordance with requirements of 10 CFR 50.55a(b)(4), 10 CFR 50.55a(b)(5) and 10 CFR 50.55a(b)(6).

5.2.1.2.2 Summary of Application

Section 5.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.2 of the AP1000 DCD, Revision 19. Section 5.2 of the DCD includes Section 5.2.1.2.

VEGP COL FSAR Section 5.2 does not include supplemental information in the incorporation by reference of Section 5.2.1.2 of the AP1000 DCD. However, VEGP COL FSAR Section 5.2 specifies supplementary information in STD COL 5.2-1 that relates to applicable Code cases.

In addition, in VEGP COL FSAR Section 5.2.1.1, the applicant provided the following:

AP1000 COL Information Item

- STD COL 5.2-1

The applicant provided additional information in STD COL 5.2-1 to address COL Action Item 5.2.1.1-1 identified in NUREG-1793 and COL Information Item 5.2-1 discussed in Section 5.2.6.1, "ASME Code and Addenda," of the AP1000 DCD. The portion of STD COL 5.2-1 evaluated here applies to applicable Code cases.

5.2.1.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the applicable Code cases are given in Section 5.2.1.2 of NUREG-0800.

The applicable regulatory requirements for the NRC staff's review of the VEGP COL application are as follows.

GDC 1 in Appendix A to 10 CFR Part 50 and 10 CFR 50.55a, as related to the establishment of the minimum quality standards for the design, fabrication, erection, construction, testing, and inspection of nuclear power plant components, require conformance with appropriate editions of published industry codes and standards.

As one means of meeting the applicable NRC regulations, RG 1.84 lists ASME BPV Code, Section III Code cases oriented to design, fabrication, materials, and testing, which are acceptable with applicable conditions for implementation at nuclear power plants. RG 1.147 lists ASME BPV Code, Section XI Code cases, which are acceptable with applicable conditions for use in the ISI of nuclear power plant components and their supports. RG 1.192 lists Code cases related to the ASME OM Code oriented to operation and maintenance of nuclear power plant components, which are acceptable with applicable conditions for implementation at nuclear power plants.

5.2.1.2.4 Technical Evaluation

The NRC staff reviewed Section 5.2 of the VEGP COL FSAR and the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to applicable Code cases. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In NUREG-1793 Section 5.2.1.2, the NRC staff states that the COL applicant may submit, with its COL application, future Code cases that are endorsed in RG 1.84 at the time of the application, provided that they do not alter the staff's safety findings on the AP1000 certified design. The staff also states that the COL applicant should submit those Code cases that are in effect at the time of the COL application and apply to operational programs involving ISI and IST. The supplement to NUREG-1793 describes the staff's technical evaluation of modifications to the list of ASME Code cases in Table 5.2-3 of Revision 17 to the AP1000 DCD.

The NRC staff followed the guidance provided in NUREG-0800, Section 5.2.1.2, "Applicable Code Cases," and RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.1.2, in evaluating VEGP COL FSAR Section 5.2.1.2 for compliance with the NRC regulations.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items to resolve.

The following portion of this technical evaluation section is reproduced from Section 5.2.1.2.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 5.2-1*

Revision 0 to the BLN COL FSAR in Section 5.2.1.1 had referenced ASME BPV Code, Section XI, as part of the reconciliation process for the use of ASME Code cases other than those included in AP1000 DCD Table 5.2-3. In RAI 5.2.1.1-4, the staff requested that the applicant explain how this met 10 CFR 50.55a(a)(3), 10 CFR 50.55a(b)(4), 10 CFR 50.55a(b)(5), and10 CFR 50.55a(b)(6).

In its response to RAI 5.2.1.1-4, the applicant noted that no Code cases other than those included in the DCD have been identified as necessary at this time. Code cases approved by the NRC in RG 1.147 may be used, and if so, they will be identified in a revision to the FSAR. The applicant also indicated that the FSAR statement regarding reconciliation of Code cases was incorrect and would be revised. Revision 1 to the BLN COL FSAR in Section 5.2.1.1 specifies that Code cases to be used in design and construction are identified in the DCD and that additional Code cases for design and construction beyond those for the DC are not required. The staff considers Revision 1 to the BLN COL FSAR Section 5.2.1.1 to be acceptable. As a result, RAI 5.2.1.1-4 is closed.

AP1000 DCD, Revision 17, Section 5.2.1.2 indicated that use of Code cases approved in revisions of the RGs issued subsequent to the DC may be used as discussed in Section 5.2.6.1 by using the process outlined for updating the ASME Code Edition and Addenda. Section 5.2.6.1 stated that the COL applicant will address in its application, the addition of ASME Code cases approved subsequent to DC. Similar to the Section III Code cases listed in DCD Table 5.2-3, in RAI 5.2.1.2-2, the staff requested that the applicant identify the ASME BPV Code, Section XI ISI and the ASME OM Code cases that are used for BLN design and construction. The applicant was also requested to confirm whether these Code cases are approved by the NRC as documented in RGs 1.147 and 1.192. If not, these Code cases must be submitted to the NRC for authorization pursuant to 10 CFR 50.55a(a)(3).

In its response to RAI 5.2.1.2-2, the applicant referred to its response to RAI 5.2.1.1-4 and noted that there are no additional Code cases used for design and construction beyond those identified in the DCD. In its RAI response, the applicant stated that the IST Program described in BLN COL FSAR Section 3.9.6

will utilize Code Case OMN- 1, Revision 1, "Alternative Rules for the Preservice and In-service Testing of Certain Electric Motor-Operated Valve Assemblies in Light Water Reactor Power Plants," which establishes alternate rules and requirements for preservice and IST to assess the operational readiness of certain motor operated valves. The staff notes that the current revision to RG 1.192 at the time of this COL review conditionally accepts the use of Code Case OMN-1, Revision 0, and does not address Revision 1 to Code Case OMN-1. The applicant will need to submit a request under 10 CFR 50.55a for authorization to apply Revision 1 to Code Case OMN-1, if RG 1.192 is not updated to accept this revision to the Code case prior to development of the IST Program for BLN. The NRC staff's review of the use of OMN-1, Revision 1, for BLN is discussed in Section 3.9.6 of this SER. In its response to RAI 5.2.1.2-2, the applicant stated that no code cases other than those included in the DCD are used for BLN and the FSAR would be revised as indicated in response to RAI 5.2.1.1-4. As noted above, Revision 1 to the BLN COL FSAR resolved RAI 5.2.1.1-4. Therefore, RAI 5.2.1.2-2 is also closed.

Based on its review, the NRC staff has determined that BLN COL FSAR Section 5.2 appropriately incorporates by reference AP1000 DCD, Section 5.2.1.2, in satisfying the NRC regulations for the design, fabrication, erection, testing, and inspection of plant SSCs commensurate with the importance of the safety function to be performed by referencing the use of accepted ASME Code cases. As a result, the staff concludes that compliance by the applicant with the provisions of the ASME Code cases accepted in RGs 1.84, 1.147, and 1.192, or individually reviewed and accepted in NUREG-1793 or its supplements, will result in component quality that is commensurate with the importance of the safety functions of the components at BLN Units 3 and 4. This satisfies the requirements of GDC 1, and, therefore, is acceptable.

AP1000 DCD, Section 5.2.6.1 states, in part, that the COL applicant will address the addition of ASME Code cases approved subsequent to the DC. As noted above, the applicant has not identified any Code cases other than those included in the AP1000 DCD as necessary at this time for the design and construction of BLN Units 3 and 4. If the applicant determines the need to apply other ASME Code cases in the future, it may apply those ASME Code cases in accordance with their acceptance in RG 1.84, RG 1.147, or RG 1.192, including any applicable conditions, or must request NRC authorization to use those Code cases.

5.2.1.2.5 Post Combined License Activities

There are no post-COL activities related to this section.

5.2.1.2.6 Conclusion

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to ASME Code cases, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR 50.55a and GDC 1, and complies with the provisions of the ASME Code cases accepted in RGs 1.84, 1.147, and 1.192. The staff based its conclusion on the following:

- STD COL 5.2-1, as related to applicable ASME Code cases, is acceptable because the NRC staff has determined that VEGP COL FSAR Section 5.2 appropriately incorporates by reference AP1000 DCD Section 5.2.1.2, in satisfying the NRC regulations for the design, fabrication, erection, testing, and inspection of plant SSCs commensurate with the importance of the safety function to be performed by referencing the use of accepted ASME Code cases. As a result, the staff concludes that compliance by the applicant with the provisions of the ASME Code cases accepted in RGs 1.84, 1.147, and 1.192, or individually reviewed and accepted in NUREG-1793 or its supplements, will result in component quality that is commensurate with the importance of the safety functions of the components at VEGP Units 3 and 4. This satisfies the requirements of GDC 1, and therefore, is acceptable.

5.2.1.3 *Alternate Classification*

In the standard plant design, Westinghouse applies an alternate classification for the chemical and volume control system (CVCS).

Section 5.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 5.2.1.3, "Alternate Classification," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

5.2.2 Overpressure Protection

RCS and steam system overpressure protection during power operation is provided by the pressurizer safety valves and the steam generator safety valves, in conjunction with the action of the reactor protection system. In addition, a relief valve in the suction line of the normal residual heat removal system (RNS) provides low-temperature overpressure protection (LTOP) for the RCPB during low-temperature operation of the plant (startup, shutdown).

Section 5.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 5.2.2, "Overpressure Protection," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

5.2.3 Reactor Coolant Pressure Boundary Materials

5.2.3.1 *Introduction*

Materials selected for RCS components must be compatible with reactor coolant water chemistry, thermal insulation materials, and the atmosphere. The specific processes (including heat treatment and welding practices) used to fabricate RCS components must maximize the corrosion resistance and fracture toughness of the components.

5.2.3.2 *Summary of Application*

Section 5.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.2 of the AP1000 DCD, Revision 19. Section 5.2 of the DCD includes Section 5.2.3.

In addition, in VEGP COL FSAR Section 5.2.3.2.1, the applicant provided the following:

Supplemental Information

- STD SUP 5.2-1

The applicant provided supplemental (SUP) information to describe the monitoring program for primary water chemistry to be implemented at the plant during plant operation.

5.2.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the RCPB materials are given in Section 5.2.3 of NUREG-0800.

The applicable regulatory requirements for acceptance of the supplementary information on water chemistry monitoring is established in GDC 14, "Reactor Coolant Pressure Boundary," which requires that the RCPB shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

5.2.3.4 *Technical Evaluation*

The NRC staff reviewed Section 5.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to RCPB materials. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content

that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items to resolve.

The following portion of this technical evaluation section is reproduced from Section 5.2.3.4 of the BLN SER:

Supplemental Information

- *STD SUP 5.2-1*

The NRC staff reviewed the standard supplementary information on water chemistry as discussed in Section 5.2.3.2.1 of the BLN COL FSAR. In its review of the supplemental information the staff used the applicable sections of NUREG-0800 and RG 1.206 as guidance. However, Section 5.2.3 of NUREG-0800 does not directly address PWR reactor coolant chemistry, but, rather, refers the reviewer to NUREG-0800, Section 9.3.4, "Chemical and Volume Control System (PWR) Including Boron Recovery." Section 9.3.4 of NUREG-0800 recommends that the Chemical and Volume Control System (CVCS) ensure that RCS chemistry meets GDC 14, by maintaining acceptable purity levels in the reactor coolant through the removal of insoluble corrosion products and dissolved ionic material by filtration and ion exchange. In addition, Section 9.3.4 of NUREG-0800 recommends that the CVCS maintain proper RCS chemistry by controlling total dissolved solids, pH, oxygen concentration, and halide concentrations within the acceptable ranges. RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.3.2 recommends that COL applications referencing PWR standard designs describe the chemistry of the reactor coolant and the additives (such as inhibitors), the water chemistry, including maximum allowable content of chloride, fluoride, sulfate, and oxygen and permissible content of hydrogen and soluble poisons, the methods to control water chemistry, including pH, the industry-recommended methodologies to be used to monitor water chemistry, and provide appropriate references. Additionally, RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.3.2 also states that "this section may reference the Electric Power Research Institute (EPRI) water chemistry guidelines to support the

plant-specific program. However, this section should fully describe and discuss the plant-specific water coolant chemistry control program and its compatibility with the RCPB materials."

The supplementary information in the BLN COL FSAR states that monitoring of water chemistry is implemented using the guidance of EPRI TR-1002884, "Pressurized Water Reactor Primary Water Chemistry Guidelines: Volume 1," Appendix F (Revision 5, dated October 2003). The cited appendix pertains specifically to sampling of soluble and insoluble corrosion products from the RCS. Use of this appendix is consistent with the recommendation in NUREG-0800 that the CVCS system maintains acceptable purity levels in the reactor coolant through the removal of insoluble corrosion products and dissolved ionic material by filtration and ion exchange, and must maintain proper RCS chemistry by controlling total dissolved solids, pH, oxygen concentration, and halide concentrations within the acceptable ranges. Accurate sampling of corrosion products supports this recommendation.

Appendix F of the Primary Water Chemistry Guidelines only provides a recommended methodology for sampling RCS corrosion products, and does not provide acceptance criteria or methods for reducing/controlling RCS corrosion products. Further, other primary water chemistry parameters that NUREG-0800 and RG 1.206 recommend be addressed in the FSAR are not addressed by Appendix F, such as pH, oxygen, and halide concentrations. These parameters are addressed in DCD Section 5.2.3 and DCD Table 5.2.2, which provides maximum values of primary water chemistry parameters including oxygen, pH and halide concentration for the various plant operating modes. Referencing Appendix F only of the Primary Water Chemistry Guidelines does not add any more detail or specificity for these other parameters. Therefore, in a letter dated April 10, 2008, the staff requested additional information (RAI 5.2.3-1) from the applicant to address these items.

Specifically, the NRC staff requested that the applicant explain the rationale for referencing only Appendix F to the "Pressurized Water Reactor Primary Water Chemistry Guidelines" rather than referencing the entire guidelines document.

The applicant responded to RAI 5.2.3-1, in a letter dated May 23, 2008, stating that "the AP1000 Design Control Document (DCD) describes, in Section 5.2.3.2.1, the RCS chemistry specifications and the methods to control water chemistry. In addition, DCD Table 5.2-2 summarizes these specifications for conductivity, pH, oxygen, chloride, hydrogen, suspended solids (corrosion product particulates), pH control agent, boric acid, silica, aluminum, calcium, magnesium, and zinc."

The applicant's response further stated that FSAR Section 5.2 incorporates the aforementioned DCD section by reference and refers to Appendix F of EPRI TR-1002884 as the industry recommended methodology to be used to monitor water chemistry. As noted by the question, Appendix F of the EPRI document is limited to corrosion products and as such, is insufficient to address the remaining details of the program. As such, the text of FSAR Section 5.2.3.2.1 will be revised to reference the complete EPRI document which does address the requested program attributes not covered by the DCD.

The applicant also proposed changes to the BLN COL FSAR Chapter 5, Section 5.2.3.2.1. The following information is to replace the previous supplemental information:

> *The water chemistry program is based on industry guidelines as described In EPRI TR-1002884, "Pressurized Water Reactor Primary Water Chemistry." The program includes periodic monitoring and control of chemical additives and reactor coolant impurities listed in DCD Table 5.2-2. Detailed procedures implement the program requirements for sampling and analysis frequencies, and corrective actions for control of reactor water chemistry. The frequency of sampling water chemistry varies (e.g., continuous, daily, weekly, or as needed) based on plant operating conditions and the EPRI water chemistry guidelines. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions. When measured water chemistry parameters are outside the specified range, corrective actions are taken to bring the parameter back within the acceptable range and within the time period specified in the EPRI water chemistry guidelines. Following corrective actions, additional samples are taken and analyzed to verify that the corrective actions were effective in returning the concentrations of contaminants.*
>
> *Chemistry procedures will provide guidance for the sampling and monitoring of primary coolant properties.*

The staff finds the applicant's response, and the proposed COL application changes, acceptable because it meets the acceptance criteria in Section 9.3.4 of NUREG-0800 related to the evaluation of the proposed chemistry program using the latest version in the EPRI report series, "PWR Primary Water Guidelines." The staff verified that Revision 1 of the FSAR (STD SUP 5.2-1) adequately incorporates the above. As a result, RAI 5.2.3-1 is closed.

Additionally, the staff finds that the BLN FSAR meets the recommendation in RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.3.2 to fully describe the primary water chemistry control program in the FSAR by referencing the most recent version of the "EPRI PWR Primary Water Guidelines" in its entirety. Although Section 5.2 of the AP1000 DCD, Revision 17, provides maximum values (and in some cases, normal ranges) for the key primary water chemistry parameters, referencing the EPRI PWR Primary Water Guidelines provides a more detailed description of the chemistry control program because various action levels (at which varying levels of corrective action are required) are specified for the key parameters for different reactor operating modes, as well as the required periodicity for sampling the various parameters.

Although the staff does not formally review or issue a safety evaluation of the revisions to the EPRI water chemistry guidelines (including the PWR Primary Water Chemistry Guidelines), the guidelines are recognized as representing industry best practices in water chemistry control. Extensive experience in

operating reactors has demonstrated that following the EPRI guidelines minimizes the occurrence of corrosion related failures. Further, the EPRI guidelines are periodically revised to reflect evolving knowledge with respect to best practices in chemistry control. Therefore, the staff accepts the use of the EPRI PWR Primary Water Chemistry Guidelines as a basis for a primary water chemistry program for a COL referencing a standard reactor design.

5.2.3.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

5.2.3.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to RCPB materials, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of GDC 14. The staff based its conclusion on the following:

- STD SUP 5.2-1 meets the relevant guidance in Section 9.3.4 of NUREG-0800 with respect to developing a water chemistry program consistent with the latest EPRI guidelines and is acceptable. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of GDC 14.

5.2.4 Inservice Inspection and Testing of Class 1 Components (Related to RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.4, "Inservice Inspection and Testing of Reactor Coolant Pressure Boundary")

5.2.4.1 *Introduction*

Components that are part of the RCPB must be designed to permit periodic inspection and testing of important areas and features to assess their structural and leaktight integrity. ISI programs are based on the requirements of 10 CFR 50.55a, "Codes and Standards," in that Code Class 1 components, as defined in Section III of the ASME BPV Code, meet the applicable inspection requirements set forth in Section XI of the ASME Code, "Rules for Inservice Inspection of Nuclear Power Plant Components."

5.2.4.2 *Summary of Application*

Section 5.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.2 of the AP1000 DCD, Revision 19. Section 5.2 of the DCD includes Section 5.2.4. The advanced safety evaluation (ASE) with confirmatory items for Section 5.2.4 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse added a new COL Information Item (COL 5.3.7). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Section 5.2.4, the applicant provided the following:

AP1000 COL Information Item

- STD COL 5.2-2

The applicant provided additional information in STD COL 5.2-2 to address COL Information Item 5.2-2. The information relates to plant-specific preservice inspection (PSI) and ISI programs.

- STD COL 5.3-7

In a letter dated August 27, 2010, the applicant proposed a new STD COL 5.3-7 to address AP1000 DCD COL Information Item 5.3-7 included in a Westinghouse letter dated August 3, 2010. The new information states that the COL holder will augment the plant-specific ISI program in VEGP COL FSAR Section 5.2.4.1, related to the Quickloc weld buildup on the reactor vessel head.

Supplemental Information

- STD SUP 5.2-2

The applicant provided supplemental information regarding guidance for inspecting the integrity of bolting and threaded fasteners.

License Condition

- License Condition 6, regarding PSI/ISI program details

5.2.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for ISI are given in Section 5.2.4 of NUREG-0800.

The applicable regulatory requirements for acceptance of the resolution to COL Information Items 5.2-2 and 5.3-7 and supplementary information on ISI and testing of Class 1 components are established in GDC 32 found in Appendix A to 10 CFR Part 50, as it relates to periodic inspection and testing of the RCPB, and 10 CFR 50.55a, as it relates to the requirements for inspecting and testing ASME Code Class 1 components of the RCPB.

The applicable policy for acceptance of COL Information Items 5.2-2 and 5.3-7, as it relates to fully describing an operational program, is found in SECY-05-0197, “Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria,” dated October 28, 2005.

5.2.4.4 *Technical Evaluation*

The NRC staff reviewed Section 5.2.4 of the VEGP COL FSAR and the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to the RCPB ISI and testing. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In Section 5.2.4 of NUREG-1793, the staff concluded that the AP1000 ISI program for Code Class 1 components is acceptable and meets the requirements of 10 CFR 50.55a with regard to the preservice and inservice inspectability of these components. The specific version of the ASME Code, Section XI used as the baseline Code in the AP1000 certified design is the 1998 Edition up to and including the 2000 Addenda. It should be noted that the staff did not identify any portions of the AP1000 ISI program for Class 1, 2, and 3 components that were excluded from the scope of the staff's review of the AP1000 DC (as the staff did for IST of valves in AP1000 FSER Section 3.9.6.4). Therefore, the staff's conclusions regarding the acceptability of the AP1000 ISI program based on the 1998 Edition up to and including the 2000 Addenda of the ASME Code, Section XI with regard to preservice and inservice inspectability of Class 1 components remains unchanged with Revision 17 of AP1000 DCD, except for the newly identified STD COL Information Item 5.3-7, which is addressed below. Accordingly, the staff's evaluation of this section focused on the acceptability of the COL applicant's supplemental information and responses to AP1000 COL information items and action items. The staff's evaluation in this section also addresses the operational program aspects of the ASME Code Class 1, 2, and 3 PSI and ISI programs.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 5.2-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

AP1000 COL Information Item

The following portion of this technical evaluation section is reproduced from Section 5.2.4.4 of the BLN SER:

- *STD COL 5.2-2*

The COL applicant added the following after the first paragraph in DCD Section 5.2.4:

> *The initial inservice inspection program incorporates the latest edition and addenda of the ASME Boiler and Pressure Vessel Code approved in 10 CFR 50.55a(b) on the date 12 months before the initial fuel load. Inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) 12 months before the start of the 120-month inspection interval (or the optional ASEM* [sic] *Code cases listed in NRC Regulatory Guide 1.147, that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed in 10 CFR 50.55a(b).*

10 CFR 50.55a(g) requires that inservice examinations of components and system pressure tests conducted during the initial 120-month inspection interval must comply with the requirements in the latest edition and addenda of the Code incorporated by reference in paragraph (b) of 10 CFR 50.55a on the date 12 months before the date scheduled for initial loading of fuel under a combined license under 10 CFR Part 52. The staff concludes that the supplemental information provided by the COL applicant meets the NRC's regulations and is, therefore, acceptable.

The COL applicant added the following at the end of DCD Section 5.2.4.1:

> *The Class 1 system boundary for both preservice and inservice inspection programs and the system pressure test program include those items within the Class 1 and Quality Group A (Equipment Class A [in accordance with] DCD Section 3.2.2 and DCD Table 3.2-3 boundary). Based on 10 CFR Part 50 and Regulatory Guide 1.26, the Class 1 boundary includes the following:*
>
> - *reactor pressure vessel;*
> - *portions of the reactor system (RXS);*
> - *portions of the chemical and volume control system (CVS);*
> - *portion of the incore instrumentation system (IIS);*
> - *portions of the passive core cooling system (PXS);*
> - *portions of the reactor coolant system;*
> - *portions of the normal residual heat removal system.*

Those portions of the above systems within the Class 1 boundary are those items that are part of the RCPB as defined in Section 5.2 of the Bellefonte COL FSAR.

Exclusions

Portions of the systems within the reactor coolant pressure boundary [RCPB], as defined above, that are excluded from the Class 1 boundary in accordance with 10 CFR Part 50, Section 50.55a, are as follows:

- *Those components where, in the event of postulated failure of the component during normal operation, the reactor can be shut down and cooled down in an orderly manner, assuming makeup is provided by the reactor coolant makeup system only; or*

- *Components that are or can be isolated from the reactor coolant system by two valves (both closed, both open, or one closed and other open). Each open valve is capable of automatic actuation and, assuming the other valve is open, its closure time is such that, in the event of postulated failure of the component during normal reactor operation each valve remains operable and the reactor can be shut down and cooled down in an orderly manner, assuming makeup is provided by the reactor coolant makeup system only.*

The NRC staff compared the proposed description of the system boundary subject to inspection and the exclusions with ASME Section XI and 10 CFR 50.55a. The staff found that the proposed system boundary and exclusions were in agreement with the ASME guidelines and regulations, and are therefore, acceptable. This portion of STD COL 5.2-2 is acceptable.

In Revision 0 of the BLN COL FSAR, the COL applicant states that NRC First Revised Order, EA-03-009, "Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," will be used to establish the required inspections of RPV heads and associated penetration nozzles to detect primary stress corrosion cracking. In addition, the COL applicant states that ASME Code Case N-729-1 (N-729-1), "Alternative Examination Requirements for Pressurized-Water Reactor (PWR) Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds," will be used. N-729-1, as modified by the NRC staff may be used to perform the inspection of the AP1000 RPV head. Finally, a visual inspection to identify potential boric acid leaks from pressure-retaining components above the RPV head is performed each refueling outage.

COL Information Item 5.2-2 includes a commitment that the COL applicant's PSI program will include specific preservice examinations of the RV closure head equivalent to those outlined in AP1000 DCD Tier 2, Section 5.3.4.7. The BLN COL FSAR added supplemental information to the end of Section 5.2.4.3.1,

describing the design of the RV closure head as it pertains to meeting the PSI requirements. The staff could not determine from the information provided, the extent of PSI examinations. Based on the information provided by the applicant, the staff requested additional information in RAI 5.2.4-1.

In response to RAI 5.2.4-1, the COL applicant stated that the PSI related to the RV closure head and penetrations as discussed in DCD Section 5.3.4.7 includes the regions identified in the first revised order, EA-03-009. The design specification includes a requirement for PSIs consistent with the first revised order EA-03-009. As part of the RPV and integrated head package design finalization, the RV closure head design and the design of components connected to, and in the region of, the RV closure head was reviewed.

The COL applicant determined that the required PSI/ISI examinations can be performed as required by ASME Section III and Section XI. Based on the information provided by the COL applicant, the staff concludes that the PSI and ISI examinations will be accomplished in accordance with the first revised order, EA-03-009, ASME Sections III and XI, and are, thus, acceptable. As a result, RAI 5.2.4-1 is closed.

In Revision 1 to the BLN COL FSAR, the COL applicant states that its augmented inspection for the reactor vessel top head uses N-729-1 as modified by the NRC in the proposed rulemaking dated April 5, 2007 (72 FR 16740). The COL applicant further noted in response to RAI 5.2.4-5, that the wording in the final rule will be adopted when the final rule is issued. The final rule to amend 10 CFR 50.55a was issued on September 10, 2008 (73 FR 52730) and includes a requirement to inspect the RPV head in accordance with N-729-1 as amended by 10 CFR 50.55a(g)(6)(ii)(D). The COL applicant's methodology to inspect the RPV head in accordance with N-729-1, as amended by 10 CFR 50.55a(g)(6)(ii)(D) meets the regulations, and is therefore acceptable. The staff will verify that the next update of the BLN COL FSAR (Section 5.2.4.1) adequately incorporates reference to the final rule. This is ***Confirmatory Item 5.2-1.***

The COL applicant added the following after the second sentence of the first paragraph of DCD Section 5.2.4.4:

> *Because 10 CFR 50.55a(g)(4) requires 120-month inspection intervals, inspection Program B of IWB-2400 must be chosen. The inspection interval is divided into three periods. Each period can be extended up to one year to enable an inspection to coincide with a plant outage. The adjustment of period end dates shall not alter the rules and requirements for scheduling inspection intervals.*

RG 1.206 recommends that inspection intervals be described in comparison with the ASME Code. The information provided by the COL applicant indicated that Inspection Program B of IWB-2400 would be used over a 10-year interval. The three periods would be three, four, and three years to comprise the interval and extensions of a period may be performed up to a year to coincide with a plant

outage. The staff finds that the supplemental information provided by the COL applicant meets the requirements of the ASME Code, Section XI and the guidelines of RG 1.206, and is, thus, acceptable.

The COL applicant proposed adding the following section after the last paragraph of DCD Section 5.2.4.7:

> *5.2.4.8 Relief Requests*
>
> *The specific areas where the applicable ASME Code requirements cannot be met are identified after the initial examinations are performed. Should relief requests be required, they will be developed through the regulatory process and submitted to the NRC for approval in accordance with 10 CFR 50.55a(a)(3) or 10 CFR 50.55a(g)(5). The relief requests include appropriate justifications and proposed alternative inspection methods.*

In addition to the above, the COL applicant stated at the end of Section 5.2.4.3:

> *The RPV nozzle-to-shell welds are 100 percent accessible for preservice inspection but might have limited areas that may not be accessible from the outer surface for inservice examination techniques. If accessibility is limited, an inservice inspection program relief request is prepared and submitted for review approval by the NRC.*

The information lead [sic] *the staff to believe that areas where preservice and inservice examination requirements cannot be met or where compliance with the ASME Code is impractical will result in a need for the licensee to submit a request for relief from impractical Code requirements pursuant to 10 CFR 50.55a(g)(5)(iii). This is not consistent with the regulations in 10 CFR 50.55a(g)(3)(i) which state that Class 1 components must be designed and provided with access to enable the performance of preservice and inservice examinations in accordance with the requirements of the ASME Code, Section XI. Furthermore, the information is not consistent with AP1000 DCD Section 5.2.4.2, which states that the components will be designed to eliminate any hindrances to performing preservice or inservice examinations. The only time a relief request for a newly designed system or component should occur is when the updated edition and addenda to the ASME Code, Section XI is selected 1 year before the initial fuel load date for the first 120-month ISI interval and during subsequent ISI intervals when later edition and addenda of the ASME Code, Section XI that are incorporated by reference in 10 CFR 50.55a(b) change the examination requirements or coverage.*

The staff considers accessibility to perform ISI on both sides of austenitic and dissimilar metal welds critical to making its safety determination in order to monitor structural integrity of these welds due to their history of cracking. Cracking of these welds due to primary water stress corrosion cracking (PWSCC) or intergranular stress corrosion cracking (IGSCC) is a well-known occurrence and a safety significant issue. Consequently, the NRC staff is not

expecting to grant requests for relief from ISIs of these susceptible welds on the basis of design, geometry or materials of construction, since these factors can be rectified at the design stage before the plant is constructed. Based on the above discussion, the staff requested additional information from the COL applicant in RAIs 5.2.4-2 and 5.2.4-3 on accessibility for nondestructive examinations of the RV head and austenitic/dissimilar metal welds.

The COL applicant stated in its response to RAI 5.2.4-2 that as part of the design-for-inspectability process, the capability of examining the RV welds was assessed. The result was that with ISI tooling design and consideration of the AP1000 RV design, examinations from the inside of the AP1000 pressure vessel, including examinations of the reactor nozzle-to-shell welds, can be completed without a need for the applicant to request relief from the ASME Code, Section XI examination requirements. Based on the response provided by the applicant, the staff concludes that the reactor nozzle-to-shell welds are adequately designed to enable the performance of inservice examinations in accordance with 10 CFR 50.55a(g)(3)(ii), and is, thus, acceptable. As a result, RAI 5.2.4-2 is closed.

The COL applicant stated in its response to RAI 5.2.4-3 that as part of the design-for-inspectability process, the ASME Class 1 portion of welds are designed for two-sided access for austenitic stainless steel piping welds wherever possible. Where two-sided access is not feasible, such as branch connection examination for circumferential degradation, the weld crowns are ground flush for one-sided examinations. The COL applicant stated that the examination procedures, equipment and personnel for one-sided examinations of austenitic/dissimilar metal welds would be qualified in accordance with Appendix VIII, as modified by 10 CFR 50.55a(b)(2)(xv)(A)(2) and 10 CFR 50.55a(b)(2)(xvi)(B). Based on the response provided by the applicant, in instances where one-sided examinations have to be performed for austenitic/dissimilar metal welds, the examinations will be conducted with ultrasonic systems that have demonstrated the capability to detect flaws, and is, thus, acceptable. As a result, RAI 5.2.4-3 is closed.

The COL applicant proposed adding the following section after the last paragraph of DCD Section 5.2.4.7:

> *5.2.4.9 Preservice Inspection of Class 1 Components*
>
> *Preservice examinations required by design specification and preservice documentation are in accordance with ASME Section III, NB-5281. Volumetric and surface examinations are performed as specified in ASME Section III, NB-5282. Components described in ASME Section III, NB-5283 are exempt from preservice examination.*

RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.4 recommends that a preservice examination program that meets the standards of NB-5280 of ASME Code, Section III, Division 1, be described because it is an operational program and that the program implementation milestones should be fully described. The information indicated that preservice examinations and documentation are in

accordance with ASME Code, Section III, NB-5281, and that volumetric and surface examinations are performed as specified in ASME Code, Section III, NB-5282. The information stated that components described in ASME Code, Section III, NB-5283 are exempt from preservice examination. The staff found that the information did not fully describe the preservice examination program, in scope and a level of detail, necessary for the staff to reach a reasonable assurance finding. Therefore, the staff requested additional information in RAI 5.2.4-4.

In its response to RAI 5.2.4-4, the applicant noted that AP1000 DCD Section 5.2.4.5, which is incorporated by reference in the COL FSAR, indicates PSI will meet the requirements in the ASME Code, Section XI, paragraph IWB-2200 consistent with NUREG-0800 acceptance criteria. FSAR Section 5.2.4.1 provides a discussion of the scope of the PSI and ISI programs by system. FSAR Section 5.2.4.3.1 describes the methods for examination for both PSI and ISI. FSAR Section 5.2.4.3.1 [sic] [5.2.4.3.2] *describes the qualification requirements of personnel performing ultrasonic examinations. In addition, DCD Section 5.2.4.5, incorporated by reference in the COL FSAR, indicates that PSIs of Class 1 components will meet the requirements of IWB-2200, and as indicated in the response to RAI 5.2.4-1, RV head preservice examinations are described in DCD Section 5.3.4.7, and are also incorporated by reference in the COL FSAR. These FSAR sections, combined with the DCD sections, provide a full description of the PSI program consistent with by SECY-05-0197. The response provided by the applicant addressed PSI program areas involving qualification requirements, scope, exemptions and methods of examination. The areas addressed meet the guidelines of Section 5.2.4 of NUREG-0800, and are therefore acceptable. Based on the information provided by the applicant, the staff concludes that the PSI program is fully described. As a result, RAI 5.2.4-4 is closed.*

The COL applicant proposed adding the following section after the last paragraph of DCD Section 5.2.4.7:

> *5.2.4.10 Program Implementation*
>
> *The milestones for preservice and inservice inspection program implementation are identified in Table 13.4-201.*

RG 1.206 states that the detailed procedures for performing the examinations may not be available at the time of the COL application, and the COL applicant should make a commitment to provide sufficient information to demonstrate that the procedures meet ASME Code standards. This information should be provided at a predetermined time agreed upon by both parties. In the BLN COL FSAR, Part 10, "License Conditions and ITAAC," proposed License Condition 6, "Operational Program Readiness," the COL applicant states:

> *The licensee shall submit to the appropriate Director of the NRC, a schedule, no later than 12 months after issuance of the COL, that supports planning for and conduct of the NRC inspection of the operational programs listed in the operation program FSAR Table 13.4-201. The schedule shall be updated every 6 months*

until 12 months before scheduled fuel loading, and every month thereafter until either the operation programs in the FSAR table have been fully implemented or the plant has been placed in commercial service.

The staff reviewed the BLN COL FSAR Table 13.4-201, and notes that both the PSI and ISI programs are listed as operational programs required by NRC regulations. The staff concludes that the commitment under proposed License Condition 6 meets the guidelines in RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.4.1, and is, thus, acceptable.

The COL applicant proposed to add the following paragraphs at the end of Section 5.2.4.3 of the AP1000 DCD:

Ultrasonic Examination of the Reactor Vessel

Ultrasonic (UT) examination for the RPV is conducted in accordance with the ASME Code, Section XI. The RPV shell welds are designed for 100 percent accessibility for both preservice and inservice examinations. The RPV nozzle-to-shell welds are 100 percent accessible for preservice examinations but might have limited areas that may not be accessible from the outer surface for inservice examination techniques. If accessibility is limited, an inservice inspection program relief request is prepared and submitted for review approval by the NRC.

Inner radius examinations are performed from the outside of the nozzle using several compound angle transducer wedges to obtain complete coverage of the required examination volume. Alternatively, nozzle inner radius examinations may be performed using enhanced visual techniques as allowed by 10 CFR 50.55a(b)(2)(xxi).

The staff finds that the information provided by the COL applicant meets ASME Section XI and is in compliance with 10 CFR 50.55a. With respect to relief requests and accessibility, see the staff evaluation of BLN COL FSAR Section 5.4.2.8.

The COL applicant added the following after the first sentence of DCD Section 5.2.4.5:

Class 1 piping supports will be examined in accordance with ASME Section XI, IWF-2500.

Preservice examinations required by design specifications and preservice documentation are in accordance with ASME Section III, NB-5280. Components exempt from preservice examination are described in ASME Section III, NB-5283.

The staff finds that the information provided by the COL applicant meets ASME Section XI and is in compliance with 10 CFR 50.55a. With respect to preservice inspection, see the staff evaluation of BLN COL FSAR Section 5.4.2.9.

The COL applicant proposed adding the following after the last sentence of DCD Section 5.2.4.5:

> *The preservice examination is performed once in accordance with ASME Section XI, IWB-2200, on all of the items selected for inservice examination, with the exception of the examinations specifically excluded by ASME Section XI from preservice requirements, such ASME Section XI VT-3 examination of valve body and pump casing internal surfaces (B-L-2 and B-M-2 examination categories, respectively) and the visual VT-2 examinations for category B-P.*

The staff finds that the information provided by the COL applicant meets ASME Section XI and is in compliance with 10 CFR 50.55a. With respect to preservice inspection, see the staff evaluation of BLN COL FSAR Section 5.4.2.9.

The COL applicant proposed adding the following after the last sentence of DCD Section 5.2.4.3:

> ***Visual Examination***
>
> *Visual examination methods VT-1, VT-2, and VT-3 are conducted in accordance with ASME Section XI, IWA-2210. In addition, VT-2 examinations will meet the requirements of IWA-5240.*
>
> *Where direct VT-1 examinations are conducted without the use of mirrors or with other viewing aids, clearance is provided where feasible for the head and shoulders of a man within a working arm's length of the surface to be examined.*
>
> ***Surface Examination***
>
> *Magnetic particle (MT) and liquid penetrant (PT) examination techniques are performed in accordance with ASME Section XI, IWA-2221 and IWA-2222, respectively. Direct examination access for magnetic particle [MT] and liquid penetrant [PT] examination is the same as that required for direct visual (VT-1) examination (See Visual Examination), except that the additional access is provided as necessary to enable physical contact with the item in order to perform the examination. Remote MT and PT generally are not appropriate as a standard examination process; however, boroscopes and mirrors can be used at close range to improve the angle of vision.*

Alternative Examination Techniques

As provided by ASME Section XI, IWA-2240, alternative examination methods, a combination of methods, or newly developed techniques may be substituted for the methods specified for a given item in this section, provided that they are demonstrated to be equivalent or superior to the specified methods, techniques, etc., which may result in improvements in examination reliability and reductions in personnel exposure. In accordance with 10 CFR 50.55a(b)(2)(xix), IWA-2240 as written in the 1997 Addenda of ASME Section XI must be used when applying these provisions.

5.2.4.3.2 Qualification of Personnel and Examination Systems for Ultrasonic Examination

Personnel performing examinations shall be qualified in accordance with ASME Section XI, Appendix VII. Ultrasonic examination systems shall be qualified in accordance with industry accepted programs for implementation of ASME Section XI, Appendix VIII. Qualification to ASME Section XI, Appendix VIII, in compliance with the provisions of 10 CFR 50.55a is considered as a satisfactory alternative to Regulatory Guide 1.150.

The COL applicant also proposed adding the following at the end of AP1000 DCD Section 5.2.4.6:

Components containing flaws or relevant conditions and accepted for continued service in accordance with the requirements of IWB-3132.4 or IWB-3142.4 are subjected to successive period examinations in accordance with the requirements of IWB-2420. Examinations that reveal flaws or relevant conditions exceeding Table IWB-3410-1 acceptance standards are extended to include additional examinations in accordance with the requirements of IWB-2430.

10 CFR 50.55a requires that nondestructive testing procedures, methods, and techniques meet ASME Code standards, including ASME Section XI, Appendix VIII requirements for ultrasonic examinations and methodology for evaluation of flaws. The COL applicant indicated that the qualification of ultrasonic testing personnel and procedures would be in accordance with ASME Section XI, Appendices VII and VIII, respectively. Based on the information provided by the COL applicant, the staff concludes that the COL applicant referenced the appropriate sections of the ASME Code to describe visual, surface volumetric and alternative examinations.

The staff concludes that the PSI and ISI programs will conform to the guidelines and requirements provided under NUREG-0800, Order EA-03-009, and the ASME Code. Therefore, the staff finds that the COL applicant's proposed

resolution to the COL information items and its supplementary information are acceptable on the basis that it meets GDC 32 of Appendix A to 10 CFR Part 50, as it relates to periodic inspection and testing of the RCPB and 10 CFR 50.55a.

Resolution of Standard Content Confirmatory Item 5.2-1

Confirmatory Item 5.2-1 required the applicant to update its FSAR to incorporate reference to the final rule. The NRC staff verified that the VEGP COL FSAR was appropriately updated to incorporate reference to 10 CFR 50.55a(g)(6)(ii)(D). As a result, Confirmatory Item 5.2-1 is now resolved.

Correction of Error in the Standard Content Evaluation Text

The NRC staff identified an error in the text reproduced above from the BLN SER, Section 5.2.4.4, that requires correction. The BLN SER quotes an applicant-proposed addition to its FSAR stating, in part:

Qualification to ASME Section XI, Appendix VIII, in compliance with the provisions of 10 CFR 50.55a is considered as a satisfactory alternative to Regulatory Guide 1.150.

That quote is from Revision 0 of the BLN FSAR. The correct quote from Revision 1 of the BLN FSAR is:

Qualification to ASME Section XI, Appendix VIII, is in compliance with the provisions of 10 CFR 50.55a.

This error does not impact the conclusions of the BLN or VEGP evaluations.

- STD COL 5.3-7

The NRC reviewed the applicant's proposal submitted in a letter dated August 27, 2010, to include additional information which addresses newly identified COL Information Item 5.3-7 in the AP1000 DCD. The applicant proposes to add the following item, STD COL 5.3-7, to the end of Section 5.2.4.1 of the VEGP COL FSAR:

The in-service inspection program is augmented to include the performance of a 100 percent volumetric examination of the weld build-up on the reactor vessel head for the instrumentation penetrations (Quickloc) conducted once during each 120-month inspection interval in accordance with the ASME Code, Section XI. The weld build-up acceptance standards are those provided in ASME Code, Section XI, IWB-3514. Personnel performing examinations and the ultrasonic examination systems are qualified in accordance with ASME Code, Section XI, Appendix VIII. Alternatively, an alternative inspection may be developed in conjunction with the voluntary consensus standards bodies (i.e., ASME) and submitted to the NRC for approval.

The proposed information, which will augment the plant-specific ISI program to include a 100 percent volumetric examination of the weld build-up on the reactor vessel head for the instrumentation penetrations (Quickloc) conducted once during each 120-month inspection interval in accordance with the ASME Code, Section XI, is acceptable to the NRC staff because

a volumetric examination ensures that potential degradation of the inside surface of the weld build-up during plant operation will be detected before it progresses through-wall. In addition, the NRC staff finds it acceptable that any alternative inspection will be submitted to the NRC for approval because it will ensure that: (1) the NRC staff is informed of changes to inservice inspection requirements established in the reference design certification; and (2) licensee submittals for NRC authorization to use alternatives to the regulations in 10 CFR 50.55a will be reviewed by the NRC staff pursuant to 10 CFR 50.55a(a)(3). The NRC staff finds that this adequately addresses COL Information Item 5.3-7 and will ensure the integrity of the reactor coolant pressure boundary weld during service. The staff notes that since this information augments the ISI program, this augmentation is part of License Condition (5-1) described in SER Section 5.2.4.5. The incorporation of the changes associated with proposed STD COL 5.3-7 into a future revision of the VEGP COL FSAR is **Confirmatory Item 5.2-2**.

Resolution of Standard Content Confirmatory Item 5.2-2

Confirmatory Item 5.2-2 is an applicant commitment to revise its FSAR Table 1.8-202 and Section 5.2.4.1 to address COL Information Item STD COL 5.3-7. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 5.2-2 is now closed.

The following portion of this technical evaluation section is reproduced from Section 5.2.4.4 of the BLN SER:

> *License Condition*
>
> - *License Condition 6, regarding PSI/ISI program details*
>
> *The BLN COL FSAR addresses implementation milestones for the PSI/ISI programs in Part 10, or the application "Proposed License Conditions (Including ITAAC)." As discussed in Part 10, Section 6, the applicant proposes a license condition for BLN for all operational programs requiring that the licensee shall submit to the appropriate Director of the NRC, a schedule, no later than 12 months after issuance of the COL, that supports planning for and conduct of NRC inspections of operational programs. This proposed license condition is consistent with the policy established in SECY-05-0197, and is therefore acceptable.*
>
> *For PSI/ISI programs, the ASME Code, Section XI provides requirements for program implementation in Paragraph IWB-2200(a) for PSI programs and Paragraph IWA-2430(b) for ISI programs. As such, a license condition for program implementation requirements is not necessary in the BLN COL FSAR. However, submittal of the schedule for the program development is necessary to plan for and conduct NRC inspections during construction. The staff finds that the license condition complies with RG 1.206, and is therefore acceptable.*
>
> *Operational programs are specific programs required by regulations. The COL application should fully describe operational programs as defined in SECY-05-0197. In addition, COL applicants should provide schedules for implementation milestones of these operational programs. The PSI and ISI*

programs are identified as operational programs in RG 1.206. This section of the SER addresses the PSI and ISI operational programs for ASME Code Class 1, 2, and 3 components.

As discussed in RG 1.206, a fully described PSI and ISI program should address: (1) system boundary subject to inspection; (2) accessibility; (3) examination categories and methods; (4) inspection intervals; (5) evaluation of examination results; (6) system pressure tests; (7) Code exemptions; (8) relief requests; and (9) ASME Code cases. For BLN, the applicant incorporated by reference the PSI and ISI programs descriptions from AP1000 DCD Sections 5.2.4 and 6.6. The DCD descriptions as supplemented by the BLN COL FSAR address these nine items and therefore fully describe the PSI/ISI operational programs.

Supplemental Information

- *STD SUP 5.2-2*

The COL applicant added the following text at the end of DCD Section 5.2.4.1:

> *The inservice inspection program, along with the boric acid corrosion control procedures, provides guidance for inspecting the integrity of bolting and threaded fasteners.*

NUREG-0800, Section 3.13, "Threaded Fasteners – ASME Code Class 1, 2, and 3," acceptance criteria states that the inspection provisions are acceptable if they conform to ASME Section XI. In addition, the staff position in Generic Letter 88-05, "Staff Position on Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," specifically recommends inspection in accordance with a boric acid corrosion control program. GL 88-05 also recommends that a boric acid control program contain four elements consisting of inspections, discovery of leak path, assessment, and follow-up inspections. In its proposed changes to Section 5.2.4.1, the COL applicant described the boric acid corrosion control procedures. The staff noted that the program description was in compliance with the four elements described under GL 88-05. Based on compliance with both ASME Section XI and staff guidance, the staff concludes that the proposed change under STD SUP 5.2-2 is acceptable.

Exception to RG 1.65

The Bellefonte FSAR Appendix 1AA provides conformance discussions for Regulatory Guides (RGs) applicable to the Bellefonte COLA. RG 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," was not addressed in Revision 0 of the FSAR. In a response to the staff's RAI-1-5, the COL applicant added a conformance discussion for RG 1.65 which takes an exception to RG position C.4. The exception states:

ASME XI ISI criteria for reactor vessel closure stud examinations are applied in lieu of the ASME Section III, NB-2545 and NB-2546 surface examinations. The volumetric examination currently required by ASME Section XI provides improved (since 1973) detection of bolting degradation.

The staff reviewed ASME Section XI, Table IWB-2500-1 examination requirements for the reactor vessel closure studs, Examination Category B-G-1, Item No. B 6.20. The subject table lists volumetric examination of the studs when in place. The staff finds that the COL applicant's proposed exception to RG 1.65 is in compliance with the 1998 Edition of the ASME Code with the 2000 Addenda, and is therefore, acceptable. This portion of RAI 1-5 is closed.

5.2.4.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license condition to address PSI/ISI program details:

- License Condition (5-1) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of the Office of New Reactors (NRO) a schedule that supports planning for and conduct of NRC inspections of the PSI/ISI program (including augmented ISI program). The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the PSI/ISI (including augmented ISI program) have been fully implemented or the plant has been placed in commercial service, whichever comes first.

5.2.4.6 *Conclusion*

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the RCPB ISI and testing, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff concludes that the relevant information presented in the VEGP COL FSAR meets the relevant acceptance criteria provided in Section 5.2.4 of NUREG-0800, the policy established in SECY-05-0197, the guidelines addressed in RG 1.206, and the requirements of GDC 32, staff positions, and 10 CFR 50.55a. The staff based its conclusion on the following:

- STD COL 5.2-2, relating to the PSI and ISI programs, conforms to the guidelines provided under NUREG-0800, Order EA-03-009, and the ASME Code. Therefore, the staff finds that the COL applicant's proposed resolution to the COL information items is acceptable on the basis that it meets GDC 32 of Appendix A to 10 CFR Part 50, as it relates to periodic inspection and testing of the RCPB and 10 CFR 50.55a.

- STD SUP 5.2-2, relating to guidance for inspecting the integrity of bolting and threaded fasteners, is acceptable because it meets the relevant guidelines in ASME Section XI; NUREG-0800, Section 3.13; and GL 88-05.

- STD COL 5.3-7, relating to the ISI program augmentation to include 100 percent volumetric examination of the weld build-up on the reactor vessel head for the Quickloc penetrations ensures that the integrity of the reactor coolant pressure boundary weld will be maintained. Therefore, the staff finds that the applicant's proposed resolution to COL

Information Item 5.3-7 is acceptable on the basis that it meets GDC 32 of Appendix A to 10 CFR Part 50, as it relates to periodic inspection to ensure the integrity of the RCPB is maintained.

5.2.5 Detection of Leakage through Reactor Coolant Pressure Boundary (Related to RG 1.206, Section C.III.1, Chapter 5, C.I.5.2.5, "Reactor Coolant Pressure Boundary Leakage Detection")

5.2.5.1 *Introduction*

The RCPB leakage detection systems are designed to detect and, to the extent practical, identify the source of reactor coolant leakage.

5.2.5.2 *Summary of Application*

Section 5.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.2.5 of Revision 19 of the AP1000 DCD. The ASE with confirmatory items for Section 5.2.5 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse added a new COL Information Item (COL 5.2-3). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, the applicant proposed the following:

AP1000 COL Information Item

- STD COL 5.2-3

In a letter, dated August 5, 2010, the applicant provided additional information in the markups of VEGP COL FSAR Table 1.8-202, Section 5.2.6.3, and Section 5.2.5.3.5 to add STD COL 5.2-3 to address COL Information Item 5.2-3. The applicant provided additional information regarding the response to unidentified RCS leakage inside containment to deal with the prolonged low-level RCS leakage issue.

5.2.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

The regulatory basis for raising the issue of prolonged low-level RCS leakage is in 10 CFR 52.79, "Contents of applications; technical information in final safety analysis report," Item 37, as it relates to "information necessary to demonstrate how operating experience insights have been incorporated into the plant design." The applicable regulatory requirements for acceptance of the resolution to COL Information Item 5.2-3 are established in GDC 30 as it relates to detecting RCPB leakage. The guidance for the staff's review is in RG 1.45, Revision 1, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage."

5.2.5.4 *Technical Evaluation*

Section 5.2 of the VEGP COL FSAR, incorporates by reference, with no departures or supplements, Section 5.2.5 of of the AP1000 DCD. The NRC staff reviewed the application and

checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section, with one exception. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The exception, which the NRC staff identified in its review, pertains to the operating experiences at Davis Besse concerning prolonged low-level RCS leakage. The operating experiences at Davis Besse (NRC Bulletin 2002-01) indicated that prolonged low-level unidentified reactor coolant leakage inside containment could cause corrosion and material degradation such that it could compromise the integrity of a system leading to the gross rupture of the RCPB. Therefore, pursuant to 10 CFR 52.79(a) 37, "information necessary to demonstrate how operating experience insights have been incorporated into the plant design," the NRC staff requested additional information from both the DCD applicant (Westinghouse) and the COL applicant (Southern Nuclear Operating Company [SNC]) to address the issue of prolonged low-level RCS leakage. The NRC staff requested the COL applicant in VEGP RAI 5.2.5-1 and RAI 5.2.5-2 to address this issue as it relates to operating procedures. The NRC staff also asked Westinghouse in RAI-DCP-CN45-SBP-01 to address this issue as it related to Design Change Package (DCP) Change Number 45 for AP1000 DCD. The procedures should specify operator actions in response to prolonged low-level unidentified reactor coolant leakage conditions that exist above normal leakage rates and below the Technical Specification (TS) limits to provide operators sufficient time to take action before the TS limit is reached. The procedures would include identifying, monitoring, trending, and managing prolonged low-level leakage.

In a letter dated July 29, 2010, Westinghouse responded to RAI-DCP-CN45-SBP-01 by stating that Revision 18 of the AP1000 DCD would add new COL Information Item 5.2-3, and described the COL item in Section 5.2.6.3 of the AP1000 DCD to address the prolonged low-level RCS leakage. The staff's review of DCP 45 is in Chapter 23 of a supplement to NUREG-1793.

AP1000 COL Information Item

- STD COL 5.2-3

In a letter, dated August 5, 2010, SNC responded to VEGP RAI 5.2.5-1 and RAI 5.2.5-2 and provided additional information in the markups of VEGP COL FSAR Table 1.8-202, Section 5.2.6.3 and Section 5.2.5.3.5 to add STD COL 5.2-3 to address the COL information item. VEGP COL FSAR Section 5.2.6.3 states that the COL item is addressed in Section 5.2.5.3.5. The proposed Section 5.2.5.3.5 reads as follows:

> 5.2.5.3.5 Response to Reactor Coolant System Leakage
>
> Operating procedures specify operator actions in response to prolonged low level unidentified reactor coolant leakage conditions that exist above normal leakage rates and below the Technical Specification (TS) limits to provide operators sufficient time to take action before the TS limit is reached. The procedures include identifying, monitoring, trending, and addressing prolonged low level leakage. The procedures for effective management of leakage, including low level leakage, are developed including the following operations related activities:

- Trends in the unidentified leakage rates are periodically analyzed. When the leakage rate increases noticeably from the baseline leakage rate, the safety significance of the leak is evaluated. The rate of increase in the leakage is determined to verify that plant actions can be taken before the plant exceeds TS limits.

- Procedures are established for responding to leakage. These procedures address the following considerations to prevent adverse safety consequences from the leakage:

  – Plant procedures specify operator actions in response to leakage rates less than the limits set forth in the Technical Specifications. The procedures include actions for confirming the existence of a leak, identifying its source, increasing the frequency of monitoring, verifying the leakage rate (through a water inventory balance), responding to trends in the leakage rate, performing a walkdown outside containment, planning a containment entry, adjusting alarm setpoints, limiting the amount of time that operation is permitted when the sources of the leakage are unknown, and determining the safety significance of the leakage.

  – Plant procedures specify the amount of time the leakage detection and monitoring instruments (other than those required by Technical Specifications) may be out of service to effectively monitor the leakage rate during plant operation (i.e., hot shutdown, hot standby, startup, transients, and power operation).

- The output and alarms from leakage monitoring systems are provided in the main control room. Procedures are readily available to the operators for converting the instrument output to a common leakage rate. (Alternatively, these procedures may be part of a computer program so that the operators have a real-time indication of the leakage rate as determined from the output of these monitors.) Periodic calibration and testing of leakage monitoring systems are conducted. The alarm(s), and associated setpoint(s), provide operators an early warning signal so that they can take corrective actions, as discussed above, i.e., before the plant exceeds TS limits.

- During maintenance and refueling outages, actions are taken to identify the source of any unidentified leakage that was detected during plant operation. In addition, corrective action is taken to eliminate the condition resulting in the leakage.

The procedures described above will be available prior to fuel load.

The staff found in the RAI response that the COL applicant committed to develop operating procedures prior to fuel load, and the procedures include identifying, monitoring, trending, and managing the prolonged low-level RCS leakage. Further, the procedures include converting the instrument output to a common leakage rate and the alarm setpoints for early warning for the operators. Therefore, the staff determined that the RAI response addressed all the questions

being asked in VEGP RAI 5.2.5-1 and RAI 5.2.5-2 regarding the procedures for the prolonged low-level RCS leakage. Further, the staff reviewed the description of the procedures in the proposed VEGP COL FSAR Section 5.2.5.3.5 and determined that it is consistent with the guidance in RG 1.45, Revision 1, pertaining to managing the prolonged low-level RCS leakage. Therefore, the staff finds that the RAI response is acceptable and concludes that GDC 30 is met based on the applicant's conformance to RG 1.45. The incorporation of the changes associated with proposed STD COL 5.2-3 into a future revision of the VEGP COL FSAR is **Confirmatory Item 5.2-3**.

Resolution of Standard Content Confirmatory Item 5.2-3

Confirmatory Item 5.2-3 is an applicant commitment to revise its FSAR Table 1.8-202 and Section 5.2.5.3.5 to address COL Information Item STD COL 5.2-3. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 5.2-3 is now closed.

5.2.5.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation above, the following FSAR commitment is identified as the responsibility of the licensee:

- Prior to initial fuel load, the operating procedures, which include identifying, monitoring, trending, and managing the prolonged low-level RCS leakage, will be developed.

5.2.5.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to RCPB leakage detection, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of GDC 30. The staff based its conclusion on the following:

- STD COL 5.2-3 meets the relevant guidance in RG 1.45, Revision 1 with respect to operating procedures for the prolonged low-level RCS leakage detection. Conformance with these guidelines provides an acceptable basis for satisfying the requirements of GDC 30.

5.3 Reactor Vessel

5.3.1 Reactor Vessel Design

The RV, as an integral part of the RCPB, will be designed, fabricated, erected and tested to quality standards commensurate with the requirements set forth in 10 CFR Part 50, 10 CFR 50.55a, and GDC 1.

Section 5.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 5.3.1 of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

5.3.2 Reactor Vessel Materials

5.3.2.1 *Introduction*

This section addresses material specifications, special processes used for manufacture and fabrication of components, special methods for nondestructive examination, special controls and special processes used for ferritic steels and austenitic stainless steels, fracture toughness, material surveillance (which will be referred to as the reactor vessel surveillance capsule program (RVSP) to avoid confusion with material surveillance programs that exist in other parts of a nuclear power plant), and RV fasteners. RCS components are addressed separately in Section 5.2.3 of this SER.

5.3.2.2 *Summary of Application*

Section 5.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.3 of the AP1000 DCD, Revision 19. Section 5.3 of the DCD includes Section 5.3.2.

In addition, in VEGP COL FSAR Section 5.3.2.6, the applicant provided the following:

AP1000 COL Information Item

- STD COL 5.3-2

The applicant provided additional information in STD COL 5.3-2 to address COL Information Item 5.3-2 and COL Action Item 5.3.2.4-1 identified in Appendix F of NUREG-1793. The additional information discusses the RV material surveillance program.

License Conditions

- Part 10, License Condition 3.J.1, Reactor Vessel Material Surveillance

The COL Holder shall implement this operational program prior to initial criticality.

- Part 10, License Condition 6

The COL applicant shall provide an operational program schedule to support NRC inspections.

5.3.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the RV materials and are given in Section 5.3.1 of NUREG-0800.

The applicable regulatory requirements and guidance for acceptance of the COL information item are as follows:

1. GDC 32 found in Appendix A to 10 CFR Part 50, as it relates to the RVSP;

2. 10 CFR 50.60, as it relates to compliance with the requirements of 10 CFR Part 50, Appendix G;

3. 10 CFR Part 50, Appendix G, as it relates to materials testing and acceptance criteria for fracture toughness;

4. 10 CFR 50.55a, as it relates to the requirements for testing and inspecting Code Class 1 components of the RCPB as specified in Section XI of the ASME Code;

5. SECY-05-0197, as it relates to fully describing an operational program; and

6. 10 CFR Part 50, Appendix H, as it relates to the RVSP.

5.3.2.4 *Technical Evaluation*

The NRC staff reviewed Section 5.3.2 of the VEGP COL FSAR and the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to the RV materials. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is

identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 5.3-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 5.3.2.4 of the BLN SER:

> *The NRC staff reviewed conformance of Section 5.3 of the BLN COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 5, C.I.5.3.1, "Reactor Vessel Materials." The RG 1.206 sections related to Material Specifications, Special Processes Used for Manufacturing and Fabrication, Special Methods for Nondestructive Examination, Special Controls for Ferritic and Austenitic Stainless Steels, Fracture Toughness and Reactor Vessel Fasteners all state that the COL applicants that reference a certified design do not need to include additional information. These topic areas were previously addressed in the AP1000 DCD and evaluated in NUREG-1793, Section 5.3.2. No COL action items were identified in these topic areas. The remaining topic area, RVSP, has a COL action item that must be addressed by a COL applicant.*
>
> *Appendix G to 10 CFR Part 50 specifies the fracture toughness requirements for ferritic materials of the pressure-retaining components of the RCPB. The RV beltline materials must have a Charpy Upper Shelf Energy (USE) in the transverse direction for base material and along the weld for weld material, of no less than 75 ft-lbs initially, and must maintain Charpy USE throughout the life of the vessel of no less than 50 ft-lbs. The fracture toughness tests required by ASME Code and by Appendix G to 10 CFR Part 50 provide reasonable assurance that adequate safety margins against the possibility of non-ductile behavior or rapidly propagating fracture can be established for all pressure-retaining components of the reactor coolant boundary. Appendix H to 10 CFR Part 50 presents the requirements for an RVSP to monitor the changes in the fracture toughness properties of the materials in the RV beltline region resulting from exposure to neutron irradiation and the thermal environment.*
>
> *Operational programs are specific programs required by regulations. The COL application should fully describe operational programs as defined in SECY-05-0197. In addition, COL applicants should provide schedules for implementation milestones for these operational programs. The RVSP is identified as an operational program in RG 1.206. This section of the SER addresses the adequacy of the RVSP description as it relates to meeting the requirements of Appendix H to 10 CFR Part 50.*
>
> *RG 1.206, Section C.III.1, Chapter 5, C.I.5.3.1.6, "Material Surveillance," provides guidelines for fully describing a material surveillance program. Specifically, this section states that the RVSP and its implementation must be described in sufficient detail to ensure that the program meets the requirements of Appendix H to 10 CFR Part 50.*
>
> *In addition, the application should describe the method for calculating neutron fluence for the RV beltline and the surveillance capsules. RG 1.206 lists some of the topics that should be addressed in the description of the RVSP:*

- *Basis for the selection of material in the program.*

- *Number and type of specimens in each capsule.*

- *Number of capsules and proposed withdrawal schedule in compliance with the edition of American Society for Testing Materials (ASTM) E-185 Annual Book of ASTM Standards, Part 30, referenced in Appendix H to 10 CFR Part 50.*

- *Neutron flux and fluence calculations for vessel wall and surveillance specimens.*

- *Projected radiation embrittlement on vessel wall.*

- *Location of capsules, method of attachment, and provisions to ensure that capsules are retained in position throughout the vessel lifetime.*

Section 5.3.2.6 of the AP1000 DCD addresses the description of the RVSP. The DCD states that the base metal specimens are oriented both parallel and normal to the principal rolling direction of the limiting base material located in the core region of the RV. In accordance with the current DCD, there are no welds in the beltline region. Therefore, the applicant has addressed the entire beltline region in their RVSP. The DCD also addresses the number and type of specimens by meeting the ASTM E-185 requirements and describing 8 capsules, along with their proposed withdrawal schedule, that contain 72 tensile specimens, 480 Charpy V-notch specimens, and 48 compact tension specimens.

The DCD states that the neutron fluence assessments of the AP1000 RV are conducted in accordance with the guidelines that are specified in RG 1.190. The vessel fracture toughness data are given in Table 5.3-3 of the AP1000 DCD, Revision 17. The end-of-life nil-ductility reference transition temperature (RT_{NDT}) and upper shelf energy projections were estimated using RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," for the end-of-life neutron fluence at the ¼-thickness and inner-diameter RV locations.

Finally, BLN has addressed the location of the capsules, their method of attachment, and the provisions to ensure that capsules are retained in position throughout the vessel lifetime by referencing AP1000 DCD, Section 5.3.2.6, which states that the capsules are located in guide baskets welded to the outside of the core barrel and positioned directly opposite the center portion of the core. DCD Figure 5.3-4 shows the azimuthal locations of the capsules around the RV.

Information about the implementation of the BLN RVSP is provided in Part 10 of the BLN COL. Section 3 proposes the following license condition:

> *J. Initial Criticality – The licensee shall implement each operational program identified below prior to initial criticality.*
>
> *J.1 – Reactor Vessel Material Surveillance*

In addition, Section 6, "Operational Program Readiness," states that the licensee will submit to the NRC a schedule, no later than 12 months after issuance of the COL, that supports the planning for and conduct of NRC inspections of operational programs, including RVSP.

AP1000 COL Information Item

- *STD COL 5.3-2*

The NRC staff reviewed STD COL 5.3-2 related to the COL information item included under Section 5.3.6.2 of the BLN COL FSAR, which states:

> *The Combined License applicant will address a Reactor Vessel Reactor Material Surveillance program based on Section 5.3.2.6.*

The commitment was also captured as COL Action Item 5.3.2.4-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will provide its Reactor Vessel Material Surveillance program.*

RG 1.206 clarifies the intent of the COL information item. RG 1.206 Section C.III.1, Chapter 5, C.I.5.3.1.6, provides guidelines for addressing an RVSP. The applicant should fully describe the program and identify the implementation milestones. As previously discussed, the applicant references Section 5.3.2 of the AP1000 DCD, which addresses the topics listed in RG 1.206 that should be included in the description of the RVSP. The applicant provided License Condition 3.J.1 to implement the RVSP and License Condition 6 to support scheduling of NRC staff inspections, consistent with SECY-05-0197.

In addition, the applicant provided supplemental information in its FSAR to address COL Information Item 5.3-2 regarding the RVSP. The applicant added text between the first and second paragraphs of Section 5.3.2.6 to the AP1000 DCD, Revision 17 to reference the milestone of initial criticality for RVSP implementation. The applicant also added a new Section 5.3.2.6.3, "Report of Test Results," to the AP1000 DCD, Revision 17 to outline the reporting criteria associated with the RVSP. When each capsule is withdrawn, a summary technical report of the data required by ASTM E-185-82 and the results of the fracture toughness tests conducted on the beltline materials in the irradiated and unirradiated conditions will be submitted to the NRC within one year of the date of capsule withdrawal.

In its review of the FSAR, the staff noted that the information provided in Section 5.3.2 of the DCD, in addition to the RVSP program implementation information provided in Part 10 of the BLN COL application, meets the minimum guidelines in RG 1.206 for a description of the RVSP and its implementation. However, the staff determined that more information was needed to fully describe the RVSP in accordance with SECY-05-0197 to reach a resolution of the COL information item. A description of the process for preparing the capsule specimens must confirm that the materials selected for the capsules are samples of the same materials used in the fabrication of the RV. Therefore, the staff must

receive this information before the vessel is fabricated. Other information, such as the capsule environment and the material types of the capsule specimens, can be provided after the RV has been procured. Thus, the staff requested additional information in RAI 5.3.1-1 to complete its review.

First, the staff requested additional information about the RVSP description. The purpose of the RVSP, as described in ASTM E-185, is to monitor radiation effects on RV materials under operating conditions. Section C.III.1, Chapter 5, C.I.5.3.1.6 of RG 1.206 states, "because the material surveillance program is an operational program, as discussed in SECY-05-0197, the applicant must describe the program and its implementation in sufficient scope and level of detail for the staff to make a reasonable assurance finding on its acceptability." The NRC staff recognizes that certain information about the program, such as actual material properties of the RV, is not currently known, but in order to complete its review of the adequacy of the RVSP, the staff requested that the applicant describe its process for preparing the capsule specimens. This description should confirm that the materials selected for the capsules are samples of those materials most likely to limit the operation of the RV.

Secondly, the staff requested additional information about the RVSP. The COL applicant must fully describe its RVSP to ensure that it meets ASTM E-185 and other requirements listed in 10 CFR Part 50, Appendix H. Specifically, the NRC staff requested detailed information on the RVSP associated with the AP1000 design, including, but not limited to, the capsule environment and the material types of the capsule specimens.

In RAI 5.3.1-1, the staff requested that the applicant describe the process for preparing the capsule specimens and to include detailed information on the capsule environment and material types of the capsule specimens. The applicant responded with a detailed description of the capsule specimen preparation process to be incorporated into the next revision of the BLN COL FSAR. The applicant also stated that the capsule environment and the material types of the capsule specimens are addressed in AP1000 DCD, Section 5.3.2.6 which is incorporated by reference.

The staff finds that the response to RAI 5.3.1-1 is acceptable, provided that the BLN COL FSAR is revised as stated by the applicant, and that the applicant confirms the staff's understanding that the surveillance capsules are backfilled with inert gas. Therefore, the staff identifies ***Confirmatory Item 5.3-1*** *to confirm that the BLN COL FSAR is revised as stated, and to confirm the staff's understanding that the surveillance capsules are backfilled with inert gas.*

Generic Letter 92-01

Generic Letter (GL) 92-01, "Reactor Vessel Structural Integrity," addressed NRC concerns regarding compliance with the requirements of Appendices G and H to 10 CFR Part 50, which address fracture toughness requirements and RVSP requirements, respectively. Specifically, NRC had concerns about Charpy USE predictions for end-of-life for the limiting beltline weld and the plate or forging, RVs constructed to an ASME Code earlier than the Summer 1972 Addenda of the 1971 Edition, and use of RG 1.99, Revision 2, to estimate the embrittlement

of the materials in the RV beltline. These topics have been addressed in the AP1000 DCD, Revision 17, which is incorporated by reference in the BLN COL FSAR.

The AP1000 DCD, Revision 17, also states that end-of-life RT_{NDT} and USE projections were estimated using RG 1.99. The construction of the RV to an ASME Code earlier than the Summer 1972 Addenda of the 1971 Edition is not a concern for new reactors, including BLN. In the BLN COL FSAR Section 5.3.2.6.3, the applicant provides additional information, which states that when each capsule is withdrawn, a summary technical report of the data required by ASTM E-185-82 and the results of the fracture toughness tests conducted on the beltline materials in the irradiated and unirradiated conditions will be submitted to the NRC within one year of the date of capsule withdrawal.

On the basis of the information discussed above, the NRC staff concludes that the applicant has adequately addressed the issues in GL 92-01.

Resolution of Standard Content Confirmatory Item 5.3-1

The NRC staff verified that the VEGP COL FSAR was updated to include a detailed description of the capsule specimen preparation process and to document that the surveillance capsules are backfilled with inert gas. As a result, Confirmatory Item 5.3-1 is resolved.

5.3.2.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following two license conditions:

- License Condition (5-2) - The licensee shall implement the RV Material Surveillance program prior to initial criticality.

- License Condition (5-3) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspections of the RV Material Surveillance program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the RV Material Surveillance program has been fully implemented.

5.3.2.6 *Conclusion*

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to RV materials, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the relevant regulatory guidance provided in Section 5.3.1 of NUREG-0800 and RG 1.206, the policy established in SECY-05-0197, and the requirements of Appendices G and H to 10 CFR Part 50. The staff based its conclusion on the following:

- STD COL 5.3-2, relating to the RV material surveillance program, is acceptable because the program is consistent with the relevant guidelines addressed in Section 5.3.1 of NUREG-0800 and in RG 1.206, Section C.III.1, Chapter 5, C.I.5.3.1. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of Appendices G and H to 10 CFR Part 50.

5.3.3 Pressure Temperature Limits (Related to RG 1.206, Section C.III.1, Chapter 5, C.I.5.3.2, "Pressure-Temperature Limits, Pressurized Thermal Shock, and Charpy Upper-Shelf Energy Data and Analyses")

5.3.3.1 *Introduction*

Pressure Temperature (P-T) limits are required as a means of protecting the RV during startup and shut down to minimize the possibility of fast fracture. The methods outlined in Appendix G of Section XI of the ASME Code are employed in the analysis of protection against nonductile failure. Beltline material properties degrade with radiation exposure, and this degradation is measured in terms of the adjusted reference temperature, which includes a reference nil-ductility temperature shift, initial RT_{NDT}, and margin.

5.3.3.2 *Summary of Application*

Section 5.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.3 of the AP1000 DCD, Revision 19. Section 5.3 of the AP1000 DCD includes Section 5.3.3.

In addition, in VEGP COL FSAR Section 5.3.6.1, the applicant provided the following:

AP1000 COL Information Item

- STD COL 5.3-1

The applicant provided additional information in STD COL 5.3-1 to address COL Information Item 5.3-1 of the AP1000 DCD and COL Action Item 5.2.2.2-1 in NUREG-1793. The information relates to plant-specific P-T curves.

Supplemental Information

- STD SUP 5.3-1

The applicant provided supplemental information related to development of operating procedures as required by Technical Specification (TS) 5.6.6.

License Condition

- Part 10, License Condition 2, Item 5.3-1

The license condition related to COL Information Item 5.3-1 sets the implementation milestone for development of plant-specific P-T curves.

5.3.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for P-T limits are given in Section 5.3.2 of NUREG-0800.

5.3.3.4 *Technical Evaluation*

The NRC staff reviewed Section 5.3.3 of the VEGP COL FSAR and the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to P-T limits. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items to resolve.

The following portion of this technical evaluation section is reproduced from Section 5.3.3.4 of the BLN SER:

> *AP1000 COL Information Item*
>
> - *STD COL 5.3-1*
>
> *The NRC staff reviewed STD COL 5.3-1 related to COL Information Item 5.3-1 included under Section 5.3.6.1 of the COL FSAR. The applicant proposes to replace the text in AP1000 DCD Section 5.3.6.1 with the following:*

The pressure-temperature curves shown in DCD Figures 5.3-2 and 5.3-3 are generic curves for AP1000 reactor vessel design, and they are limiting curves based on copper and nickel material composition. Plant-specific curves will be developed based on material composition of copper and nickel. Use of plant-specific curves will be addressed during procurement and fabrication of the reactor vessel. As noted in the bases to Technical Specification 3.4.14, use of plant-specific curves requires evaluation of the LTOP system. This includes an evaluation of the setpoint pressure for the RNS relief valve to determine if the setpoint pressure needs to be changed based on plant-specific pressure-temperature curves. The development of the plant-specific curves and evaluation of the setpoint pressure are required prior to fuel load.

In addition, in Section 5.3.3.2 of NUREG-1793, the staff identified related COL Action Item 5.2.2.2-1 in which the COL applicant will address the use of plant-specific curves during procurement of the RV.

The COL applicant stated that the P-T limits shown in DCD Figures 5.3-2 and 5.3-3 are generic curves for AP1000 RV design, and they are limiting curves based on copper and nickel material composition. The applicant committed to provide P-T limits using the plant-specific material composition after the combined license is issued and when the RV is procured. The applicant also stated that the development of the plant-specific P-T limits is required prior to fuel load. The staff found that a more specific implementation milestone for completing the plant-specific P-T limits was needed. Thus, the following additional information was requested.

In RAI 5.3.2-1, the staff noted Westinghouse's plan to: a) submit a generic PTLR [pressure temperature limits report] for the AP1000 RV using the bounding properties for NRC staff review and approval; and b) update the AP1000 DCD to include the use of the generic AP1000 PTLR by all COL applicants. The NRC staff requested that Part 10 of the BLN COL, proposed license conditions, Section 2, COL holder items, and COL Information Item 5.3-1 be revised by adding the following statement:

The COL Holder shall update the P/T limits using the PTLR methodologies approved in the AP1000 DCD, and using the plant-specific material properties. The COL Holder will inform the NRC of the updated P/T limits.

The approach described above is consistent with that used for all operating reactors where licensees using PTLRs (reference: GL 96-03) inform the NRC staff of any subsequent change in P-T limits with no NRC approval necessary when there are no changes to the approved PTLR methodology. Subsequently, in a letter dated May 30, 2008, Westinghouse submitted a generic PTLR for AP1000 plants. The NRC staff reviewed the PTLR and approved its use for AP1000 RVs in a safety evaluation (ML083470258) dated December 30, 2008.

In response to RAI 5.3.2-1, the applicant proposed to modify the COL application Part 10, Proposed Combined License Conditions, Section 2, COL Holder Item 5.3-1. Accordingly, the modified license condition states, "The COL Holder shall update the P/T limits using the PTLR methodologies approved in the AP1000 DCD using plant-specific material properties or confirm that the reactor vessel material properties meet the specifications and use the Westinghouse generic PTLR curves."

The staff finds that the applicant's modification to the proposed license condition is adequate and the staff verified that the revision to Part 10 of the application incorporates the above. As a result, RAI 5.3.2-1 is closed.

Supplemental Information

- *STD SUP 5.3-1*

Development of plant operating procedures as required by TS 5.6.6 ensures that P-T limits are adhered to during normal and abnormal operating conditions and system tests and is therefore, acceptable.

5.3.3.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license condition:

- License Condition (5-4) – Prior to initial fuel load, the licensee shall update the P-T limits using the PTLR methodologies approved in the AP1000 DCD using the plant-specific material properties or confirm that the RV material properties meet the specifications and use the Westinghouse generic PTLR curves.

5.3.3.6 *Conclusion*

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to P-T limits, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the regulatory basis addressed in NUREG-1793. Specifically, the relevant regulatory basis includes Section 5.3.2 of NURGEG-0800, GL 96-03, and Appendix G to 10 CFR Part 50. The staff based its conclusion on the following:

- STD COL 5.3-1, relating to plant-specific P-T curves, is acceptable because the program is consistent with the guidelines addressed in Section 5.3.2 of NUREG-0800. Conformance with these guidelines provides an acceptable basis for satisfying in part, the requirements of Appendix G to 10 CFR Part 50.

- STD SUP 5.3-1, relating to development of operating procedures, is acceptable because it ensures that P-T limits are adhered to during normal and abnormal operating conditions and system tests.

5.3.4 Reactor Vessel Integrity (Related to RG 1.206, Section C.III.1, Chapter 5, C.I.5.3.3 "Reactor Vessel Integrity")

5.3.4.1 *Introduction*

Section 5.3.4 of the AP1000 DCD describes the RV integrity. The RV is the RCPB used to support and enclose the reactor core. It provides flow direction with the reactor internals through the core and maintains a volume of coolant around the core. The vessel is fabricated by welding together the lower head, the transition ring, the lower shell, and the upper shell. The upper shell contains the penetrations from the inlet and outlet nozzles and direct vessel injection nozzles.

As part of the RV integrity, this section also addresses the pressurized thermal shock (PTS) for the PWR RV. PTS events are potential transients in a PWR RV that can cause severe overcooling of the vessel wall, followed by immediate repressurization. The thermal stresses, caused when the inside surface of the RV cools rapidly, combined with high-pressure stresses, will increase the potential for fracture if a flaw is present in a low-toughness material. The materials most susceptible to PTS are the materials in the RV beltline where neutron radiation gradually embrittles the material over time.

5.3.4.2 *Summary of Application*

Section 5.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.3 of the AP1000 DCD, Revision 19. Section 5.3 of the DCD includes Section 5.3.4.

In addition, in VEGP COL FSAR Section 5.3.6, the applicant provided the following:

AP1000 COL Information Item

- STD COL 5.3-4

The applicant provided additional information in STD COL 5.3-4 to address COL Information Item 5.3-4 and related COL Action Item 5.3.4.3-1. The applicant proposed to verify the plant-specific beltline material properties consistent with the requirements in DCD Section 5.3.3.1 and DCD Tables 5.3-1 and 5.3-3 prior to fuel load. The applicant also proposed in STD COL 5.3-4 to perform a PTS evaluation based on as procured RV material data and the projected neutron fluences for the plant design objective of 60 years.

License Condition

- Part 10, License Condition 2, Item 5.3-4

The milestone for the implementation of the proposed actions related to RV material properties will be prior to initial fuel load.

5.3.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the RV integrity are given in Section 5.3.3 of NUREG-0800.

In addressing the COL information item, PWRs are required, in part, to have the pressurized thermal shock reference temperature (RT_{PTS}), evaluated for the end-of-life fluence for each of the RV beltline materials in accordance with requirements of 10 CFR 50.61.

5.3.4.4 *Technical Evaluation*

The NRC staff reviewed Section 5.3.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to RV integrity. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory items or open items to resolve.

The following portion of this technical evaluation section is reproduced from Section 5.3.4.3 of the BLN SER:

AP1000 COL Information Item

- *STD COL 5.3-4*

The NRC staff reviewed STD COL 5.3-4 related to COL Information Item 5.3-4 and related COL Action Item 5.3.4.3-1. The applicant proposed to verify the plant-specific beltline material properties consistent with the requirements in DCD Section 5.3.3.1 and DCD Tables 5.3-1 and 5.3-3 prior to fuel load. The applicant also proposed in STD COL 5.3-4 to perform a PTS evaluation based on as procured RV material data and the projected neutron fluences for the plant design objective of 60 years.

License Condition

- *Part 10, License Condition 2, Item 5.3-4*

In response to the COL information item, the applicant proposed a license condition (Part 10, Item 2, COL Information Item 5.3-4) that a plant-specific PTS evaluation would be performed by the COL holder using as-procured RV material data and submitted for NRC review prior to initial fuel loading.

The as-procured RV material properties will be available to the COL holder after the acceptance of the RV. In order to provide sufficient time for NRC review of the PTS evaluation using the as-procured RV material properties as required by 10 CFR 50.61, the staff requested a more specific and timely milestone for submitting the PTS evaluation to the NRC be established. Therefore, the staff requested that the proposed license condition for COL Information Item 5.3-4 be revised to state that, within a reasonable period of time following acceptance of the RV, the COL holder submit to the NRC staff the plant-specific PTS evaluation, for example, one year after the acceptance of the RV. This was identified in RAI 5.3.3-1.

In response to RAI 5.3.3-1, the applicant proposed that the licensee shall submit to the appropriate Director of the NRC, a schedule, no later than 12 months after the issuance of the COL, that supports planning for and conduct of NRC inspections of operational programs listed in the operational program FSAR Table 13.4-201. This schedule shall include a submittal schedule for the RV pressurized thermal shock evaluation at least 18 months prior to initial fuel load. Accordingly, the applicant will revise the COL application, Part 10, proposed License Condition 6.

The staff finds that Revision 1 of the application incorporates the proposed change to the proposed License Condition 6, and therefore the applicant's response to COL Information Item 5.3-4 meets the implementation requirements of 10 CFR 50.61, and is therefore acceptable. As a result, RAI 5.3.3-1 is closed.

5.3.4.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes the following two license conditions:

- License Condition (5-5) – Prior to initial fuel load, the licensee shall complete verification of plant-specific belt line material properties consistent with the requirements in FSAR Section 5.3.3.1 and FSAR Tables 5.3-1 and 5.3-3. The verification shall include a PTS evaluation based on as-procured RV material data and the projected neutron fluence for the plant design objective of 60 years. This evaluation report shall be submitted for an NRC confirmatory review at least 18 months prior to initial fuel load.

5.3.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to RV integrity, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR meets the relevant acceptance criteria provided in Section 5.3.3 of NUREG-0800, and the requirements of Appendix B to 10 CFR Part 50 and 10 CFR 50.61. The staff based its conclusion on the following:

- STD COL 5.3-4, relating to plant-specific beltline material properties, is acceptable because the applicant's proposed resolution meets the relevant acceptance criteria addressed in Section 5.3.3 of NUREG-0800 and thus provides an acceptable basis for satisfying, in part, the requirements of Appendix B to 10 CFR Part 50 and 10 CFR 50.61.

5.3.5 Reactor Vessel Insulation

RV insulation is provided to minimize heat losses from the primary system. Non-safety-related reflective insulation similar to that in use in current PWRs is utilized.

Section 5.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 5.3.5 of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

5.4 Component and Subsystem Design (Related to RG 1.206, Section C.III.1, Chapter 5, C.I.5.4, "Reactor Coolant System Component and Subsystem Design")

5.4.1 Introduction

This section pertains to the design of various components and subsystems within, or associated with, the RCS. Principal components or subsystems include the following:

- Reactor coolant pumps (RCP)
- Steam generators (SG), including materials and ISI
- RCS piping and valves
- Main steam line flow restriction
- Pressurizer and pressurizer relief discharge
- Automatic depressurization system valves
- RNS
- RCS pressure relief devices
- Component supports
- RCS high point vents
- Core makeup tank
- Passive residual heat removal heat exchanger

The majority of the design-related information in the DCD is incorporated by reference in the COL application. Regarding the SGs, a program is developed by the COL applicant to ensure tube structural and leakage integrity will be maintained at a level comparable to that of the original design requirements. An effective program depends on both the program and the design features of the SGs.

5.4.2 Summary of Application

Section 5.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 5.4 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 5.4.2.5, the applicant provided the following:

AP1000 COL Information Item

- STD COL 5.4-1

The applicant provided additional information in STD COL 5.4-1 to address COL Information Item 5.4-1 as described in Section 5.4.15 of the AP1000 DCD. The information in STD COL 5.4-1 provides the SG program description, references the applicable ASME BPV Code, Section XI requirements and industry guidelines, and refers to the TS for the program requirements.

The detailed inspection and reporting requirements are provided in VEGP COL FSAR, Part 4, "Technical Specifications," Sections 1.1 ("Definitions"), 3.4.7 ("RCS Operational Leakage"), 3.4.18 ("Steam Generator (SG) Tube Integrity"), 5.5.4 ("Steam Generator (SG) Program"), 5.6.8 ("Steam Generator Tube Inspection Report"), and in the associated bases sections of the TS.

5.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the component and subsystem design are given in Section 5.4.2 of NUREG-0800.

The applicable regulatory requirements for acceptance of the COL information item are 10 CFR 50.55a, "Codes and Standards," as it relates to periodic inspection and testing of the RCPB as detailed in Section XI of the ASME Code, and 10 CFR Part 50, Appendix A, GDC 32, "Inspection of Reactor Coolant Pressure Boundary," as it relates to the accessibility of SG tubes for periodic testing. In addition, 10 CFR 50.55a(b)(2)(iii) states that if the TS include SG surveillance requirements that are different than those in Article IWB-2000 of the ASME Code, Section XI, then the SG tube inspection requirements are governed by the TS.

5.4.4 Technical Evaluation

The NRC staff reviewed Section 5.4 of the VEGP COL FSAR and the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to RCS component and subsystem design. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items to resolve.

The following portion of this technical evaluation section is reproduced from Section 5.4.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 5.4-1*

In AP1000 DCD Section 5.4.15, Westinghouse identified COL Information Item 5.4-1 for the COL applicant to address the SG tube integrity with an SG Tube Surveillance Program and address the need to develop a program for periodic monitoring of degradation of steam generator internals. Similarly, in NUREG-1793, Section 5.4.2.2.2, the staff identified COL Action Item 5.4.2.2.3-1 and noted that an SG tube surveillance program is necessary to address the concerns raised in GL 97-06, "Degradation of Steam Generator Internals."

In Revision 17 of the AP1000 DCD, Westinghouse proposed changes to the AP1000 generic TS related to adopting TS Task Force Traveler (TSTF) 449, Revision 4, "Steam Generator Tube Integrity." TSTF 449 is incorporated in the current Westinghouse Owners Group Standard Technical Specifications (STS), NUREG-1431, Revision 3.1, December 1, 2005. The TS and bases sections listed above for SG tube integrity in the BLN SER are identical to those in Revision 17 of the AP1000 DCD.

With respect to the information provided in STD COL 5.4-1, the staff reviewed the description in Chapter 5 of the FSAR using the guidelines in RG 1.206, Section C.III.1, Chapter 5, C.I.5.4.2.2; Section 5.4.2.2 of NUREG-0800; and the TS proposed in the AP1000 DCD (which are based on NUREG-1431, Revision 3.1 and are the STS for Westinghouse operating plants). The staff confirmed tube inspection will meet the requirements of Section XI of the ASME Code, and that the applicant referenced an acceptable method (RG 1.121) for determining the tube repair criteria for maintaining structural integrity. The staff determined the TS proposed for BLN Nuclear Plant, Units 3 and 4 are consistent with the approved STS and the leakage limits and SG tube integrity requirements are appropriate as they apply to BLN, and are therefore acceptable. In addition, the applicant took exception to the guidance contained in Regulatory Guide 1.83, Revision 1 and stated that the applicant's program will be implemented according to Nuclear Energy Institute (NEI) 97-06 ("Steam Generator Program Guidelines") and EPRI SG guidelines, which are referenced in the STS and, thus, provide acceptable methods for implementing ASME Code requirements. With respect to tube integrity considerations, the Model Delta-125 SG planned for the BLN units closely resembles the Model Delta-75 installed as replacement SGs at some operating plants.

According to Section 5.4.2.2 of NUREG-0800, because the SG program is part of the ISI requirements, it is an operational program that should be fully described, with implementation milestones listed in the appropriate table in Chapter 13 of the FSAR. In response to RAI 5.4.2.2-1 from the staff, in a letter dated June 5, 2008, the applicant proposed revising FSAR Chapter 13, Table 13.4-201 to add Section 5.4.2.5 ("Steam Generator Inservice Inspection") as one of the FSAR sections addressed by the operational program titled "Inservice Inspection Program." Similarly, in response to RAI 5.4.2.2-2, the applicant proposed

revising Table 13.4-201 to add Section 5.4.2.5 as one of the FSAR sections addressed by the operational program titled "Preservice Inspection Program." These proposed revisions are acceptable because they make the SG tube ISI part of the operational programs and ensure PSIs will be performed, consistent with the acceptance criteria in Section 5.4.2.2 of NUREG-0800 and RG 1.206. The staff verified that Revision 1 of Table 13.4-201 adequately incorporates the above. As a result, RAI 5.4.2.2-1 and RAI 5.4.2.2-2 are closed.

5.4.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license condition to address SG PSI/ISI:

- License Condition (5-6) – No later than 12 months after the issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspections of the SG PSI/ISI program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the SG PSI/ISI program has been fully implemented or the plant has been placed in commercial service, whichever comes first.

5.4.6 Conclusion

The NRC staff reviewed the application and the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to RCS component and subsystem design, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the relevant regulatory requirements provided in Appendix A to 10 CFR Part 50, GDC 32 and 10 CFR 50.55a, and the regulatory guidance addressed in RG 1.206 and RG 1.121. The staff based its conclusion on the following:

- STD COL 5.4-1 relating to the SG Program, is acceptable because it meets the relevant guidelines of RG 1.206, Section C.III.1, Chapter 5, C.I.5.4.2.2 and RG 1.121. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of Appendix A to 10 CFR Part 50, GDC 32, and 10 CFR 50.55a including the specific modification provided in 10 CFR 50.55a(b)(2)(iii).

6.0 ENGINEERED SAFETY FEATURES

6.0 Engineered Safety Features

Engineered safety features (ESF) protect the public in the event of an accidental release of radioactive fission products from the reactor coolant system (RCS). The ESF function is to localize, control, mitigate, and terminate such accidents, and to maintain radiation exposure levels to the public below applicable limits and guidelines.

Section 6.0 of the Vogtle Electric Generating Plant (VEGP) combined license (COL) Final Safety Analysis Report (FSAR), Revision 5, incorporates by reference, with no departures or supplements, Section 6.0, "Engineered Safety Features," of Revision 19 of the AP1000 Design Control Document (DCD). The Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[21] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements.

6.1 Engineered Safety Features Materials

This section provides the evaluation of the materials used in the fabrication of ESF components and of the provisions to avoid material interactions that could impair the operation of the ESF. The design information in VEGP COL FSAR Section 6.1 is divided into two sections, Section 6.1.1, "Metallic Materials"; and Section 6.1.2, "Organic Materials." The NRC staff's evaluation of these two FSAR sections is provided below.

6.1.1 Metallic Materials

6.1.1.1 *Introduction*

In this section, the NRC staff reviews metallic materials used in ESF components to ensure that they are compatible with one another and with ESF fluids. The compatibility of fluids in ESF systems should ensure that there is a low probability of causing abnormal leakage, of rapidly propagating failure, and of gross rupture of reactor coolant pressure boundary (RCPB) components. Metallic materials and fluids should also be compatible with the auxiliary systems that directly support ESF systems.

6.1.1.2 *Summary of Application*

Section 6.1 of the VEGP COL FSAR, Revision 5 incorporates by reference Section 6.1 of the AP1000 DCD, Revision 19. Section 6.1 of the AP1000 DCD includes Section 6.1.1.

[21] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification (DC).

In addition, in VEGP COL FSAR Section 6.1.1, the applicant provided the following:

AP1000 COL Information Item

- STD COL 6.1-1

The applicant provided additional information in Standard (STD) COL 6.1-1 to resolve COL Information Item 6.1-1. STD COL 6.1-1 describes quality assurance measures for special processes in fabricating austenitic stainless steels. In a letter dated April 7, 2010, the DCD applicant, Westinghouse, proposed to revise Appendix 1A of the AP1000 DCD to remove stated exceptions to conformance with Regulatory Guide (RG) 1.44, "Control of the Use of Sensitized Steel," Revision 0. The NRC staff's review of STD COL 6.1-1 includes the information in the Westinghouse letter. The COL applicant did not submit additional information in response to this proposed DCD revision.

6.1.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the metallic materials are given in Section 6.1.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

The regulatory basis of the COL information item is described in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic licensing of production and utilization facilities," Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," as it relates to the quality assurance requirements for the design, fabrication, and construction of safety-related structures, systems, and components (SSCs). Guidance for the COL information item is described in RG 1.31, "Control of Ferrite Content in Stainless Steel Weld Metal," Revision 3, and RG 1.44.

6.1.1.4 *Technical Evaluation*

The NRC staff reviewed Section 6.1.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to metallic materials. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this safety evaluation report (SER) provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the Bellefonte Nuclear Plant (BLN), Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL

FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items related to the standard content in the BLN SER.

The following portion of this technical evaluation section is reproduced from Section 6.1.1.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 6.1-1*

The NRC staff reviewed STD COL 6.1-1 related to COL Information Item 6.1-1 included under Section 6.1.1.2 of the BLN COL FSAR, which addresses the COL information item identified in AP1000 DCD Section 6.1.3.1 related to the fabrication requirements for austenitic stainless steel.

The COL information item identified in AP1000 DCD Section 6.1.3.1 states:

> *The Combined License applicants referencing the AP1000 will address review of vendor fabrication and welding procedures or other quality assurance methods to judge conformance of austenitic stainless steels with Regulatory Guides 1.31 and 1.44.*

This commitment was also documented as COL Action Item 6.1.1-1 in the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will review vendor fabrication and welding procedures or other quality assurance methods to ensure that austenitic stainless steels meet the guidelines of RGs 1.31 and 1.44.*

The COL information in the FSAR that is to be added to AP1000 DCD Section 6.1.1.2 states:

> *In accordance with Appendix B to 10 CFR Part 50, the quality assurance program establishes measures to provide control of special processes. One element of control is the review and acceptance of vendor procedures that pertain to the fabrication, welding, and other quality assurance methods for safety related component [sic] to determine both code and regulatory conformance. Included in this review and acceptance process are*

those vendor procedures necessary to provide conformance with the requirements of Regulatory Guides 1.31 and 1.44 for engineered safety features components as discussed in DCD Section 6.1 and reactor coolant system components as discussed in DCD Section 5.2.3.

The staff finds the COL information provided by the applicant meets the quality assurance guidelines for austenitic stainless steels specified in RG 1.31 (weld metal ferrite content) and RG 1.44 (the use of sensitized stainless steel). The staff's conclusion is based on the applicant's statement affirming that its Appendix B quality assurance program will address the concerns of these RGs. It is also based on Appendix 1A of the AP1000 DCD, as modified by a letter dated April 7, 2010, from the AP1000 applicant. The modified DCD appendix will be incorporated by reference in a future version of the BLN COL FSAR and will indicate full conformance with these RGs. In addition, the discussions in AP1000 DCD Sections 6.1.1.2 and 5.2.3.4 provide details about how conformance will be accomplished.

6.1.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

6.1.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to metallic materials used in the ESF, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix B, with the additional guidance provided in RG 1.31 and RG 1.44. The staff based its conclusion on the following:

- STD COL 6.1-1 is acceptable because the Appendix B quality assurance program proposed by the applicant provides adequate controls over vendor fabrication and welding procedures to ensure that austenitic stainless steels meet the guidelines of RG 1.31 and RG 1.44.

6.1.2 Organic Materials

6.1.2.1 *Introduction*

Protective coatings are applied for corrosion prevention to the interior and exterior surfaces of the containment vessel, radiologically controlled areas outside containment, and the remainder of the plant. The considerations for protective coatings differ for these four areas and the coatings selection process accounts for these differing considerations. The AP1000 design considers the function of the coatings, their potential failure modes, and their requirements for maintenance.

Other organic materials that may be present in the containment are associated with the specific type of equipment and the supplier selected to provide it. Materials are evaluated for potential interaction with the ESF to provide confidence that the performance of the ESF is not unacceptably affected.

6.1.2.2 *Summary of Application*

Section 6.1 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 6.1 of the AP1000 DCD, Revision 19. Section 6.1 of the AP1000 DCD includes Section 6.1.2.

In addition, in VEGP COL FSAR Section 6.1.2, the applicant provided the following:

AP1000 COL Information Item

- STD COL 6.1-2

The applicant provided additional information in STD COL 6.1-2 to resolve COL Information Item 6.1-2. STD COL 6.1-2 discusses a program to control procurement, application, inspection, and monitoring of Service Level I and Service Level III coatings. In a letter dated March 31, 2010, the DCD applicant, Westinghouse, proposed revisions to COL Information Item 6.1-2 in Section 6.1.3.2 of the AP1000 DCD to address Service Level II coatings. In letters dated July 2 and August 13, 2010, the VEGP applicant proposed to revise the VEGP COL FSAR to address the updated COL Information Item 6.1-2.

6.1.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for protective coatings are given in Section 6.1.2 of NUREG-0800.

The applicable regulatory basis for acceptance of the resolution to the COL information item is described in 10 CFR Part 50, Appendix B, as it relates to the quality assurance requirements for the design, fabrication, and construction of safety-related SSCs. Guidance for the COL information item is described in RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," Revision 1.

6.1.2.4 *Technical Evaluation*

The NRC staff reviewed Section 6.1.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to protective coatings and other organic materials inside containment. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard

content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. Although the staff concluded that the evaluation performed for the standard content is directly applicable to the VEGP COL application, there is a difference in how the VEGP applicant addressed STD COL 6.1-2 and how the BLN applicant addressed this review item. This difference, which is based on a change proposed in the AP1000 DCD, is evaluated by the staff below, following the standard content material for STD COL 6.1-2. There was one open item (Open Item 6.1.2-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 6.1.2.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 6.1-2*

The NRC staff reviewed STD COL 6.1-2 included under Section 6.1.2.1.6 of the BLN COL FSAR related to COL Information Item 6.1-2. COL Information Item 6.1-2 states:

> *The Combined License applicants referencing the AP1000 will provide a program to control procurement, application, and monitoring of Service Level I and Service Level III coatings. The program for the control of the use of these coatings will be consistent with [DCD] subsection 6.1.2.1.6.*

This commitment was also captured as COL Action Item 6.1.2-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will prepare a program to control procurement, application, and monitoring of Service Level I and Service Level III coatings.*

The added information in the BLN COL FSAR replaces the third paragraph under the section titled, "Service Level I and Service Level III Coatings," in AP1000 DCD Section 6.1.2.1.6 with the following:

> *During the design and construction phase the coatings program associated with selection, procurement and application of safety related coatings is performed to applicable quality standards. Regulatory Guide 1.54 and [American Society for Testing and Materials] ASTM D5144 form the basis for the coating program. During the operations phase, the coatings program is administratively controlled in accordance with the quality assurance program implemented to satisfy 10 CFR Part 50, Appendix B, and 10 CFR Part 52 requirements. The coatings program provides direction for the procurement, application, and monitoring of safety related coating systems. Coating system monitoring requirements for the containment coating systems are based on ASTM D5163, "Establishing Procedures to Monitor the Performance of Coating Service Level I Coating Systems in an Operating Nuclear Power Plant," and ASTM D7167, "Establishing Procedures to Monitor the Performance of Safety-Related Coating Service Level III Lining Systems in an Operating Nuclear Power Plant." Any anomalies identified during coating monitoring are resolved in accordance with applicable quality assurance requirements.*

The AP1000 DCD, which the applicant incorporates by reference, includes the following description of the quality assurance program:

> *The quality assurance program for Service Level I and Service Level III coatings conforms to the requirements of [American Society of Mechanical Engineers] ASME NQA-1-1983 as endorsed in Regulatory Guide 1.28 ["Quality Assurance Program Criteria (Design and Construction)"]. Safety related coatings meet the pertinent provisions of 10 CFR Part 50 Appendix B to 10 CFR Part 50. The service level classification of coatings is consistent with the positions given in Revision 1 of Regulatory Guide 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants." Service Level I and Service Level III coatings used in the AP1000 are tested for radiation tolerance and for performance under design basis accident conditions. Where decontaminability is desired, the coatings are evaluated for decontaminability. The coating applicator submits and follows acceptable procedures to control surface preparation, application of coatings and inspection of coatings. The painters are qualified and certified, and the inspectors are qualified and certified.*
>
> *The inorganic zinc coating used on the inside surface (Service Level I coatings) and outside surface (Service Level III coatings) of the containment shell is inspected using a non-destructive dry film thickness test and a MEK rub test. These inspections are performed after the initial application and after recoating. Long*

term surveillance of the coating is provided by visual inspections performed during refueling outages. Other inspections are not required.

Section 6.1.2 of NUREG-0800 references RG 1.54 as providing an acceptable method of complying with the quality assurance requirements in regard to protective coatings applied to ferritic steels, aluminum, stainless steel, zinc-coated (galvanized) steel, concrete, or masonry surfaces of nuclear facilities. RG 1.54 lists a number of ASTM standards that provide guidance on practices and programs that are acceptable to the NRC staff for the selection, application, qualification, inspection, and maintenance of protective coatings applied in nuclear power plants. Section 6.1.2 of NUREG-0800 also states that a coating system to be applied inside the containment vessel is acceptable if it meets the regulatory positions of RG 1.54 and the standards of ASTM D5144-00 and ASTM D3911-03. By contrast, the AP1000 DCD references RG 1.54, but only with respect to classification of coating service level as I, II, or III.

The AP1000 DCD text to be replaced with the COL information item stated that the procurement, application, and monitoring of Service Level I and Service Level III coatings are controlled by a program prepared by the COL applicant The information provided clarified that the applicant's coatings program, with respect to procurement, application, inspection, and monitoring, will be consistent with the recommendations of RG 1.54, which is endorsed in Section 6.1.2 of NUREG-0800 as an acceptable method of meeting the quality assurance requirements of 10 CFR Part 50, Appendix B for safety-related and nonsafety-related coatings. However, the information provided by the applicant to resolve the COL information item merely states that the protective coatings program complies with RG 1.54, when, in fact, the program was not yet developed. Therefore, the COL applicant had not provided a coatings program as committed in COL Information Item 6.1-2.

To resolve this issue, in request for additional information (RAI) 6.1.2-1, the staff requested the following information:

1. *The applicant should describe the standards to be applied to maintenance of the protective coatings in the program description. The description of the proposed coatings program should also describe the standards to be applied to selection and qualification of coatings, if the applicant intends to use coatings systems different than those described in the AP1000 DCD, either during construction or after plant operation commences.*

2. *The program description should describe the administrative controls that will be applied to the coatings program.*

3. *Provide the schedule for full implementation of the coatings program with respect to major milestones in the construction of the plant; for example, prior to application of coatings, prior to preparation of surfaces to be coated, or prior to procurement of coatings materials.*

In a letter dated May 23, 2008, the applicant provided the following response:

Item 1) The coating program will be based on Revision 1 of RG 1.54 and the referenced ASTM standards in ASTM D5144. Also, the guidance provided in ASTM D5163, "Establishing Procedures to Monitor the Performance of Coating Service Level I Coating Systems in an Operating Nuclear Power Plant," and in ASTM D7167, "Establishing Procedures to Monitor the Performance of Coating Service Level III Coating Systems in an Operating Nuclear Power Plant," will be used to specify monitoring (maintenance) requirements for the safety-related coating systems pertaining to containment. While a change in coating systems (from those described in the AP1000 DCD) is not anticipated, if a different safety-related coating system is needed, it will be evaluated in accordance with the appropriate change process, i.e., 10 CFR 50.59 or 10 CFR Part 52, Appendix D, Section VIII.

Item 2) FSAR Section 6.1.3.2, Coating Program, will be revised to indicate compliance with 10 CFR Part 50, Appendix B, and 10 CFR Part 52 requirements implemented by the quality assurance program for the plant (see FSAR Chapter 17 and Part 11 of the COL application) for design, construction, and operation of the units.

Item 3) During the design and construction phase, the requirements for the coating program will be contained in certified drawings and/or standards and specifications controlling the coating processes of the designer (Westinghouse); these design documents will be available prior to the procurement and application of the coating material by the constructor of the plant. Prior to initial fuel loading, a consolidated plant coating program will be in place to address procurement, application, and monitoring (maintenance) of those coating system(s) for the life of the plant.

The staff finds the applicant's response to Item 1 acceptable because, pursuant to RG 1.54, ASTM D5163 provides guidelines that are acceptable to the NRC staff for establishing an in-service coatings monitoring program for Service Level I coating systems in operating nuclear power plants and for Service Level II and other areas outside containment (as applicable). The applicant also specified ASTM D7167 for monitoring (maintenance) requirements for the safety-related coating systems pertaining to containment. Although ASTM D7167 is not listed in RG 1.54 or ASTM D5144, the staff finds it an appropriate standard because it addresses maintenance of Service Level III coatings. Additionally, ASTM D7167 references ASTM D4541 and ASTM D3359, which are listed in RG 1.54 as acceptable standards for maintenance of protective coatings in nuclear power plants. Further, if a change in any of the originally specified coatings systems is necessary, the applicant will use an appropriate process, either the 10 CFR 50.59 or 10 CFR Part 52, Appendix D, Section VIII process, to evaluate the change. The staff finds the application of these regulations an appropriate alternative to control of the selection of coatings by the consolidated coatings program.

The BLN application references later versions of ASTM D5144 and ASTM D5163 than those referenced in RG 1.54, Revision 1. The use of the 2008 revision of ASTM D5144 is acceptable because it provides detailed requirements through reference to other coatings standards applicable to BLN. In this regard, it is not changed with respect to the 2000 revision referenced in the RG 1.54, Revision 1. Similarly, the 2005 revision of ASTM D5163 is referenced in the BLN COL application rather than the 1996 revision referenced in RG 1.54, Revision 1. The staff finds this acceptable because the NRC staff has accepted the 2005 revision of ASTM D5163 as the basis for the Aging Management Program XI.S8 in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Volume 2, Revision 2 (license renewal). With respect to simulated design-basis accident qualification testing for coatings, the staff notes that the applicable version of ASTM D3911 is the 1995 revision, as indicated in Appendix 1A of the AP1000 DCD.

In response to Item 2, the applicant stated that the administrative controls spelled out in its Quality Assurance Program Document (QAPD) will be applied to the coatings program. The staff finds that this will ensure compliance with the requirements of 10 CFR Part 50, Appendix B, which is a regulatory acceptance criterion of Section 6.1.2 of NUREG-0800. However, the staff notes that the QAPD references ASME NQA-1-1994 as an acceptable means to implement the requirements of 10 CFR Part 50, Appendix B, rather than ASME NQA-1-1983 as referenced by AP1000 DCD Section 6.1.2.1.6. ASME NQA-1-1994 is used as the basis for NUREG-0800 Section 17.5, "Quality Assurance Program Description - Design Certification, Early Site Permit and New License Applicants," which is applicable to the quality assurance program for a COL. Therefore, the staff finds the use of ASME NQA-1-1994 acceptable with respect to quality assurance requirements for coatings.

The staff finds the response to Item 3 acceptable because the applicant indicated the consolidated plant coating program will be in place to address procurement, application, and monitoring (maintenance) of those coating system(s) for the life of the plant, prior to initial fuel loading. During the construction phase, the requirements for the coating program will be contained in certified drawings and/or standards and specifications controlling the coating processes, which meets the requirements of 10 CFR Part 50, Appendix B, Criterion III with respect to design control and instructions, Criterion IV with respect to procurement document control, and Criterion V with respect to procedures and drawings.

The applicant also provided proposed changes to BLN COL FSAR Section 6.1.2.1.6 to incorporate the information included in the response to RAI 6.1.2-1. The staff confirmed that FSAR Section 6.1.2.1.6 has been revised to include information on the quality assurance program. However, since the information proposed to be added does not include the detailed information on control of coatings during the design and construction phase, the staff identified ***Open Item 6.1.2-1*** *to ensure that BLN COL FSAR Section 6.1.2.1.6 is revised to include the information from the response to RAI 6.1.2-1, Item 3, related to control of the coating program during the design and construction phase and the schedule for full implementation of the consolidated coatings program.*

Resolution of Standard Content Open Item 6.1.2-1

Standard Content Open Item 6.1.2-1 was identified by the staff because the information the BLN applicant provided about the control of coatings during the design and construction phase, although acceptable, was not included in the BLN COL FSAR. In the July 2, 2010, letter, the VEGP applicant proposed inserting the three paragraphs below in Section 6.1.2.1.6 of the VEGP FSAR. These paragraphs would replace the third paragraph under "Service Level I and Service Level III Coatings" in DCD Section 6.1.2.1.6.

> During the design and construction phase, the coatings program associated with selection, procurement and application of safety related coatings is performed to applicable quality standards. The requirements for the coatings program are contained in certified drawings and/or standards and specifications controlling the coating processes of the designer (Westinghouse) (these design documents will be available prior to the procurement and application of the coating material by the constructor of the plant). Regulatory Guide 1.54 and ASTM D5144 ([FSAR] Reference 201) form the basis for the coatings program.
>
> During the operations phase, the coatings program is administratively controlled in accordance with the quality assurance program implemented to satisfy 10 CFR Part 50, Appendix B, and 10 CFR Part 52 requirements. The coatings program provides direction for the procurement, application, inspection, and monitoring of safety related coating systems. Prior to initial fuel loading, a consolidated plant coatings program will be in place to address procurement, application, and monitoring (maintenance) of those coating system(s) for the life of the plant.
>
> Coating system monitoring requirements for the containment coating systems are based on ASTM D5163 ([FSAR] Reference 202), "Standard Guide for Establishing Procedures to Monitor the Performance of Coating Service Level I Coating Systems in an Operating Nuclear Power Plant," and ASTM D7167 ([FSAR] Reference 203), "Standard Guide for Establishing Procedures to Monitor the Performance of Safety-Related Coating Service Level III Lining Systems in an Operating Nuclear Power Plant." Any anomalies identified during coating inspection or monitoring are resolved in accordance with applicable quality assurance requirements.

As discussed above in the portion of the staff's evaluation reproduced from Section 6.1.2.4 of the BLN SER, the staff finds the COL information related to control of coatings during the design and construction phase acceptable. Subsequently, the staff finds the FSAR revisions proposed above consistent with the information reviewed for the BLN SER and applicable to VEGP. Therefore, the staff finds the FSAR revisions proposed in the July 2, 2010, letter acceptable for closing Open Item 6.1.2-1. The incorporation of these proposed revisions is being tracked as **Confirmatory Item 6.1-1**.

Resolution of Standard Content Confirmatory Item 6.1-1

Confirmatory Item 6.1-1 is an applicant commitment to revise its FSAR Section 6.1.2.1.6 to provide information regarding Service Level I and Service Level III coatings. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 6.1-1 is now closed.

Evaluation of Additional Design Information

As discussed above, AP1000 DCD Section 6.1.3.2 requires the COL applicants to provide a program for procurement, application, and monitoring of Service Level I and Service Level III coatings consistent with DCD Section 6.1.2.1.6. However, DCD Section 6.1.2.1.6 also states that COL applicants will also address the program for Service Level II coatings, and that coatings programs for Service Level I, II, and III will include inspection. Therefore, in a letter dated March 31, 2010, the AP1000 DCD applicant proposed the following revision to DCD Section 6.1.3.2:

> The Combined License applicants referencing the AP1000 will provide programs to control procurement, application, inspection, and monitoring of Service Level I, Service Level II, and Service Level III coatings. The programs for the control of the use of these coatings will be consistent with subsection 6.1.2.1.6.

In letters dated July 2 and August 13, 2010, the VEGP applicant addressed the addition of Service Level II to the COL information item by proposing the following additions to Section 6.1.2.1.6 of the VEGP COL FSAR. The first is a new second paragraph under "Service Level II Coatings" in DCD Section 6.1.2.1.6.

> Such safety-related Service Level II coatings used inside containment are procured to the same standards as Service Level I coatings with regard to radiation tolerance and performance under design basis accident conditions as discussed below.

The second addition replaces the second sentence of the third paragraph under "Service Level II Coatings" in DCD Section 6.1.2.1.6.

> Coating system application, inspection, and monitoring requirements for the Service Level II coatings used inside containment will be performed in accordance with a program based on ASTM D5144 ([FSAR] Reference 201), "Standard Guide for Use of Protective Coating Standards in Nuclear Power Plants," and the guidance of ASTM D5163 ([FSAR] Reference 202), "Standard Guide for Establishing Procedures to Monitor the Performance of Coating Service Level I Coating Systems in an Operating Nuclear Power Plant." Any anomalies identified during coating inspection or monitoring are resolved in accordance with applicable quality requirements.

The NRC staff finds it acceptable to procure Service Level II coatings in containment to the same standards as Service Level I coatings because the staff, through RG 1.54, has endorsed the use of these standards to procure safety-related coatings inside containment. The staff also finds it acceptable to use ASTM D5144 and D5163 as a basis for application, inspection, and monitoring requirements for Service Level II coatings. As discussed in RG 1.54, ASTM D5144 is a top-level standard that provides general guidance on coating programs and detailed guidance by reference to other ASTM standards. Since it contains a single set of application requirements for all coatings, the staff finds an acceptable basis for Service Level II coatings application and inspection. The staff finds ASTM D5163 acceptable for monitoring Service Level II coatings in containment because the use of ASTM D5163 conforms to the guidance in RG 1.54 for monitoring the performance of safety-related (Service Level I) coatings in

containment, and there is no separate standard for Service Level II coatings. The incorporation of the proposed revisions to address Service Level II coatings into a future revision of the VEGP COL FSAR is being tracked as **Confirmatory Item 6.1-2**.

Resolution of Standard Content Confirmatory Item 6.1-2

Confirmatory Item 6.2-1 is an applicant commitment to revise its FSAR Section 6.1.2.1.6 to provide information regarding the procurement of Service Level II coatings. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 6.1-2 is now closed.

6.1.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

6.1.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to protective coatings and other organic materials inside containment, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix B, with the additional guidance provided in RG 1.54. The staff based its conclusion on the following:

- STD COL 6.1-2 is acceptable because the Appendix B quality assurance program, with the additional guidance provided in RG 1.54, provides adequate controls over the programs to control procurement, application, inspection, and monitoring of Service Level I, Service Level II, and Service Level III coatings.

6.2 Containment Systems

6.2.1 Introduction

The containment systems (CSs), which include the primary containment, passive cooling system (heat removal system), isolation system, hydrogen control system, and leak rate test system, are discussed in this section. The containment encloses the reactor system and is the final barrier against the release of significant amounts of radioactive fission products in the event of an accident. The containment structure must be capable of withstanding, without loss of function, the pressure and temperature conditions resulting from postulated loss-of-coolant, steam line break, or feed water line break accidents. The containment structure must also maintain functional integrity in the long term following a postulated accident; i.e., it must remain a low leakage barrier against the release of fission products for as long as postulated accident conditions require.

6.2.2 Summary of Application

Section 6.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 6.2 of the AP1000 DCD, Revision 19. Section 6.2 of the DCD includes Sections 6.2.1, "Containment Functional Design"; 6.2.2, "Passive Containment Cooling System"; 6.2.3, "Containment Isolation System"; 6.2.4, "Containment Hydrogen Control System"; and 6.2.5, "Containment Leak Rate Test System." DCD Section 6.2.5 is evaluated by the NRC staff in Section 6.2.6 of NUREG-1793. NUREG-1793 also includes the staff's evaluation of the following issues:

- Fracture prevention of the containment pressure boundary in accordance with NUREG-0800, Section 6.2.7

- In-containment refueling water storage tank (IRWST) hydrodynamic loads

There are no COL information items associated with the review of either of these issues. The staff's evaluation of the incorporated by reference sections that address fracture prevention of the containment pressure boundary is found in Section 3.8 of this SER. With respect to the hydrodynamic loads, the staff's evaluation may be found in Section 6.2.8 of NUREG-1793.

The staff's evaluation of the containment cleanliness program associated with Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on PWR [Pressurized-Water Reactor] Sump Performance," is evaluated in Section 6.3 of this SER.

In addition, in VEGP COL FSAR Section 6.2.5, the applicant provided the following:

AP1000 COL Information Item

- STD COL 6.2-1

The applicant provided additional information in STD COL 6.2-1 to address COL Information Item 6.2-1 and COL Action Item 6.2.6-1, which addresses the containment leak rate test program. In addition, VEGP COL FSAR Table 1.9-203, "Listing of Unresolved Safety Issues and Generic Safety Issues," includes a line item for Task Action Plan Item A-23, "Containment Leak Testing." This item is addressed in VEGP COL FSAR Section 6.2.5.1, STD COL 6.2-1.

License Conditions

- Part 10, License Condition 3, Item G.8

This proposed license condition states that the COL holder shall implement the containment leakage rate testing program prior to initial fuel load, as stated in VEGP COL FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations."

- Part 10, License Condition 6

This proposed license condition states that the COL holder shall provide an operational program schedule to support NRC inspections.

6.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for containment leak rate testing are given in Section 6.2.6 of NUREG-0800.

The regulatory requirements related to this section are established in General Design Criteria (GDC) 52, "Capability for Containment Leakage Rate Testing"; GDC 53, "Provisions for Containment Testing and Inspection"; GDC 54, "Piping System Penetrating Containment"; and 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors." In addition, the staff used guidance found in Nuclear Energy Institute (NEI) 94-01, as endorsed and modified by RG 1.163, "Performance-Based Containment Leak-Test Program."

The staff used the guidelines of NuStart Technical Report, AP-TR-NS01-A, Revision 2, "Containment Leak Rate Test Program," dated April 4, 2007, to review the operational program, Containment Leakage Rate Testing Program.

6.2.4 Technical Evaluation

The NRC staff reviewed Section 6.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the containment systems. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items related to the standard content in the BLN SER.

The following portion of this technical evaluation section is reproduced from Section 6.2.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 6.2-1*

The NRC staff reviewed STD COL 6.2-1 related to COL Information Item 6.2-1 included under Section 6.2.5 of the BLN COL FSAR regarding the text added to Section 6.2.6 of the COL application. The added text references the program, which was reviewed and approved by the NRC in a letter from Stephanie Coffin, NRC, to Marilyn Kray, NuStart, "Final Safety Evaluation for AP1000 Technical Report No. AP-TR-NS01, Containment Leak Rate Test Program (TAC No. MD5136)," dated October 25, 2007.

License Conditions

- *Part 10, License Condition 3, Item G.8*
- *Part 10, License Condition 6*

The portion of License Conditions 3 and 6 relevant to this SER section is the containment leakage rate testing program listed in BLN COL FSAR Table 13.4-201. As noted in Section 13.4 of this SER, the containment leakage rate testing program meets the criteria for an operational program as specified in SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria." Therefore, the NRC staff finds License Conditions 3 and 6 acceptable, with respect to the inclusion of the containment leakage rate testing program in Table 13.4-201.

Due to discrepancies in the implementation milestones provided in various locations in the BLN COL application, RAI 6.2.6-1 was forwarded to the applicant. The applicant's response was that the milestones were meant to reflect the implementation of an approved testing program and when the tests were actually to be performed. However, the applicant agreed that this was not consistently reflected. The discrepancies have been addressed in BLN COL FSAR, Table 13.4-201, sheet 2 of 7, and Part 10, License Conditions and ITAAC. The changes indicate that the containment leak rate testing program will be implemented prior to initial fuel load. This RAI is closed.

6.2.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license conditions related to the containment leakage rate testing program:

- License Condition (6-1) - The licensee shall implement the containment leakage rate testing program prior to initial fuel load.

- License Condition (6-2) - No later than 12 months after issuance of the COL, the licensee shall submit to the Director of the Office of New Reactors (NRO) a schedule that supports planning for and conduct of NRC inspections of the containment leakage rate testing program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the containment leakage rate testing program has been fully implemented.

6.2.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the containment systems, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and complies with the guidance and staff positions in RG 1.163. The staff based its conclusion on the following:

- STD COL 6.2-1, as related to the containment leak rate testing program, is acceptable because the NRC staff has determined that the requirements of 10 CFR Part 50, Appendix J, have been met.

6.3 Passive Core Cooling System (Related to RG 1.206, Section C.III.1, Chapter 6, C.I.6.3, "Emergency Core Cooling System")

6.3.1 Introduction

The passive core cooling system is designed to provide emergency core cooling to mitigate design-basis events that involve a decrease in the RCS inventory, such as a loss-of-coolant accident (LOCA), a decrease in heat removal by the secondary system, such as a feedwater system piping failure, or an increase in heat removal by the secondary system, such as a steam system piping failure. It also provides core cooling for shutdown events, such as a loss of normal residual heat removal system during a shutdown operation. The passive core cooling system is designed to perform the following safety-related functions:

- emergency core decay heat removal
- RCS emergency makeup and boration
- safety injection
- containment sump pH control

During long-term operation, the AP1000 passive core cooling system must withstand the effects of debris loading on the containment recirculation screens, IRWST screens and the fuel assemblies. The concern that debris may lead to unacceptable head loss for the recirculating flow was raised in GSI-191 and it is the topic of Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," and Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors." Section 6.3 of the AP1000 DCD

includes an evaluation of this issue and Section 6.2.1.8 of NUREG-1793 includes the staff's review, which was performed in accordance with the NRC-approved evaluation methodology.

6.3.2 Summary of Application

Section 6.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 6.3 of the AP1000 DCD, Revision 19. Section 6.3 of the DCD includes Section 6.3.2.2.7, "IRWST and Containment Recirculation Screens"; Section 6.3.8.1, "Containment Cleanliness Program"; and Section 6.3.8.2, "Verification of Water Sources for Long-Term Recirculation Cooling Following a LOCA."

In addition, in VEGP COL FSAR Section 6.3.8.1, the applicant provided the following:

AP1000 COL Information Items

- STD COL 6.3-1

The applicant provided additional information in STD COL 6.3-1 to address COL Information Item 6.3-1 identified in AP1000 DCD Table 1.8-2, "Summary of AP1000 Standard Plant Combined License Information Items." STD COL 6.3-1 requires the applicant to develop a containment cleanliness program to limit the amount of debris that might be left in the containment following refueling and maintenance outages.

Section 1.9 of the VEGP COL FSAR incorporates by reference Section 1.9, "Compliance With Regulatory Criteria," of the AP1000 DCD. Section 1.9 of the DCD includes Section 1.9.4.2.3, "New Generic Issues," and Section 1.9.5.5, "Operational Experience."

In addition, in VEGP COL FSAR Section 1.9, the applicant provided the following information related to the effect of debris accumulation on long-term cooling:

- STD COL 1.9-3

The applicant provided additional information in STD COL 1.9-3 to address the review of GSI-191.

- STD COL 1.9-2

The applicant provided additional information in STD COL 1.9-2 to address the review of Bulletin 03-01 and GL 04-02.

6.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In conducting its review of STD COL 6.3-1, the NRC staff used the guidance and staff positions of RG 1.82, Revision 3, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," and NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, Volume 1, as supplemented by the NRC in the "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02," in NEI 04-07, Revision 0, Volume 2.

6.3.4 Technical Evaluation

The NRC staff reviewed Section 6.3 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the passive core cooling system. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 6.3-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 6.3.4 of the BLN SER:

> *AP1000 COL Information Items*
>
> - *STD COL 6.3-1*
>
> *The applicant provided additional information in STD COL 6.3-1 to address COL Action Item 6.2.1.8.1-1 identified in NUREG-1793 and COL Information Item 6.3-1 identified in Table 1.8-2 of the AP1000 DCD. The applicant added information to BLN COL FSAR Section 6.3.8.1, "Containment Cleanliness Program," providing details of the program and procedures to minimize the amount of debris that might be left in containment following refueling and maintenance outages, including requirements for cleanliness inspections and limits on materials introduced into containment. TVA states that the cleanliness program will be consistent with the evaluation discussed in the AP1000 DCD.*

In its June 9, 2009, response to RAI 6.2.2-1, the applicant addressed the changes made to Revision 17 of the AP1000 DCD in APP-GW-GLE-002 and staff questions on cleanliness measurements with a modification to STD COL 6.3-1. This included adding that the cleanliness program will meet the DCD limits on latent debris, that housekeeping procedures will be implemented to return work areas to original conditions upon completion of work, and that a sampling program will be used to quantify the amount of latent debris. The sampling program is stated to be consistent with NEI 04-07 Volumes 1 (guidance report) and 2 (NRC safety evaluation). The sampling will be done after containment exit cleanliness inspections, prior to start up, and the results will be evaluated post-start up. Any non-conforming results will be addressed in the Corrective Action Program.

The resulting cleanliness program is consistent with the RG 1.82 recommendation that procedures be in place to regularly clean the containment and to control and remove foreign materials from containment. The sampling program included in STD COL 6.3-1 is required to demonstrate that the latent debris found in containment is within the AP1000 DCD specified limits of 130 pounds, of which, up to 6.6 pounds may be fibrous material. The DCD specified limits were demonstrated to be acceptable through scale testing and analysis. Thus, STD COL 6.3-1 is consistent with the RG 1.82 recommendation that the cleanliness program be correlated to the amount of debris used in the long term cooling analysis. It is appropriate that the sampling program be in accordance with NEI 04-07, Volumes 1 and 2, because these documents contain the most recent NRC-approved evaluation methodology for cleanliness programs. The response to RAI 6.2.2-1 is acceptable and incorporation of the changes to STD COL 6.3-1 in the BLN FSAR will be tracked as ***Confirmatory Item 6.3-1****.*

The staff reviewed the following information in the BLN COL FSAR as it relates to the effect of debris accumulation on long term cooling:

- *STD COL 1.9-3*

The applicant added information to Section 1.9.4.2.3, "New Generic Issues," regarding Issue 191. The applicant states that the design aspects are addressed by the AP1000 DCD and the COL applicant portions are the protective coatings program discussed in BLN COL FSAR Section 6.1.2.1.6 and the containment cleanliness program discussed in BLN COL FSAR Section 6.3.8.1. The staff agrees that these are the only two COL items identified in the staff's review of GSI-191 from Section 6.2.1.8 of NUREG-1793.

- *STD COL 1.9-2*

The applicant added line items for Bulletin 03-01 and GL 04-02 in Table 1.9-204, "Generic Communications Assessment." The new information states that the design aspects are addressed in the AP1000 DCD and that the COL applicant aspects are addressed in BLN COL FSAR Section 6.3 for Bulletin 03-01 and BLN COL FSAR Section 6.3.8.1 for GL 04-02. The staff agrees that the design aspects of these generic communications are addressed in the staff's review of

GSI-191 from Section 6.2.1.8 of NUREG-1793. The COL applicant aspects are addressed in the staff's review of BLN COL FSAR Section 6.1.2.1.6 and BLN COL FSAR Section 6.3.8.1.

Resolution of Standard Content Confirmatory Item 6.3-1

Confirmatory Item 6.3-1 required the applicant to update its FSAR to include the information related to the cleanliness program provided in the BLN applicant's above-mentioned June 9, 2009, response to RAI 6.2.2-1 (which was endorsed by the VEGP applicant). The NRC staff verified that the VEGP COL FSAR was appropriately updated with this information. As a result, Confirmatory Item 6.3-1 is resolved.

6.3.5 Post Combined License Activities

There are no post-COL activities related to this section.

6.3.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the passive containment cleanliness program, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the regulatory requirements and guidance discussed in Section 6.3.3 of this SER. The staff based its conclusion on the following:

- STD COL 6.3-1 is acceptable because the containment cleanliness program complies with the guidance in RG 1.82.

- STD COL 1.9-3, related to GSI-191, is acceptable because the only two items that need to be addressed by the COL applicant have been resolved. The protective coatings program is evaluated in SER Section 6.1.2, and the containment cleanliness program is evaluated under STD COL 6.3-1.

- STD COL 1.9-2, related to Bulletin 03-01 and GL 04-02, is acceptable because the only two items that need to be addressed by the COL applicant have been resolved. The protective coatings program is evaluated in SER Section 6.1.2, and the containment cleanliness program is evaluated under STD COL 6.3-1.

6.4 Habitability Systems

6.4.1 Introduction

The design and operation of a set of systems provide habitability functions for the AP1000 design. These systems include the nuclear island non-radioactive ventilation system (VBS), the main control room (MCR) emergency habitability system (VES), the radiation monitoring system (RMS), the plant lighting system (ELS), and the fire protection system (FPS).

6.4.2 Summary of Application

Section 6.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 6.4 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 6.4, the applicant provided the following:

AP1000 COL Information Items

- STD COL 6.4-1

The applicant provided a list of onsite chemicals in VEGP COL FSAR Table 6.4-201 to supplement the list of chemicals identified in Table 6.4-1 of the AP1000 DCD. The chemicals in Table 6.4-201 associated with STD COL 6.4-1 (as annotated in the left margin) include: hydrogen (both in a gas and liquid form), nitrogen, carbon dioxide, hydrazine, morpholine, sulfuric acid, sodium hydroxide, fuel oil, sodium molybdate, sodium hexametaphosphate, sodium hypochlorite and ammonium comp polyethoxylate. In a letter dated June 17, 2010, the applicant proposed modifications to the FSAR regarding the storage of standard and plant-specific chemicals described under STD COL 6.4-1 and VEGP COL 6.4-1. In a letter dated July 3, 2010, the applicant proposed modifications to the FSAR related to the size and stated location of the liquid hydrogen storage tank.

- STD COL 6.4-2

The applicant provided additional information in STD COL 6.4-2 to address COL Information Item 6.4-2 regarding the procedures and training for control room (CR) habitability pursuant to the resolution of GSI-83, “Control Room Habitability.”

- VEGP COL 6.4-1

The applicant provided VEGP COL 6.4-1 to address COL Information Item 6.4-1. The local toxic gas services are evaluated to determine the need for monitoring for CR habitability In a letter dated June 17, 2010, the applicant proposed modifications to the FSAR regarding the storage of standard and plant-specific chemicals described under STD COL 6.4-1 and VEGP COL 6.4-1.

- VEGP COL 9.4-1b

The applicant referred to VEGP COL FSAR Section 2.2.3 and VEGP ESP SSAR Section 2.2.3 for the evaluation of site-specific onsite chemicals.

Supplemental Information

- STD SUP 6.4-1

The applicant provided supplemental information in STD SUP 6.4-1 to address CR doses for accident analyses in the downwind unit of a dual unit site.

- VEGP SUP 6.4-2

The applicant supplemented DCD Section 6.4.4 by stating that the hazard due to the effects of a design basis accident (DBA) from Units 1 and 2 is discussed in Section 2.2.3.4 of the VEGP Early Site Permit (ESP) Application Site Safety Analysis Report (SSAR), Revision 5.

- STD SUP 6.4-3

The applicant provided a list of onsite chemicals in VEGP COL FSAR Table 6.4-201 to supplement the list of chemicals identified in Table 6.4-1 of the DCD. In a letter dated June 17, 2010, the applicant combined the chemicals listed individually under STD SUP 6.4-3 and STD COL 6.4-1 in Table 6.4-201 into one list of chemicals under STD COL 6.4-1 and deleted the left margin annotations for STD SUP 6.4-3. STD SUP 6.4-3 no longer appears in the FSAR and, consequently, the staff did not prepare a separate evaluation of STD SUP 6.4-3 in this SER.

6.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for habitability systems are given in Section 6.4 of NUREG-0800.

MCR habitability is addressed in the following regulations and guidance:

- GDC 4, “Environmental and Dynamic Effects Design Bases,” as it relates to SSCs important to safety being designed to accommodate the effects of and to be compatible with the environmental conditions associated with postulated accidents.

- GDC 5, “Sharing of Structures, Systems and Components,” as it relates to ensuring that sharing among nuclear power units of SSCs important to safety will not significantly impair the ability to perform safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining unit(s).

- GDC 19, “Control Room,” as it relates to maintaining the nuclear power unit in a safe condition under accident conditions and providing adequate radiation protection.

- 10 CFR 50.34(f)(2)(xxviii), as it relates to evaluations and design provisions to preclude certain MCR habitability problems.

- 10 CFR 52.80(a), which requires that a COL application address the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act, and the NRC's regulations.

- Three Mile Island (TMI) Action Plan, Item III.D.3.4, “Control Room Habitability.”

- RG 1.78, “Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release,” Revision 1.

- RG 1.52, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post Accident Engineered Safety Feature Atmosphere Cleanup Systems in Light Water Cooled Nuclear Power Plants,” Revision 3, June 2001.

- RG 1.196, “Control Room Habitability at Light Water Nuclear Power Reactors,” May 2003.

6.4.4 Technical Evaluation

The NRC staff reviewed Section 6.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff’s review confirmed that the information in the application and incorporated by reference addresses the required information relating to habitability systems. The results of the NRC staff’s evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff’s findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR, except for the evaluation of STD SUP 6.4-2 and STD COL 6.4-1. For these two items, the staff compared the BLN COL FSAR, Revision 2 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 6.4-2) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

AP1000 COL Information Items

- STD COL 6.4-1

The following portion of this technical evaluation section is reproduced from Section 6.4.4 of the BLN SER. The staff notes that Table 6.4-202 in the BLN FSAR, Revision 2, is equivalent to Table 6.4-201 in the VEGP COL FSAR. Information in the BLN COL FSAR having a left margin annotation STD SUP 6.4-2 was assigned a left margin annotation of STD SUP 6.4-3 in the VEGP COL FSAR, and revisions proposed by the applicant, described below, combined the information from STD SUP 6.4-3 and STD COL 6.4-1 under a single left margin annotation of STD COL 6.4-1. Therefore, the evaluation of STD COL 6.4-1 in this SER includes references to material identified as STD SUP 6.4-2 in the BLN COL FSAR.

- *STD SUP 6.4-2*

STD SUP 6.4-2 provides the chemical names, state of the chemical, quantity and location of the chemicals. The chemicals include: hydrogen (both in a gas and liquid form), hydrazine, morpholine, sulfuric acid, sodium hydroxide, fuel oil, sodium molybdate (molybdic acid, disodium salt), sodium hexametaphosphate, and sodium hypochlorite.

Subsequent to the issuance of Section 2.2.3 of this report, the staff reviewed the applicant's inventory of chemicals contained in STD SUP 6.4-2 for threats to CR habitability. The staff has determined, with the exception of hydrazine, that the STD SUP 6.4-2 chemicals do not warrant additional analysis for CR habitability because they do not exceed the immediate danger to life and health (IDLH) limit at ground level at the location of the CR.

Regarding hydrazine, a further analysis with the HABIT computer code (RG 1.78) confirms that the hydrazine may exceed the IDLH limit at ground level. However, additional analysis shows that the hydrazine concentrations at the CR intake and inside the CR will not exceed the IDLH limit when crediting the design of the CR ventilation intake located at the auxiliary building (57 ft. above ground), calculations show concentrations much less than the IDLH limit. These results are based on a temperature of 25 °C and a wind speed of 1 m/sec, with meteorology F class, which are the conditions used by the applicant and RG 1.78. Hence, it is determined that the hydrazine listed in STD SUP 6.4-2 will not pose a threat to CR habitability.

AP1000 COL Information Items

- *STD COL 6.4-1*

STD COL 6.4-1 information also provides the chemical names, state of the chemical, quantity and location of the chemicals. The chemicals include: nitrogen, carbon dioxide, and ammonium comp polyethoxylate.

Subsequent to the issuance of Section 2.2.3 of this report, the staff reviewed the applicant's inventory of chemicals listed in STD COL 6.4-1, and screened out the toxic chemicals that do not pose a threat to CR habitability. The staff has determined that with the exception of carbon dioxide the STD COL 6.4-1

chemicals do not warrant additional analysis because they do not exceed the IDLH limit at ground level at the location of the CR.

Regarding carbon dioxide, analysis with the HABIT computer code (RG 1.78) finds that carbon dioxide will not exceed the IDLH limit at ground level. This analysis is based on a temperature of 25 °C and a wind speed of 1 m/sec, with meteorology F class, which are the conditions used by the applicant and RG 1.78. Hence, it is determined that the carbon dioxide contained in STD COL 6.4-1 will not pose a threat to CR habitability.

The staff notes that the chemical analysis relied on by the COL applicant includes assumptions associated with design features, such as the intake location for the CR ventilation system. In RAI 6.4-8, the staff asked if any of the analyses of the chemicals in Table 6.4-202 credit design features, such as an elevated CR intake, to keep the chemical concentration in the CR below the IDLH levels, in which case a description of the design features credited in the safety analyses should be provided in the FSAR. This is ***Open Item 6.4-1****.*

Resolution of Standard Content Open Item 6.4-1

In a letter dated June 17, 2010, the applicant proposed modifications to Table 6.4-201 in the VEGP COL FSAR to address Open Item 6.4-1. The proposed modifications included addition of a column entitled "MCR Habitability Impact Evaluation" to the table that indicated when design features were considered in the impact evaluation, including either the MCR intake height or other design details beyond the intake height. The staff determined that the modifications sufficiently described the design assumptions considered by the applicant, and Open Item 6.4-1 is resolved. The incorporation of this modification to Table 6.4-201 into a future revision of the VEGP COL FSAR is being tracked as **Confirmatory Item 6.4-1.**

Resolution of Standard Content Confirmatory Item 6.4-1

Confirmatory Item 6.4-1 is an applicant commitment to revise its FSAR Table 6.4-201 to add a column entitled "MCR Habitability Impact Evaluation" that will indicate when design features are considered in the impact evaluation, including either the MCR intake height or other design details beyond the intake height. The staff verified that VEGP COL FSAR Table 6.4-201 was appropriately revised. As a result, Confirmatory Item 6.4-1 is now closed.

Evaluation of Additional Revisions to STD COL 6.4-1

In the letter dated June 17, 2010, the applicant proposed additional voluntary revisions to Table 6.4-201 in the VEGP COL FSAR regarding the storage of standard chemicals described under STD COL 6.4-1. The proposed revisions included changes to the chemical quantities, evaluated distances, and storage locations, as well as changes to the table organization, column headings, and table notes. The proposed revisions also included combining the chemicals listed under separately STD COL 6.4-1 and STD SUP 6.4-3 under a single left margin annotation of STD COL 6.4-1, thereby eliminating STD SUP 6.4-3.

In a letter dated July 30, 2010, the applicant proposed additional revisions to STD COL 6.4-1 related to the evaluated maximum quantity and location of the liquid hydrogen storage tank.

On April 14 and June 7, 2010, the NRC staff audited the applicant's proprietary calculation notes, APP-VES-M3C-006, entitled "Main Control Room Emergency Habitability from Toxic Chemical Effluents," Revision 0 and Revision 1 to verify the information supporting STD COL 6.4-1 and VEGP COL FSAR Table 6.4-201. As a result of these audits, the staff issued RAI 6.4-5. The applicant subsequently prepared calculation notes APP-PGS-M3C-011, entitled "AP1000 Gas Spill or Release Effects on Control Room Habitability," Revision 0 and Revision 1 that were audited by the staff on July 26 and August 23, 2010. In a letter dated September 3, 2010, the applicant proposed the following changes to the FSAR and provided the following additional information about calculated concentrations of chemicals that would occur at the MCR intake to address RAI 6.4-5:

- Proposed to change the evaluated minimum distance between the MCR and the storage locations for liquid hydrogen, nitrogen, and carbon dioxide.

- For hydrogen, nitrogen, and carbon dioxide, proposed to indicate that MCR design details were considered in evaluating the potential impact to the MCR.

- Proposed to clarify that the MCR design details considered included MCR volume, envelope boundaries, ventilation systems, and occupancy factor.

- Provided information about how the analysis considered the effect of wind speeds less than 1 meter (m)/second.

- Provided information about concentrations occurring at the MCR intake more than two minutes after a potential release occurs.

- For hydrogen, nitrogen, and carbon dioxide, provided information about concentrations occurring at the MCR intake when no building wake effects are considered.

- For carbon dioxide, provided information about concentrations occurring in the MCR based on a corrected conservative value for the MCR outside air exchange rate.

In the evaluation presented in Section 2.2.3 of this SER, the staff reviewed the applicant's revised chemical inventory information listed in STD COL 6.4-1, and screened out the toxic chemicals that do not pose a threat to MCR habitability. The staff determined that, with the exception of hydrazine and carbon dioxide, the STD COL 6.4-1 chemicals do not warrant additional analysis for MCR habitability because they would not exceed the IDLH limit at ground level below the MCR ventilation intake. Hydrazine and carbon dioxide are evaluated below.

Regarding hydrazine, the NRC staff used the HABIT computer code (as referenced in RG 1.78) to confirm that hydrazine concentration may exceed the IDLH limit at ground level below the MCR intake. The staff then conducted an additional analysis showing that the hydrazine concentration at the MCR intake and inside the MCR would not exceed the IDLH limit when crediting the design of the MCR ventilation intake located at the auxiliary building (which is located 17.37 m (57 feet (ft)) above ground). The applicant annotated "IH" in VEGP COL FSAR Table 6.4-201 to indicate that the credit of MCR ventilation intake height had been taken in the safety analysis.

Regarding carbon dioxide, the NRC staff has used the HABIT computer code to confirm that the carbon dioxide concentration may exceed the IDLH limit at the MCR intake. The staff then conducted an additional analysis showing that the carbon dioxide concentration inside the MCR would remain below the IDLH limit.

Based on the FSAR revisions proposed and additional information provided by the applicant and the confirmatory analyses performed by the staff, the staff determined that the hydrazine and carbon dioxide would not pose a threat to MCR habitability, and RAI 6.4-5 is closed.

The incorporation of the revisions to STD COL 6.4-1 Table 6.4-201 into a future revision of the VEGP COL FSAR, as proposed in letters from the applicant dated June 17, July 30, and September 3, 2010, is being tracked as **Confirmatory Item 6.4-2**.

Resolution of Standard Content Confirmatory Item 6.4-2

Confirmatory Item 6.4-2 is an applicant commitment to revise its FSAR Table 6.4-201 to revise information related to standard chemicals. The staff verified that VEGP COL FSAR Table 6.4-201 was appropriately revised. As a result, Confirmatory Item 6.4-2 is now closed.

The following portion of this technical evaluation section is reproduced from Section 6.4.4 of the BLN SER:

- *STD COL 6.4-2*

The NRC staff reviewed STD COL 6.4-2, related to COL Information Item 6.4-2 and COL Action Item 6.4-1, included under Section 6.4.3 of the BLN COL FSAR. The applicant stated that procedures and training for CR habitability are written in accordance with Section 13.5 for CR operating procedures, and Section 13.2 for operator training. In Section 6.4.3 of the FSAR, the applicant states that the procedures and training will be verified to be consistent with the intent of GSI-83.

However, the level of detail provided in the standard portion of BLN COL FSAR Section 6.4.3 is not adequate to determine if the regulatory requirements are met. As a result, the staff issued RAI 6.4-7, which asked the applicant to provide in the FSAR the essential elements of the training and procedures necessary to demonstrate that the regulatory requirements are met. The staff questioned what the operators would be directed and trained to do to meet the recommendations in RG 1.196. Specifically, in RAI 6.4-7, the staff requested information addressing the following:

- *RG 1.78, Regulatory Position C.5, "Emergency Planning"*
- *RG 1.196, Regulatory Position 2.5, "Hazardous Chemicals"*
- *RG 1.196, Regulatory Position 2.2.1, "Comparison of System Design, Configuration, and Operation with the Licensing Basis"*

- *RG 1.196, Regulatory Position 2.7.1, "Periodic Evaluations and Maintenance"*

The resolution of RAI 6.4-7 is identified as ***Open Item 6.4-2****.*

Resolution of Standard Content Open Item 6.4-2

The BLN response to RAI 6.4-7 dated January 5, 2010, stated that the operational aspects of the identified guidance had been met as documented in BLN COL FSAR Appendix 1AA. The BLN applicant's response also stated that the additional information would be provided in a future revision to BLN COL FSAR Section 6.4.3, addressing how procedures, testing, and training related to CR habitability would be consistent with the above stated regulatory positions in RG 1.78 and RG 1.196. The VEGP applicant endorsed the BLN response to RAI 6.4-7 in a letter dated June 17, 2010, and committed to appropriately update Section 6.4.3 of the VEGP COL FSAR. Therefore, Standard Content Open Item 6.4-2 is resolved for the VEGP application, and the incorporation of the proposed revision to Section 6.4.3 of the VEGP COL FSAR is being tracked as **Confirmatory Item 6.4-3**.

Resolution of Standard Content Confirmatory Item 6.4-3

Confirmatory Item 6.4-3 is an applicant commitment to revise its FSAR Section 6.4.3 to include information regarding procedures, testing and training related to CR habitability. The staff verified that VEGP COL FSAR Section 6.4.3 was appropriately revised. As a result, Confirmatory Item 6.4-3 is now closed.

- VEGP COL 6.4-1

The NRC staff reviewed VEGP COL 6.4-1, related to COL Information Item 6.4-1 included under Section 6.4.4 of the VEGP COL FSAR. As part of VEGP COL 6.4-1, Table 6.4-201 of the VEGP COL FSAR provides information on the chemical names, physical states, quantities, and locations for VEGP site-specific impact evaluations. VEGP COL 6.4-1 also provides information on the evaluated minimum distance between the chemical storage location and the MCR.

In a letter dated June 17, 2010, the applicant proposed modifications to Table 6.4-201 in the VEGP COL FSAR regarding the storage of site specific onsite chemicals described under VEGP COL 6.4-1. The proposed modifications included changes to the evaluated distances; changes to the table organization, column headings, and table notes; and inclusion of an additional column that addressed how the evaluation of MCR habitability impacts for each chemical was performed.

In the evaluation presented in Section 2.2.3 of this SER, the staff reviewed the applicant's inventory of chemicals in VEGP COL 6.4-1, and screened out the toxic chemicals that do not pose a threat to MCR habitability. The staff determined that, with the exception of methoxypropylamine (MPA) and ammonium bisulfate, the VEGP COL 6.4-1 chemicals do not warrant additional analysis for MCR habitability because their concentrations would not exceed the IDLH limit at ground level at the intake of the MCR.

In response to RAIs 6.4-2 and 6.4-3, on March 5, 2010, the applicant provided additional information on the physical properties of MPA and ammonium bisulfate. The applicant also provided information on the input values of variables used to model the concentrations of MPA and ammonium bisulfate resulting from releases of these compounds and increased the input value used for the MCR air exchange rate.

On April 14, 2010, the NRC staff audited the applicant's calculation notes, SNC no. SV0-SSAR-XNC-2002, Revision 1, to verify VEGP COL 6.4-1 information in VEGP COL FSAR Table 6.4-201. In addition, the staff performed a confirmatory analysis using the HABIT computer code and concluded that the MPA and ammonium bisulfite concentrations at the MCR intake and inside the MCR would not exceed the IDLH limits when crediting the design of the MCR ventilation intake located at the auxiliary building (17.37 m [57 ft] above ground). Based on the audit and confirmatory analysis, the staff determined that the MPA and ammonium bisulfite listed in VEGP COL 6.4-1 would not pose a threat to MCR habitability. Therefore, RAI 6.4-2 is closed.

In its March 5, 2010, response to RAI 6.4-3 (issued on February 5, 2010), the applicant proposed revisions to VEGP COL FSAR Section 2.2.3.2.3.1, which analyzes a case of a hydrazine release from a 6,644 gallon tank located near VEGP Units 1 and 2. The staff performed a confirmatory analysis using the HABIT computer code and concluded that the hydrazine concentrations at the MCR intake would remain below the IDLH limit. As a result, RAI 6.4-3 is closed. The incorporation of the applicant's proposed revisions into a future version of the FSAR is being tracked as Confirmatory Item 2.2-1.

Resolution of VEGP Site-specific Confirmatory Item 2.2-1

Confirmatory Item 2.2-1 is an applicant commitment to revise its FSAR Section 2.2.3.2.3.1 to include information about the consequences from the potential release from a hydrazine tank located near VEGP Units 1 and 2. The staff verified that VEGP COL FSAR Section 2.2.3.2.3.1 was appropriately revised. As a result, Confirmatory Item 2.2-1 is now closed.

- VEGP COL 9.4-1b

The applicant referred to VEGP COL FSAR Section 2.2.3 and VEGP ESP SSAR Section 2.2.3 for the evaluation of site-specific onsite chemicals. The staff has already reviewed Section 2.2.3 of the VEGP ESP SSAR and found the information included therein to be acceptable as documented in NUREG-1923, "Safety Evaluation Report for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant (VEGP) ESP Site." Section 2.2.3 of this SER includes the remainder of the review for site-specific onsite chemicals. The staff concluded that the information in VEGP ESP SSAR Section 2.2.3 and in Section 2.2.3 of this SER to be sufficient to resolve this COL item.

Supplemental Information

The following portion of this technical evaluation section is reproduced from Section 6.4.4 of the BLN SER:

- *STD SUP 6.4-1*

The NRC staff reviewed STD SUP 6.4-1 related to the evaluation of CR doses in the other unit of a dual unit plant included under Section 6.4.4 of the BLN COL

FSAR. The staff concludes that STD SUP 6.4-1 is acceptable because the dose to the CR operators at an adjacent AP1000 due to a radiological release from another unit is bounded by the dose to CR operators on the affected unit. Further, simultaneous accidents at multiple units at a common site are not considered to be a credible event, unless there is a reliance on shared systems between the two units. This is not the case for the AP1000 design. STD SUP 6.4-1 is also evaluated by the NRC staff in SER Section 15.9, "Radiological Consequences of Accidents."

Clarification of Statement in the Standard Content Evaluation Text

The NRC staff identified a statement in the text reproduced above from Section 6.4.4 of the BLN SER that requires clarification for the VEGP COL application. The BLN SER states that STD SUP 6.4-1 is also evaluated by the NRC staff in SER Section 15.9, "Radiological Consequences of Accidents." For this SER, the entire review of STD SUP 6.4-1 appears in this SER section.

- VEGP SUP 6.4-2

The applicant supplemented DCD Section 6.4.4 by stating that the hazard due to the effects of a DBA from Units 1 and 2 is discussed in Section 2.2.3.4 of the VEGP ESP SSAR. The staff has already reviewed Section 2.2.3.4 of the VEGP ESP SSAR and found the information included therein to be acceptable as documented in NUREG-1923. The staff concludes that the information in VEGP ESP SSAR Section 2.2.3.4 is sufficient to satisfy the requirements of VEGP SUP 6.4-2. Hence, the NRC staff considers this SUP item resolved.

6.4.5 Post Combined License Activities

For the reasons discussed in the technical evaluation above, the following FSAR commitment is identified as the responsibility of the licensee:

- FSAR Commitment 6.4-1. The licensee's CR operator training program shall address the following:
    - Regulatory Position C.5, "Emergency Planning," of RG 1.78
    - Regulatory Position 2.5, "Hazardous Chemicals," of RG 1.196
    - Regulatory Position 2.2.1, "Comparison of System Design, Configuration, and Operation with Licensing Basis," of RG 1.196
    - Regulatory Position 2.7.1, "Periodic Evaluations and Maintenance," of RG 1.196

6.4.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to MCR habitability, and there is no outstanding information expected to be addressed in the VEGP COL

FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the information presented in the VEGP COL FSAR is acceptable because it meets the acceptance criteria associated with the relevant requirements of the Commission regulations for habitability systems given in Section 6.4 of NUREG-0800. The staff based its conclusions on the following:

- STD COL 6.4-1 is acceptable because the chemicals do not exceed the IDLH limit at ground level at the intake of the MCR, using the regulatory guidance in RG 1.78.

- STD COL 6.4-2 is acceptable because the procedures, testing and training related to MCR habitability will be consistent with the stated regulatory positions in RG 1.78 and RG 1.196.

- VEGP COL 6.4-1 is acceptable because the plant-specific chemicals do not exceed the IDLH limit at the intake of the MCR, using the regulatory guidance in RG 1.78.

- VEGP COL 9.4-1b is acceptable based on the NRC staff evaluation of site-specific onsite chemicals as documented in NUREG-1923.

- STD SUP 6.4-1 is acceptable because the dose to the MCR operators at an adjacent AP1000 due to a radiological release from another unit is bounded by the dose to MCR operators on the affected unit, using the regulatory guidance in Section 6.4 of NUREG-0800.

- VEGP SUP 6.4-2 is acceptable based on the NRC staff evaluation of the hazard due to the effects of a DBA from Units 1 and 2 as documented in NUREG-1923.

6.5 Fission Product Removal and Control Systems

In the event of a design basis LOCA there is an assumed core degradation that results in a significant release of radioactivity to the containment atmosphere. This activity would consist of noble gases, particulates, and a small amount of elemental and organic iodine. Fission product removal and control systems are considered to be those systems for which credit is taken in reducing accidental release of fission products. The AP1000 design has no active system to control fission products in the containment following a postulated accident. The fission product control system is the primary containment. AP1000 DCD, Appendix 15B, "Removal of Airborne Activity from the Containment Atmosphere Following a LOCA," discusses satisfactory removal of airborne activity (elemental iodine and particulates) from the containment atmosphere by natural removal processes (e.g., deposition and sedimentation) without the use of containment spray.

Section 6.5 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 6.5 of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue

related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

6.6 Inservice Inspection of Class 2, 3, and MC Components (Related to RG 1.206, Section C.III.1, Chapter 6, C.I.6.6, "Inservice Inspection of Class 2 and 3 Components")

6.6.1 Introduction

Inservice inspection (ISI) programs must meet requirements of 10 CFR 50.55a, "Codes and Standards," in which Section XI of the ASME Boiler and Pressure Vessel Code (ASME Code) is incorporated by reference. This section addresses the ISI of ASME Code Class 2 and 3 components. ASME Code Class 2 and 3 components must meet the applicable inspection requirements set forth in Subsections IWC and IWD of Section XI of the ASME Code, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components." Subsection IWC and IWD also include requirements for preservice examinations prior to initial plant startup as provided in Subarticles IWC-2200 and IWD-2200.

6.6.2 Summary of Application

Section 6.6 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 6.6 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 6.6, the applicant provided the following:

AP1000 COL Information Items

- STD COL 6.6-1

The applicant provided additional information in STD COL 6.6-1 to address COL Information Item 6.6-1. The information relates to plant-specific preservice inspection (PSI) and ISI programs.

- STD COL 6.6-2

The applicant provided additional information in STD COL 6.6-2 to address COL Information Item 6.6-2. The information relates to preservation of component accessibility design considerations during the construction phase.

Supplemental Information

- STD SUP 6.6-1

The applicant provided supplemental information to add additional text to AP1000 DCD Section 6.6.1. The information relates to the design stage consideration of component accessibility to enable the performance of ISI examinations.

License Condition

- Part 10, License Condition 6

This proposed license condition states that the COL holder shall provide an operational (PSI/ISI) program schedule to support NRC inspections.

6.6.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for ISI of Class 2 and 3 components are given in Section 6.6 of NUREG-0800.

The applicable regulatory requirements for acceptance of the resolution of COL information items and supplementary information on ISI and testing of Class 2 and 3 components are established in GDC 45, "Inspection of Cooling Water System," found in 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," as it relates to periodic inspection of important components, such as heat exchangers and piping to assure the integrity and capability of the system.

The applicable policy for acceptance of COL information items, as it relates to fully describing an operational program, is found in SECY-05-0197.

6.6.4 Technical Evaluation

The NRC staff reviewed Section 6.6 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the ISI of Class 2 and 3 components. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no confirmatory or open items related to the standard content in the BLN SER.

The following portion of this technical evaluation section is reproduced from Section 6.6.4 of the BLN SER:

AP1000 COL Information Items

- *STD COL 6.6-1*

In Section 6.6 of the NRC staff FSER (NUREG-1793, dated September 2004), the staff concluded that the AP1000 ISI program for ASME Code Class 2 and 3 components is acceptable and meets the requirements of 10 CFR 50.55a with regard to the preservice and inservice inspectability of these components. The specific version of the ASME Code, Section XI used as the baseline Code in the AP1000 certified design, is the 1998 Edition up to and including the 2000 Addenda. It should be noted that the staff did not identify any portions of the AP1000 ISI program for Class 1, 2 and 3 components that were excluded from the scope of the staff's review of the AP1000 DC (as the staff did for inservice testing of valves in AP1000 FSER Section 3.9.6.4). Therefore, the staff's conclusions regarding the acceptability of the AP1000 ISI program based on the 1998 Edition up to and including the 2000 Addenda of the ASME Code, Section XI with regard to preservice and inservice inspectability of Class 2 and 3 components remains unchanged. The staff's evaluation of the operational program aspects of the ASME Code Class 2 and 3 ISI program is addressed with Class 1 ISI in Section 5.2.4 of this SER. The review of the COL applicant's supplemental information also includes the adequacy of the ISI program for reactor containment (Class MC). In Revision 17 of the AP1000 DCD, Class MC components were added to the DCD, Section 6.6, as being within the scope of the ISI Program. The COL applicant incorporated DCD Section 6.6 in its entirety under Revision 1 of its FSAR. Accordingly, the staff's evaluation of this section focused on the acceptability of the COL applicant's supplemental information and responses to AP1000 COL information items and action items as they relate to ISI of ASME Code Class 2, 3, and MC components.

As part of STD COL 6.6-1, the COL applicant added to the end of DCD Section 6.6.2 words to state that the initial ISI program will incorporate the latest Edition and Addenda of the ASME Code (Section XI) approved in 10 CFR 50.55a(b) on the date 12 months before initial fuel load. The COL applicant stated that successive 120-month inspection intervals must comply with the requirements of the latest Edition and Addenda of the Code incorporated by reference in 10 CFR 50.55a(b) 12 months before the start of the 120-month interval, subject to the limitations and modifications listed in 10 CFR 50.55a(b). The requirements in 10 CFR 50.55a(g) state that inservice examinations of components and system pressure tests conducted during the initial 120-month inspection interval must comply with the requirements in the latest Edition and Addenda of the Code incorporated by reference in paragraph (b) of

10 CFR 50.55a on the date 12 months before the date scheduled for initial loading of fuel under a COL under 10 CFR Part 52. The staff concludes that the supplemental information provided by the COL applicant meets the NRC's regulations and is, therefore, acceptable.

As part of STD COL 6.6-1, the COL applicant added to the end of DCD Section 6.6.1 words to state that Class 2 and 3 components are included in the equipment designation list contained in the ISI program. The requirements in 10 CFR 50.55a(g)(3)(ii) state, in part, that Class 2 and 3 components be designed and provided with access to enable the performance of ISI examinations. In addition, the inclusion of Class 2 and 3 components is consistent with the requirements of an ISI program as defined under ASME Section XI, and is, therefore, acceptable. The staff concludes that the supplemental information provided by the COL applicant meets the NRC's regulations and is, therefore, acceptable.

In Section 6.6 of the FSER (NUREG-1793), the staff identified COL Action Item 6.6-1 in which the COL applicant will prepare a PSI program and an ISI program for ASME Code, Class 2 and 3 systems, components and supports. The PSI and ISI programs will address the equipment and techniques used. As part of STD COL 6.6-1, the COL applicant describes the use of visual, surface, ultrasonic, alternative examination techniques, and the use of automated equipment to perform the examinations. The COL applicant referenced the relevant portions of the ASME Code, Section XI to describe the nondestructive examination techniques and alternative examinations. The COL applicant also added information to describe the 120-month inspection interval as defined by IWB-2400 for Inspection Program B and the evaluation of examination results as defined by the ASME Code, Section XI, paragraphs IWC-, IWD-, IWE-, or IWF-3400 acceptance criteria. In addition, the COL applicant appropriately referenced 10 CFR 50.55a(b)(2)(xix) and IWA-2240 as described in the 1997 Addenda of the ASME Code, Section XI when applying alternative examination provisions. The supplemental information provided by the COL applicant meets the requirements in 10 CFR 50.55a, the ASME Code, Section XI, and the guidelines in RG 1.206, Section C.III.1, Chapter 6, C.I.6.6.3, and is, therefore, acceptable. Based on the discussion above, the staff concludes that the supplemental information under STD COL 6.6-1 is acceptable.

- *STD COL 6.6-2*

As part of STD COL 6.6-2, the COL applicant states that during the construction phase of the project, anomalies and construction issues are addressed using change control procedures. Modifications reviewed following DC will adhere to the same level of review as the certified design, thus, control of accessibility is maintained during post-DC activities. Control of accessibility for inspectability and testing during post-DC activities is provided via procedures for design control and plant modifications. In the NRC staff's FSER (NUREG-1793), the staff identified COL Action Item 6.6-2, which recommends COL applicants referencing the AP1000 certified design address the controls to preserve accessibility and inspectability for ASME Code, Section III, Class 2 and 3 components and piping during construction or other post-DC activities. The NRC staff reviewed the applicant's proposed resolution of COL Action Item 6.6-2 using NUREG-0800,

Section 6.6. The staff finds that the accessibility needed to perform PSI/ISI examinations is maintained during the design, construction and operational phases, which satisfies NUREG-0800, Section 6.6 recommendations for accessibility. In addition, the supplemental information meets the regulations under 10 CFR 50.55a(g)(3)(ii), which requires that Class 1, 2, and 3 components be designed and provided with access that enables the performance of ISI examinations, and the requirements under ASME Code, Section XI, IWA-1500. Based on the discussion above, the staff concludes that STD COL 6.6-2 is acceptable.

Supplemental Information

- *STD SUP 6.6-1*

As part of STD SUP 6.6-1, the COL applicant added supplemental information to the AP1000 DCD, Section 6.6.2, to address accessibility of Class 2, 3, and Class MC pressure retaining components to permit preservice and inservice examinations. Factors considered, such as examination requirements, techniques, accessibility, geometry, and material selections, are used in establishing the designs with the goals being to eliminate uninspectable components, reduce occupational radiation exposure, reduce inspection times, allow state-of-the-art inspection systems, and enhance detection and the reliability of flaw characterization.

The requirements in 10 CFR 50.55a(g)(3)(ii) state, in part, that Class 2 and 3 components be designed and provided with access to enable the performance of ISI examinations. ASME Code, Section XI, IWA-1500 requires that access be provided to enable the performance of ISI examinations, along with design considerations to render ISI practical. The staff finds that the supplemental information under STD SUP 6.6-1 meets the requirements of 10 CFR 50.55a and ASME Code, Section XI, and is, therefore, acceptable.

License Condition

- *Part 10, License Condition 6*

The COL applicant proposed a license condition for BLN for all operational programs requiring that the licensee shall submit to the appropriate Director of the NRC a schedule, no later than 12 months after issuance of the COL, that supports planning for and conduct of NRC inspections of operational programs. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational program has been implemented or the plant has been placed into commercial service. A separate license condition for PSI and ISI program implementation requirements is not necessary in the BLN COL FSAR since it is a requirement under 10 CFR 50.55a. However, submittal of the schedule for the PSI and ISI program development is necessary to plan for and conduct NRC inspections during construction. The staff finds that this schedule will enable the staff to adequately plan and schedule inspections of the PSI and ISI programs during the construction phase. This proposed license condition is consistent with the policy established in SECY-05-0197, and is acceptable.

6.6.5 Post Combined License Activities

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license condition associated with the PSI and ISI programs:

- License Condition (6-3) - No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspections of the PSI and ISI programs. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the PSI and ISI programs have been fully implemented or the plant has been placed in commercial service, whichever comes first.

6.6.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to ISI of ASME Code Class 2 and 3 components, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of GDC 45 and 10 CFR 50.55a. The staff based its conclusion on the following:

- STD COL 6.6-1 is acceptable because the staff concluded that the applicant's AP1000 ISI program for ASME Code Class 2, 3, and MC components is acceptable and meets the requirements of 10 CFR 50.55a with regard to the preservice and inservice inspectability of these components.

- STD COL 6.6-2 is acceptable because the staff concluded that the accessibility needed to perform PSI/ISI examinations is maintained during the design, construction and operational phases, and satisfies NUREG-0800, Section 6.6 acceptance criteria for accessibility.

- STD SUP 6.6-1 is acceptable because the staff concluded that accessibility to perform ISI examinations would be incorporated into the design, and satisfies the regulations under 10 CFR 50.55a(g)(3)(ii).

7.0 INSTRUMENTATION AND CONTROLS

Nuclear power plant instrumentation senses various plant parameters and transmits appropriate signals to the control systems during normal operation and to the reactor trip and engineered safety feature systems during abnormal and accident conditions. The information provided in this chapter emphasizes those instruments and associated equipment that constitute the protection and safety systems.

7.1 Introduction

7.1.1 Introduction

Westinghouse (WEC) proposed to revise the AP1000 Design Control Document (DCD) to address final setpoint calculations for protective functions. These proposed changes to the DCD impact the AP1000 combined license (COL) applications.

7.1.2 Summary of Application

Section 7.1 of the Vogtle Electric Generating Plant (VEGP) COL Final Safety Analysis Report (FSAR), Revision 5 incorporates by reference Section 7.1 of the AP1000 DCD, Revision 19. The advanced safety evaluation (ASE) with confirmatory items for Section 7.1 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse created a new COL Information Item (COL 7.1-1). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, the applicant proposed the following:

AP1000 COL Information Item

- STD COL 7.1-1

In a letter dated March 8, 2010, WEC proposed to revise the AP1000 DCD by adding COL Information Item 7.1-1 to address final setpoint calculations. In a letter dated June 4, 2010, the applicant proposed a revision to the VEGP COL FSAR by adding Standard (STD) COL 7.1-1, "Setpoint Calculations for Protective Functions" to reflect the above.

7.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for Instrumentation and Controls are in Section 7.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)."

The applicable regulatory requirements for the information being reviewed in this section are:

- Title 10 of the *Code of Federal Regulations* (10 CFR) 50.36, "Technical specifications"
- 10 CFR 52.79(a)(30)

7.1.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Section 7.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[22] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to safety-related display information. The results of the NRC staff's evaluation of information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The applicant, in its letter dated May 21, 2010, proposed to incorporate the Setpoint Program (SP) that will be added to the AP1000 DCD into the VEGP Technical Specifications (TS). This proposal was made to address Open Item 16.1-1. In Chapter 16 of this safety evaluation report (SER), the staff concludes that the response to Open Item 16.1-1 is acceptable. The incorporation of this program into the VEGP TS in a later revision is being tracked as **Confirmatory Item 16.1-1**. The closure of this confirmatory item is provided in SER Section 16.1.

In addition, in a letter dated June 4, 2010, the applicant proposed adding STD COL 7.1-1 as a new COL information item addressed in the VEGP COL FSAR.

AP1000 COL Information Item

- STD COL 7.1-1

The applicant proposed adding a new line item to VEGP COL FSAR Table 1.8-202 to address COL Information Item 7.1-1. The applicant also proposed the following addition to VEGP COL FSAR Section 7.1:

> 7.1.6.1 Setpoint Calculations for Protective Functions
>
> The Setpoint Program described in Technical Specifications Section 5.5 provides the appropriate controls for update of the instrumentation setpoints following completion of the calculation of setpoints for protective functions and the reconciliation of the setpoints against the final design.

The applicant states that the TS program identified in the proposed Section 7.1.6.1 was that addressed in the VEGP revised response to Bellefonte Nuclear Plant (BLN) Open Item 16.1-1, dated May 21, 2010, and that the calculation and reconciliation of the setpoints discussed is required by the AP1000 Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) included in AP1000 DCD Tier 1, Table 2.5.2-8, Item 10. In Chapter 16 of this SER, the staff concludes that the May 21, 2010, response to BLN Open Item 16.1-1 is acceptable.

[22] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification (DC).

Based on the ITAAC in Table 2.5.2-8, Item 10 and the TS controls in Section 5.5, the staff finds there are adequate controls for updating the instrumentation and controls (I&C) setpoints. Therefore, the staff finds STD COL 7.1-1 acceptable. The incorporation of the changes associated with proposed STD COL 7.1-1 into a future revision of the VEGP COL FSAR is **Confirmatory Item 7.1-1**.

Resolution of Standard Content Confirmatory Item 7.1-1

Confirmatory Item 7.1-1 is an applicant commitment to revise its FSAR Table 1.8-202 and Section 7.1 to address COL Information Item STD COL 7.1-1. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 7.1-1 is now closed.

7.1.5 Post Combined License Activities

There are no post-COL activities related to this section.

7.1.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to setpoint calculations for protective functions, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff has compared the application to the relevant NRC regulations and other NRC regulatory guides and concludes that the applicant is in compliance with the NRC regulations. The staff based its conclusion on the following:

- STD COL 7.1-1, the applicant provided a program for setpoint calculations for protective functions in accordance with the requirements of 10 CFR 50.36 and 10 CFR 52.79(a)(30).

7.2 Reactor Trip

Section 7.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 7.2, "Reactor Trip," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

7.3 Engineered Safety Features

Section 7.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 7.3, "Engineered Safety Features," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there

is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In request for additional information (RAI) 1-4, issued to the applicant for the BLN, Units 3 and 4, the staff questioned how the applicant would verify that the as-built I&C system configuration conformed to schematics. In its response to RAI 1-4, the BLN applicant indicated that it or a designee would verify I&C cabinets as-built against the design drawings during manufacturing and would functionally test each system. In addition, the BLN applicant's response indicated that the I&C cabinets would be tested during preoperational testing and in accordance with several ITAAC related to the I&C system. The BLN response to RAI 1-4 was endorsed as standard for VEGP by Southern Nuclear Operating Company (SNC) in its letter dated December 17, 2008.

The staff notes that vendor qualification testing, which may be done offsite, and preoperational testing fall under the applicant's quality assurance program. Any anomalies found during the testing or any problems identified from the time the testing is complete until the components are installed at the site would be corrected in accordance with the applicant's quality assurance program. The staff finds the verification of the as-built I&C system configuration against schematics using a combination of vendor and onsite testing that falls under the applicant's quality assurance program acceptable. In addition, the staff finds that adequate program controls exist to ensure that once the testing was complete, the I&C system configuration would be maintained as valid throughout the life of the plant. Based on the above, the staff finds the response to BLN RAI 1-4 and the SNC endorsement of that response acceptable.

7.4 Systems Required for Safe Shutdown

Section 7.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 7.4, "Systems Required for Safe Shutdown," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

7.5 Safety-Related Display Information (Related to RG 1.206, Section C.III.1, Chapter 7, C.1.7.5, "Information Systems Important to Safety")

7.5.1 Introduction

Safety-related display information includes equipment that processes safety-related information and displays it for use by the operator to monitor and maintain the safety of the AP1000 throughout operating conditions that include anticipated operational occurrences and accident and post-accident conditions.

7.5.2 Summary of Application

Section 7.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 7.5 of the AP1000 DCD, Revision 19. The ASE with confirmatory items for Section 7.5 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the

NRC, Westinghouse created a new COL Information Item (COL 7.5-1). This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Section 7.5, the applicant provided the following:

Supplemental Information

- VEGP SUP 7.5-1

The applicant provided additional information in VEGP COL FSAR Section 7.5, "Safety-Related Display Information," describing the FSAR Table 7.5-201 supplement (SUP) to DCD Table 7.5-1 and providing variable data shown in the DCD table as "site specific."

The applicant also provided additional information in VEGP COL FSAR Section 7.5, describing the FSAR Table 7.5-202 supplement to DCD Table 7.5-8 and providing variable data shown in DCD Table 7.5-8 as "site specific."

In addition, the applicant provided the following:

AP1000 Information Items

- STD COL 7.5-1
- VEGP COL 7.5-1

In a letter dated May 26, 2010, in response to DCD Open Item OI-SRP7.5-ICE-01, WEC proposed to revise the AP1000 DCD adding COL Information Item 7.5-1 for site-specific post accident monitoring variables. In a letter dated July 6, 2010, the applicant proposed a revision to VEGP COL FSAR by replacing VEGP SUP 7.5-1 with STD COL 7.5-1 and VEGP COL 7.5-1 to reflect the above.

7.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the information systems important to safety are in Section 7.5 of NUREG-0800.

The applicable regulatory requirements, guidelines, and related acceptance criteria for the supplemental information item are as follows:

- General Design Criterion (GDC) 13, "Instrumentation and Control"
- GDC 64, "Monitoring Radioactivity Releases"

The regulatory bases require, in part, that instrumentation be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to ensure adequate safety. Monitoring should include checking the plant environs for radioactivity that may be released from postulated accidents.

7.5.4 Technical Evaluation

The NRC staff reviewed Section 7.5 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to safety-related display information. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 7.5-1 (Replaced by VEGP COL 7.5-1 and STD COL 7.5-1)

The AP1000 DCD references and commits to Regulatory Guide (RG) 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Revision 3, as the method of complying with GDC 13 and GDC 64.

Appendix 1AA of VEGP COL FSAR, Revision 2, takes exception to Revision 4 of RG 1.97. The applicant, instead, states conformance to Revision 3 of RG 1.97. The applicant states, "Portable equipment outside the DCD scope conforms to Revision 3 of this Regulatory Guide for consistency with DCD scope since Revision 4 indicates that partial implementation is not advised." The staff discusses the acceptability of Revision 3 of RG 1.97 in Section 12.1 of this SER.

Revision 3 of RG 1.97 states that the variable and range information should be provided for environs radiation and radioactivity, and meteorological instrumentation.

The staff issued RAI 7.5-1 requesting information on boundary environs radiation and meteorological instrumentation. The staff finds that the range of the boundary environs radiation instruments is necessary to ensure that the instruments are adequate for monitoring radioactivity that may be released from a postulated accident. The applicant provided a supplemental response to RAI 7.5-1 with sufficient meteorological range and accuracy information for wind direction, wind speed, and differential temperature. In addition, the revised VEGP COL FSAR Table 7.5-201 included the boundary environs radiation variable and the required range information for the post-accident monitoring system. The supplemental information conforms to the guidance of Revision 3 of RG 1.97. The staff confirmed that the VEGP COL FSAR was updated to incorporate the instrumentation supplemental information. The staff finds the response acceptable and considers RAI 7.5-1 closed.

In a letter dated May 26, 2010, WEC proposed a change to the AP1000 DCD to add COL Information Item 7.5-1 requiring that COL applicants provide information for variables listed as "site specific" in DCD Tables 7.5-1 and 7.5-8. Although this information was provided for VEGP as part of VEGP SUP 7.5-1 and incorporated in the VEGP COL FSAR, the identification of COL Information Item 7.5-1 in the DCD required that the applicant address this information with a COL identifier rather than as supplemental information. Accordingly, the applicant's letter dated July 6, 2010, proposes to replace VEGP SUP 7.5-1 with STD COL 7.5-1 (for standard information) and VEGP COL 7.5-1 (for VEGP-specific information). This change of identifiers

does not impact the staff's conclusion regarding the instrumentation information added to the VEGP COL FSAR. The incorporation of the changed identifiers into the VEGP COL FSAR is **Confirmatory Item 7.5-1**.

Resolution of Standard Content Confirmatory Item 7.5-1

Confirmatory Item 7.5-1 is an applicant commitment to revise its FSAR Tables 1.8-202, 1.8-205 and Sections 7.5.2 and 7.5.3.5 to address COL Information Item STD COL 7.5-1. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 7.5-1 is now closed.

7.5.5 Post Combined License Activities

There are no post-COL activities related to this section.

7.5.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to safety-related display information, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff has compared the application to the relevant NRC regulations and other NRC RGs and concludes that the applicant is in compliance with the NRC regulations. The applicant has satisfactorily addressed the guidance of Revision 3 of RG 1.97 through the response to RAI 7.5-1. The staff based its conclusion on the following:

- In VEGP SUP 7.5-1 (replaced by VEGP COL 7.5-1 and STD COL 7.5-1), the applicant provided sufficient information regarding the safety-related display information, and, is, therefore, acceptable in accordance with the requirements of 10 CFR Part 50, Appendix A, GDC 13 and GDC 64.

7.6 Interlock Systems Important to Safety

Section 7.6 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 7.6, "Interlock Systems Important to Safety," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

7.7 Control and Instrumentation Systems (Related to RG 1.206, Section C.III.1, Chapter 7, C.I.7.7, "Control Systems Not Required for Safety")

Section 7.7 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 7.7, "Control and Instrumentation Systems," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review

confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

8.0 ELECTRIC POWER

The electric power system is the source of power for station auxiliaries during normal operation and for the reactor protection system and engineered safety features during abnormal and accident conditions. This chapter provides information on the functional adequacy of the offsite power systems and safety-related onsite electric power systems, as applicable to the AP1000 passive design, and ensures that these systems have adequate capacity, capability, redundancy, independence, and testability in conformance with the current criteria established by the U.S. Nuclear Regulatory Commission (NRC).

8.1 Introduction

8.1.1 Introduction

This section provides the applicant's description of the offsite power system with regard to the interrelationships between the nuclear unit, the utility grid, and the interconnecting grids.

In addition, this section includes a regulatory requirements applicability matrix that lists all design bases, criteria, regulatory guides (RGs), standards, and other documents to be implemented in the design of the electrical systems that are beyond the scope of the design certification (DC).

8.1.2 Summary of Application

Section 8.1 of the Vogtle Electric Generating Plant (VEGP) combined license (COL) Final Safety Analysis Report (FSAR), Revision 5, incorporates by reference Section 8.1 of the AP1000 Design Control Document (DCD), Revision 19.

In addition, in VEGP COL FSAR Section 8.1, the applicant provided the following:

Supplemental Information

- VEGP SUP 8.1-1

The applicant provided supplemental (SUP) information in VEGP COL FSAR Section 8.1, "Introduction," describing the Southern Nuclear Operating Company (SNC), the Southern Balancing Authority Area (SBAA) transmission grid, and the connection interfaces with VEGP Unit 3 via the Units 1, 2, and 3, 230/500 kilovolt (kV) switchyard and with VEGP Unit 4 via the Unit 4, 500kV switchyard at the plant site.

- VEGP SUP 8.1-2

The applicant provided supplemental information in VEGP COL FSAR Section 8.1 describing additional information for regulatory guidelines and standards.

8.1.3 Regulatory Basis

The regulatory basis for the information incorporated by reference is addressed in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the introduction to the electric power systems are given in Section 8.1 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)."

The applicable regulatory requirements, guidelines, and related acceptance criteria for the supplemental information items are as follows:

- Title 10 of the *Code of Federal Regulations* (10 CFR) 50.63, "Loss of all alternating current power"

- RG 1.155, "Station Blackout"

- RG 1.206, "Combined License Applications for Nuclear Power Plants (Light-Water Reactor (LWR) Edition)"

8.1.4 Technical Evaluation

The NRC staff reviewed Section 8.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[23] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the introduction to the electric power systems. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the following information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 8.1-1

The NRC staff reviewed the supplemental information related to the SBAA transmission system and its connection to VEGP included under VEGP SUP 8.1-1. The applicant's supplement to Section 8.1.1 is summarized as follows:

> VEGP is interconnected to the SBAA transmission grid operated by Southern Company Transmission (SCT). The SBAA transmission grid interconnects hydro plants, fossil-fueled plants, and nuclear plants supplying electric energy over a transmission grid consisting of various voltages up to 500 kV. VEGP Units 1 and 2 and Plant Wilson, a six-unit oil-fueled combustion turbine facility owned by Georgia Power Company (GPC), are located on the VEGP site. VEGP Units 1 and 2 are two Westinghouse Electric Company, LLC (Westinghouse) pressurized water reactors (PWRs) that have been in commercial operation since 1987 and 1989, respectively. VEGP Units 3 and 4 are adjacent to and west of VEGP Units 1 and 2. SNC is the licensed operator of the

[23] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a DC.

nuclear facilities at the VEGP site, with control of the nuclear facilities, including complete authority to regulate any and all access and activity within the plant exclusion area boundary.

VEGP Unit 3 is connected to the Units 1, 2 and 3, 230/500 kV switchyard at the 230 kV level. The 230 kV and 500 kV levels of the Units 1, 2 and 3, 230/500 kV switchyard are arranged in a breaker-and-a-half configuration and are interconnected through two, 230/500 kV autotransformers. VEGP Unit 4 is connected to the Unit 4, 500 kV switchyard. This switchyard is also arranged in a breaker-and-a-half configuration. The Unit 4, 500 kV switchyard is connected to the 500 kV section of the Units 1, 2 and 3, 230/500 kV switchyard by overhead lines. Five, 230 kV and three, 500 kV transmission lines connect the VEGP high voltage switchyards to the remainder of the SBAA transmission grid.

The NRC staff finds that the applicant has adequately described the VEGP Units 3 and 4 connections to the utility grid and the information provided is in accordance with the recommendations of RG 1.206 and the guidance in Section 8.1 of NUREG-0800.

- VEGP SUP 8.1-2

The NRC staff also reviewed supplemental information included in VEGP SUP 8.1-2, related to regulatory guidelines and industry standards and found it to be consistent with Section 8.1 of NUREG-0800 with the exception of the information discussed below.

VEGP COL FSAR Table 8.1-201, 1b indicated that RG 1.155 is not applicable to VEGP. This item was deemed as standard among COL applications being discussed in Bellefonte's (BLN) response to request for additional information (RAI) 8.1-2. In this RAI, staff requested that the applicant identify local power sources and transmission paths that could be made available to resupply power to the plant following a loss of grid or station blackout (SBO). The RAI also asked the applicant to describe the procedures and training provided to the plant operators for a SBO event of the specified duration and recovery therefrom as recommended in the guide. In addition, the applicant was requested to provide the SBO procedures that include severe weather guidelines established for BLN. In a letter dated May 15, 2009, SNC stated that the BLN standard response to RAI 8.1-2 applies to the VEGP COL application with a clarification.

The standard response submitted for BLN in a letter dated June 24, 2008, is summarized as follows. The BLN applicant stated that AP1000 design meets the requirements of 10 CFR 50.63 for 72 hours and, therefore, no specific procedures or training specific to SBO are necessary. The NRC staff found the above response to be inconsistent with the recommendations of RG 1.155 and the requirements of 10 CFR 50.63. The staff recognizes that the passive systems can maintain safe-shutdown conditions after design-basis events for 72 hours, without operator action, following a loss of both onsite and offsite alternating current (ac) power sources. However, the applicant needs to establish SBO procedures and training for operators to include actions necessary to restore offsite power by addressing ac power restoration (e.g., coordination with transmission system load dispatcher), and severe weather guidance (e.g., identification of site-specific actions to prepare for the onset of severe weather, such as an impending tornado) in accordance with RG 1.155, Positions C.2 and C.3.4.

Several discussions were held between the NRC staff and the BLN applicant regarding this issue. Subsequently, in a letter dated April 15, 2009, the BLN applicant stated that the training and procedures to support mitigation of an SBO event would be implemented in accordance

with BLN COL FSAR Sections 13.2 and 13.5, respectively. As recommended by NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," which is endorsed by RG 1.155, the loss of all ac power event mitigation procedures will address response (e.g., restoration of onsite power sources), ac power restoration (e.g., coordination with transmission system load dispatcher), and severe weather guidance (e.g., identification of actions to prepare for the onset of severe weather, such as an impending tornado), as applicable. In addition, the BLN applicant stated that there are no nearby large power sources, such as a gas turbine or black start fossil fuel plant that can directly connect to the station to mitigate the event. This response was found acceptable by the NRC staff.

The clarification submitted along with the acceptance of the standard response is presented as follows. The last sentence of the third paragraph of the RAI response for BLN states: "In addition, there are no nearby large power sources, such as a gas turbine or black start fossil fuel plant that can directly connect to the station to mitigate the event," was not incorporated for VEGP because the VEGP site has a black start fossil fuel plant nearby. The applicant stated that the VEGP Units 3 and 4 FSAR will incorporate the standard FSAR changes in a future revision, with the following change: The fourth sentence of the first paragraph that reads: "In addition, there are no nearby large power sources, such as a gas turbine or black start fossil fuel plant, that can directly connect to the station to mitigate the event." will not be incorporated.

The NRC staff verified that VEGP COL FSAR Sections 1.9.5.1.5 and 1.9.6 have been updated to include the above-mentioned items. Also, the staff finds that the implementation of training and procedures to support mitigation of an SBO event satisfies RG 1.155, Positions C.2 and C.3.4. Based on the above, the NRC staff finds this item resolved.

8.1.5 Post Combined License Activities

There are no post-COL activities related to this section.

8.1.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the introduction to the electric power systems, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff has compared the additional COL-specific supplemental information in the application to the relevant NRC regulations; guidance in NUREG-0800, Section 8.1, and other NRC regulatory guides and concludes that the applicant is in compliance with the NRC regulations. The staff based its conclusion on the following:

- VEGP SUP 8.1-1, the applicant provided sufficient information regarding the SBAA transmission system and its connection to VEGP in accordance with the recommendations of RG 1.206.

- VEGP SUP 8.1-2, COL-specific regulatory guidelines and industry standards and additional new regulatory guidelines are adequately addressed by the applicant. In

conclusion, the applicant has provided sufficient information for satisfying the requirements of 10 CFR 50.63 and the guidance in RG 1.155.

8.2 Offsite Power System

8.2.1 Introduction

The offsite power system is referred to in industry standards and RGs as the "preferred power system." It includes two or more physically independent circuits capable of operating independently of the onsite standby power sources and encompasses the grid, transmission lines (overhead or underground), transmission line towers, transformers and other switchyard components.

The AP1000 design includes an exemption, in 10 CFR Part 52, "Licenses, certifications, and approvals for nuclear power plants," Appendix D, "Design Certification Rule for the AP1000 Design," paragraph V.B.3, to the requirement of General Design Criterion (GDC) 17, "Electric Power Systems," to have only one (not two) physically independent offsite circuit to provide for safety-related passive systems for core cooling and containment integrity. Therefore, for VEGP Units 3 and 4, the single offsite power source provided from the transmission network is reviewed below to assure that it satisfies the requirements of GDC 17 with respect to its capacity and capability.

8.2.2 Summary of Application

Section 8.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 8.2 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 8.2, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 8.2-1

The applicant provided additional information in VEGP COL 8.2-1 to address COL Information Item 8.2-1 (COL Action Items 8.2.3-1 and 8.2.3.3-1) to address the design of the ac power transmission system and its testing and inspection plan. The information describes: 1) the designs of the three plant site high voltage switchyards, the five 230 kV transmission lines connecting the Units 1, 2, and 3, 230/500 kV switchyard to various substations throughout the transmission grid, the three 500 kV transmission lines connecting the Units 1, 2 and 3, 230/500 kV switchyard and the Unit 4, 500 kV switchyard to other substations throughout the SBAA transmission grid; 2) the connections of the generator step-up (GSU) transformers and the reserve auxiliary transformers (RATs) to the switchyards; 3) the designs of the switchyard circuit breakers and disconnect switches; 4) the transformer area arrangement for each unit; 5) the designs of the GSU transformers, unit auxiliary transformers (UATs) and RATs; 6) the design of the control building for each of the high voltage switchyards; 7) the administrative control of the switchyard and transmission lines circuit breakers, 8) the switchyard and transmission lines testing and inspection plan, and 9) voltage operating range, frequency decay rate, and preservation of grid connection. VEGP COL 8.2-1 is addressed in VEGP COL FSAR Sections 8.2.1, 8.2.1.1, 8.2.1.2, 8.2.1.3, and 8.2.1.4.

- VEGP COL 8.2-2

The applicant provided additional information in VEGP COL 8.2-2 to address COL Information Item 8.2-2 (COL Action Items 8.2.3.1-1, 8.2.3.1-2, and 8.2.3.1-3), describing: 1) the switchyard arrangement and design of the protective relaying scheme; and 2) a transmission system study performed to verify grid stability, switchyard voltage, and frequency to confirm the transmission system capability to maintain reactor coolant pump (RCP) operation for three seconds following a turbine trip, as specified in AP1000 DCD Section 8.2.2. VEGP COL 8.2-2 is addressed in VEGP COL FSAR Sections 8.2.1.2.1 and 8.2.2.

Site-Specific Information Replacing Conceptual Design Information (CDI)

- VEGP CDI

The applicant provided site-specific information describing the transformer area located next to each unit's turbine building and containing the GSU transformer, the UATs, and the RATs. This replaced the CDI located in the AP1000 DCD.

Supplemental Information

- VEGP SUP 8.2-1

The applicant provided supplemental information describing details of a Failure Mode and Effects Analysis (FMEA) performed for the offsite power distribution system, plant site switchyards, and the transmission system. It also provided information on the transmission system operator (TSO), and the detailed voltage and other requirements to be maintained by the TSO.

- VEGP SUP 8.2-2

The applicant provided supplemental information describing the agreement between VEGP and SCT, which is the TSO, setting the requirements for transmission system studies and analyses.

- VEGP SUP 8.2-3

The applicant provided supplemental information describing SCT's responsibility for maintaining area bulk transmission system reliability and demonstrating, by power system simulation studies, projections, and analyses, the current and future reliability of the system. The applicant provided information on conducting planning studies on an ongoing basis, including information on updating the studies to assess future system performance.

- VEGP SUP 8.2-4

The applicant provided supplemental information describing the agreement between VEGP and SCT demonstrating that protocols are in place for VEGP to remain cognizant of grid vulnerabilities in order to make informed decisions regarding maintenance activities critical to the electric system. It also provided grid stability analysis results for events in addition to the turbine trip.

- VEGP SUP 8.2-5

The applicant provided supplemental information describing the reliability of the 230 kV and 500 kV transmission lines feeding the VEGP site for the period from January 1, 1992 to November 30, 2007.

- VEGP SUP 8.2-6

The applicant provided supplemental information stating that the protective devices controlling the switchyard breakers are set with consideration given to preserving the plant grid connection following a turbine trip.

Interface Requirements

The plant interfaces for the standard design of the AP1000 are discussed in DCD Tier 2, Section 8.2.5, and in items 8.1, 8.2, and 8.3 of DCD Tier 2, Table 1.8-1, where they are identified as "non-nuclear safety (NNS)" interfaces.

8.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the offsite power system are given in Sections 8.1 and 8.2 of NUREG-0800.

The regulatory bases for acceptance of the COL information and supplementary information items are established in:

- For VEGP COL 8.2-1 and VEGP SUP 8.2-1, the requirements of 10 CFR Part 50, Appendix A, GDC 17; GDC 18, "Inspection and Testing of Electrical Power Systems"; and the guidelines of RG 1.206.

- For VEGP COL 8.2-2, VEGP SUP 8.2-2, VEGP SUP 8.2-3, VEGP SUP 8.2-5 and VEGP SUP 8.2-6, the requirements of GDC 17 and the guidelines of RG 1.206.

- For VEGP SUP 8.2-4, the requirements of GDC 17, GDC 18, and 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," and the guidelines of Generic Letter (GL) 2006-2, "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power," and RG 1.206.

- For VEGP CDI, the requirements of GDC 17.

8.2.4 Technical Evaluation

The NRC staff reviewed Section 8.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the offsite power system. The results of the NRC staff's evaluation of the information

incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Items

- VEGP COL 8.2-1

The applicant provided additional information in VEGP COL 8.2-1 to resolve COL Information Item 8.2-1, which states:

> Combined License applicants referencing the AP1000 certified design will address the design of the ac power transmission system and its testing and inspection plan (DCD Section 8.2.5).

The commitment was also captured as COL Action Items 8.2.3-1 and 8.2.3.3-1 in Appendix F of NUREG-1793, which states:

> The operating voltage for the high side of the AP1000 transformer and transmission switchyard, as well as the frequency decay rate are site specific and, therefore, will be addressed in the COL application. The COL applicant will provide analysis of these matters, including transient stability, voltage operating range, and preservation of the grid connections, in the COL application. (COL Action Item 8.2.3-1)
>
> Combined License applicants referencing the AP1000 certified design will address the design of the ac power transmission system and its testing and inspection plan (COL Action Item 8.2.3.3-1).

The NRC staff reviewed the resolution to COL Information Item VEGP COL 8.2-1, related to the transmission system design, testing, and inspection addressed in Section 8.2 of the VEGP COL FSAR. The NRC staff's evaluation is described below.

VEGP Units 3 and 4 are served via three high-voltage switchyards located north of the facility. The three high-voltage switchyards are defined as follows:

- Units 1, 2 and 3, 230/500 kV switchyard
- Unit 4, 500 kV switchyard
- Units 3 and 4, RAT supply, 230 kV switchyard

The interconnection of the three switchyards, including the location of the GSUs and RATs, and the 230 kV and 500 kV transmission lines are described in Section 8.2.1 of the VEGP COL FSAR. VEGP Unit 3 is tied into the 230 kV transmission grid via the Units 1, 2 and 3, 230/500 kV switchyard. Unit 4 is tied into the 500 kV transmission grid via the Unit 4, 500 kV switchyard. The Units 3 and 4 RAT supply 230 kV switchyard consists of 4 breakers installed in a ring bus configuration.

VEGP Units 3 and 4 are supplied with offsite power from the SBAA 230 kV and 500 kV grid via two separate switchyard buses and backfed through the GSUs. The VEGP switchyards are

connected to eight transmission lines. No single transmission line is designated as the preferred circuit, but analysis shows that with any one of these transmission lines out of service, the transmission grid can supply the switchyard with sufficient power for the safety-related systems and other auxiliary loads for Units 3 and 4 during normal, abnormal, and accident conditions.

VEGP COL FSAR Figure 8.2-202 shows several line crossings in the vicinity of the plant. The NRC staff was concerned that during adverse weather conditions high winds could cause the loss of both the 500 kV and 230 kV lines to supply offsite power to Units 3 and 4. In RAI 8.2-13, the staff asked the applicant to perform an analysis of each crossing of lines and demonstrate that this vulnerability is acceptable for VEGP offsite power system designs for Units 3 and 4. In a letter dated January 7, 2010, the applicant provided the analysis of transmission line crossings within the area of the VEGP site. The applicant reported that:

> Sixteen line crossing locations were evaluated to demonstrate that offsite power would be available to both Unit 3 and Unit 4 from at least one of the three available offsite power supplies to each unit and to confirm that Units 1 and 2 would not be affected. A non-mechanistic failure was assumed for each of the 16 transmission lines (a line is considered to be any one of the three phases) allowing it to fall on the line or lines immediately below it, resulting in a fault on each of the associated lines. In three cases, the falling line was assumed to contact two lines below. In all, 13 separate cases of falling transmission lines were evaluated. No single failures of protective relaying or breakers were assumed in this evaluation. The evaluation demonstrated that, in each case, at least one offsite power supply remained available to both Unit 3 and Unit 4. In addition, there were no adverse effects to Unit 1 or Unit 2.

Attachments with supporting information were also provided. The applicant also committed to include a proposed revision of the FSAR. The NRC staff has reviewed the response and the proposed revision and concludes that the applicant's analysis demonstrates that at least one offsite power source will be available to both Units 3 and 4 under the above contingencies. The above satisfies the requirements of GDC 17 as it applies to AP1000 design; therefore the staff finds this issue is resolved subject to the verification that the FSAR has been updated to include the proposed revision. This is **Confirmatory Item 8.2-1**.

Resolution of VEGP Site-Specific Confirmatory Item 8.2-1

Confirmatory Item 8.2-1 is an applicant commitment to revise its FSAR Section 8.2.1.1 to reflect the applicant's analysis demonstrates that at least one offsite power source will be available to both Units 3 and 4 under adverse weather conditions. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 8.2-1 is now closed.

With regard to the maintenance and testing of the offsite power circuits, in RAI 8.2-7, the staff asked the applicant to clarify the extent of the word "observes" and to clarify if VEGP would follow North American Electric Reliability Corporation (NERC) reliability standards.

In a letter dated April 28, 2010, the applicant stated that this statement was intended to indicate that SCT follows the NERC standards for switchyard maintenance and testing. The NRC staff concludes that since the applicant would follow the NERC standard for switchyard maintenance and testing, this information satisfies the requirements of GDC 18 related to testing and is

acceptable. This issue is considered resolved subject to the verification that the FSAR has been updated to include the proposed clarification. This is **Confirmatory Item 8.2-2**.

Resolution of VEGP Site-Specific Confirmatory Item 8.2-2

Confirmatory Item 8.2-2 is an applicant commitment to revise its FSAR Section 8.2.1.4 to reflect the applicant's plans for switchyard maintenance and testing in accordance with the NERC standards. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 8.2-2 is now closed.

Additionally, the applicant provided the site-specific voltage and frequency variations expected at all VEGP switchyards during transient and steady state operating conditions and the site-specific frequency decay rate to satisfy VEGP COL 8.2-1.

- VEGP COL 8.2-2

The applicant provided additional information in VEGP COL 8.2-2 to resolve COL Information Item 8.2-2, which states:

> The Combined License applicant will address the technical interfaces listed in Table 1.8-1 and Section 8.2.2. These technical interfaces include those for ac power requirements from offsite and the analysis of the offsite transmission system and the setting of protective devices.

The NRC staff's evaluation of the technical interfaces is addressed in the "Interface Requirements" section of this safety evaluation report (SER).

The commitment was also captured as COL Action Items 8.2.3.1-1, 8.2.3.1-2, and 8.2.3.1-3 in Appendix F of NUREG-1793, which states:

> The COL applicant will perform a site-specific grid stability analysis to show that, with no electrical system failures, the grid will remain stable and the reactor coolant pump bus voltage will remain above the voltage necessary to maintain the flow assumed in the Chapter 15 analyses for a minimum of 3 seconds following a turbine trip. (COL Action Items 8.2.3.1-1 and 8.2.3.1-3)
>
> The COL applicant will set the protective devices controlling the switchyard breakers in such a way as to preserve the grid connection following a turbine trip. (COL Action Item 8.2.3.1-2)

The NRC staff reviewed the resolution to COL information item, VEGP COL 8.2-2, related to the transmission system stability analysis and switchyard circuit breaker protective device settings included under Section 8.2 of the VEGP COL FSAR. The NRC staff's evaluation follows.

VEGP COL FSAR Section 8.2.1.2.1 states that the switchyards are designed to provide high speed fault clearing while also maintaining high reliability and operational flexibility. The arrangement of the switchyards allows for isolation of components and buses, while preserving VEGP's connection to the grid. Under normal operating conditions all 230 kV and 500 kV circuit breakers and all bus sectionalizing motor operated disconnect switches are closed and all bus sections are energized. Each 230 kV and 500 kV transmission line is protected by two independent protection schemes (primary and secondary) to achieve high speed clearing for a

fault anywhere on the line and to provide remote back-up protection for remote faults. Each scheme has a pilot protection package and a stand alone step distance line protection package. The breaker failure scheme is initiated by either of the primary or secondary protection schemes and operates through a timing relay, and should a breaker fail to trip within the time setting of its timing relay, the associated breaker failure trip relay will trip and lock out all necessary breakers to isolate the faulted area. Based on the above, the staff concludes that the switchyard breaker arrangements, the protection of lines by two independent protection schemes, and the breaker failure scheme would preserve the VEGP's connection to the grid to satisfy the requirements of GDC 17. This satisfies COL Action Item 8.2.3.1-2.

With regard to the transmission system stability analysis, the applicant stated that the VEGP grid stability analysis confirms that the grid will remain stable and the reactor coolant pump bus voltage will remain above the voltage necessary to maintain the flow assumed in the Chapter 15 analyses for a minimum of 3 seconds following a turbine trip as specified in DCD Section 8.2.2 (COL Action Item 8.2.3.1-3). The staff determined that additional information was needed to conclude the technical evaluation of this item. In RAI 8.2-1, the staff asked the applicant to confirm that the single offsite power circuit complied with the requirements of GDC 17 to provide voltage and frequency variations at all switchyards. The applicant was also asked to confirm that these voltage and frequency limits are acceptable for auxiliary power system equipment operation and Class 1E battery chargers during different operating conditions. The confirmation should include the following calculations: load flow analysis (bus and load terminal voltages of the station auxiliary system); short circuit analysis; equipment sizing studies; protective relay setting and coordination; and motor starting with minimum and maximum grid voltage conditions. A separate set of calculations should be performed for each available connection to an offsite power supply. In addition, the applicant was asked to discuss how the results of the calculations will be verified before fuel loading.

In a letter dated January 16, 2009, the applicant stated that the results of grid stability studies performed for each available connection to an offsite power supply demonstrate the offsite power source capacity and capability to power plant components during normal, shutdown, startup and turbine trip conditions.

The applicant also stated that the 500 kV switchyard voltage was set to 517 kV (1.03 per unit [p.u.]) and the 230 kV voltage was set at 235 kV (1.02 p.u.). This is the anticipated voltage and is consistent with standard practice for grid studies at VEGP. For an AP1000 turbine trip event, adequate grid voltage is required for 3 seconds. The unit's electric generator will motor immediately following a turbine trip, providing mega volt amp reactives (MVARs) to support this voltage, and, therefore, the generator bus voltage remains relatively stable.

In addition, the applicant stated that the grid voltage evaluation results provided in the response are verified during the preoperational testing identified in AP1000 DCD Section 14.2.10, which includes the following tests:

- 100 Percent Load Rejection (DCD Section 14.2.10.4.21)
- Plant Trip from 100 Percent Power (DCD Section 14.2.10.4.24)
- Loss of Offsite Power (DCD Section 14.2.10.4.26)

In a revised response, dated October 23, 2009, the applicant stated that the conclusion that the voltage and frequency variations expected at all VEGP switchyards are acceptable for auxiliary power system equipment operation during steady-state and transient operating conditions is based on stability studies, which include the most critical contingencies, such as simulation of

turbine trip events, loss of the most critical transmission line, loss of the largest load and loss of the largest unit in the area.

The NRC staff has reviewed the above information and concludes that this information is sufficient to demonstrate that the grid will remain stable to maintain RCP operation for 3 seconds following a turbine trip. The NRC staff finds that the applicant has satisfied the portion of COL Information Item 8.2-2 to maintain the voltage at the RCP to ≥ 80 percent for at least 3 seconds following a turbine trip, to maintain the reactor coolant flow assumed in the Chapter 15 analyses.

In a public meeting with the Nustart Consortium on April 7, 2009, there was an agreement that portions of VEGP RAI 8.2-1 were not within the scope of the VEGP COL, but rather within the scope of the AP1000 DC. This is considered a standard item applicable to all COL applications including VEGP. Therefore, the staff finds that the relevant portions of RAI 8.2-1 are resolved.

In RAI 8.2-2, the staff asked the applicant to provide a discussion as to how a single offsite power circuit complied with GDCs 2, 4, 5, 17 and 18, as well as with guidance in NUREG-0800, Section 8.2.II, and how SNC intends to meet the requirements of 10 CFR 50.65.

In a letter dated January 16, 2009, the applicant stated that there is no portion of the single offsite circuit required to conform with GDC 2, 4, 5, and 18 and that these GDCs are for structures, systems, and components important to safety. The staff agrees that GDC 2 and 4 do not apply to the AP1000 design. However, based on the information provided in the applicant's letter of April 28, 2010, the NRC staff notes that the environmental effects are considered in the design of the offsite power circuit for VEGP. For example, conductors are designed to withstand a particular high temperature (normally 100°C) before violating sag clearances, and transmission lines are designed for high winds, typically 100 miles per hour (mph), and for appropriate levels of snow and ice. Additionally, transmission lines include overhead ground wires and, in an area with a history of lightning strikes or an area of high ground resistivity, have lightning arrestors installed. Based on the above, the staff finds this information is consistent with the recommendation of RG 1.206 with respect to the design of the switchyard components to withstand environmental conditions at the VEGP site.

With respect to GDC 5, the NRC staff concludes that because the offsite power system for VEGP Units 3 and 4 UATs is not shared among the units, the requirements of GDC 5 do not apply.

With respect to GDC 17, the NRC staff finds that the results of the grid stability analysis demonstrate the offsite source capacity and capability to power plant components during normal, shutdown, startup, and turbine trip conditions. The results of the failure modes and effects analysis demonstrate the reliability of the offsite source, which minimizes the likelihood of its failure under normal, abnormal and accident conditions. Therefore, the NRC staff concludes that the VEGP design meets the requirements of GDC 17, as it is applicable to the AP1000 design, and this item is resolved.

With regard to GDC 18, NUREG-1793, Section 8.2.3.2 identifies COL Action Item 8.2.3.3-1 to demonstrate that the testing and inspection capability of the offsite power system is in conformance with GDC 18; therefore, this interface item must also be satisfied by the applicant.

In a letter dated November 20, 2009, the applicant endorsed the standard content response provided in BLN RAI 8.2-10. The staff has verified that VEGP FSAR Section 8.3.1.4 has been

revised to include implementation of procedures for periodic verification of proper operation of the onsite ac power system capability for automatic and manual transfer from the preferred power supply to the maintenance power supply and return from the maintenance power supply to the preferred power supply. The above satisfies the requirements of GDC 18 and is, therefore, acceptable.

Based on the above, the staff considers the issue of applicability of GDC 5, 17, and 18 resolved.

With regard to 10 CFR 50.65, the applicant stated that VEGP COL FSAR Section 17.6 describes implementation of the requirements of 10 CFR 50.65. As indicated therein, implementation of the Nuclear Energy Institute (NEI) 07-02A, "Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52," program description will determine the applicability of the maintenance requirements for the offsite power circuit. NEI 07-02A provides a template for presenting this information that has also been endorsed by the staff in a letter to NEI, dated January 24, 2008. The NRC staff verified that the reference to this topical report is in VEGP COL FSAR Table 1.6-201. Since the scope of structures, systems, and components (SSCs) covered by the maintenance rule program is determined using the scoping procedures defined in the maintenance rule program description in accordance with NEI 07-02A, the offsite power system and its components then will be evaluated for inclusion into the maintenance rule program in accordance with these scoping procedures during program implementation. The NRC staff notes that NEI 07-02A, Section 17.X.1.5, "Risk assessment and risk management per 10 CFR 50.65(a)(4)," addresses risk assessment and risk management from maintenance activities in accordance with 10 CFR 50.65(a)(4), and includes consideration of the issues associated with grid/offsite power system reliability as identified in NRC GL 2006-02, Items 5 and 6. Therefore, although detailed maintenance risk assessment is not anticipated in advance of the schedule defined in Table 13.4-201 of the VEGP COL FSAR, performance of "grid-risk-sensitive" maintenance activities is considered to be a necessary consideration of the program in accordance with NEI 07-02A guidance. Based on the above, the NRC staff finds this item resolved.

In RAI 8.2-9, the staff asked the applicant that since the voltage at the high side of the GSU, and RAT cannot drop more than 15 percent from the pre-trip steady-state voltage as specified in Section 8.2.2 of the FSAR, describe if a voltage drop of 15 percent is the worst expected switchyard voltage.

In a letter dated January 16, 2009, the applicant stated that the worst expected voltage would be a 15 percent drop from the pre-trip steady-state voltage. However, the applicant's response to RAI 8.2-5 stated that after the loss of the largest unit in the area, the voltage would recover to a value well-within the Westinghouse requirement of +/- 20 percent for a transient event. The NRC staff concluded that the applicant needed to clarify what the actual worst expected switchyard voltage would be under any operating condition.

In a letter dated October 23, 2009, the applicant provided the required additional clarification. The applicant indicated that the steady-state and transient voltage requirements were provided by Westinghouse and these requirements are satisfied as follows:

- Under steady-state conditions (no line faults, load losses, transients, or unit trips), the minimum pre-trip scheduled switchyard voltages at the VEGP 230 kV and 500 kV switchyards are 235 kV and 517 kV. While maintaining the scheduled voltage, the

steady-state generator bus voltage is maintained within the Westinghouse requirement of 0.95 p.u. to 1.05 p.u.

- To ensure adequate voltage is maintained to the RCPs for 3 seconds following a turbine trip event, Westinghouse also requires that the voltage at the high side of the GSU transformer and RATs not drop more than 15 percent from the pre-trip steady-state voltage. A grid stability study for VEGP Units 3 and 4 was performed, which concluded that during a turbine trip event, the voltage at the high side of the GSU and RATs would drop a maximum of 5 percent on a transient basis and recover to an acceptable post-trip steady-state value. Therefore, the turbine trip event is well within the Westinghouse requirement.

- During transients, such as a loss of the most critical transmission line or fault on a transmission line, the Westinghouse requirement is to maintain the generator bus voltage within +/- 20 percent. The most significant transient was determined to be a fault on the West McIntosh 500 kV line. During this transient, after the fault clears (within approximately 6 cycles), generator bus voltage recovers to within 0.8 p.u. and returns to the pre-transient voltage within seconds, thereby reaching an acceptable steady state voltage level.

In summary, the applicant stated that only during short-term transient conditions does the generator bus voltage or switchyard voltage drop below the steady-state voltage stated above.

The NRC staff has reviewed the above information and finds that the applicant has satisfied the Westinghouse acceptance criteria to maintain the voltage at the RCP to ≥80 percent for at least 3 seconds following a turbine trip, to maintain the reactor coolant flow assumed in the Chapter 15 analyses. Therefore, the NRC staff finds the issues in RAI 8.2-9 are resolved. This satisfies COL Action Items 8.2.3.1-1 and 8.2.3.1-3.

Therefore, VEGP COL Information Item 8.2-2 is satisfied.

Submerged/Inaccessible Electrical Cables

In RAI 8.2-14, the staff asked the applicant to describe the inspection, testing and monitoring program to detect degradation of inaccessible or underground control and power cables that support equipment and other systems that are within the scope of 10 CFR 50.65. The description should include the frequency of testing and inspection. Guidance on the selection of electric cable condition monitoring can be found in Sections 3 and 4.5 of NUREG/CR-7000, "Essential Elements of an Electric Cable Condition Monitoring Program."

In a letter dated May 6, 2010, the applicant stated that the Maintenance Rule (MR) program will not be implemented until prior to fuel load; as such, specific information necessary to determine appropriate inspections, tests and monitoring is not available at this time. In order to determine the method and frequency, a review of detailed design and procurement information is needed. The applicant also stated that the latest industry experience and other available information, including NUREG/CR-7000, will be followed in developing a cable condition monitoring program as part of the MR program. The applicant also committed to revise its FSAR to include condition monitoring of underground or inaccessible cables in its MR program. The commitment will be reflected in the COL application Part 2, FSAR Chapter 17, Section 17.6 as shown below.

> Condition monitoring of underground or inaccessible cables is incorporated into the maintenance rule program. The cable condition monitoring program incorporates lessons learned from industry operating experience, addresses regulatory guidance, and utilizes information from detailed design and procurement documents to determine the appropriate inspections, tests and monitoring criteria for underground and inaccessible cables within the scope of the maintenance rule (i.e., 10 CFR 50.65). The program takes into consideration Generic Letter 2007-01.

Based on the above, the staff concludes that the applicant's condition monitoring program for underground or inaccessible cables satisfies the recommendations of GL 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," and the guidance in NUREG/CR-7000 and NUREG-0800 Section 8.2.III.1.L. Therefore, this item is resolved subject to the verification that the VEGP COL FSAR has been updated to include applicable portions of the RAI response. This is identified as **Confirmatory Item 8.2-3**.

Resolution of Standard Content Confirmatory Item 8.2-3

Confirmatory Item 8.2-3 is an applicant commitment to revise its FSAR Section 17.6 to address condition monitoring of underground or inaccessible cables. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 8.2-3 is now closed.

Supplemental Information

- VEGP SUP 8.2-1

VEGP SUP 8.2-1 was provided by the applicant describing details of a FMEA performed for the offsite power distribution system, plant site switchyard, and the SBAA transmission system. The NRC staff reviewed the applicant's FMEA and determined that a detailed description of each event evaluated in the FMEA is necessary to evaluate and determine that the offsite power to each unit is not lost. In RAI 8.2-4, the NRC staff asked the applicant to provide such detailed analysis for evaluation. In a letter dated January 16, 2009, the applicant provided details of the FMEA performed based on the design of the switchyard and the interconnecting transmission line. The staff evaluated the FMEA of the VEGP switchyard and agrees with the applicant that a single initiating event, such as a breaker not operating during a fault condition, a fault on a switchyard bus, a spurious relay trip, or a loss of control power supply would not cause failure of more than one single offsite transmission line, or a loss of offsite power to either VEGP Units 3 or 4 via the GSU. Based on the above, the NRC staff concludes that the information provided by the applicant satisfies the requirements of GDC 17 and the recommendation of RG 1.206. Therefore, this issue is resolved.

With regard to the information on the transmission system operator (TSO), the applicant provided the following:

SCT is the TSO within the SBAA and is responsible for the safe and reliable operation of the SBAA transmission grid. SCT and VEGP have an agreement and protocols in place to provide safe and reliable operation of the transmission grid and equipment at VEGP Units 3 and 4. Elements of this agreement are implemented in accordance with the procedures of both parties. The TSO establishes a voltage schedule for the 230 kV and 500 kV switchyards. VEGP Units 3 and 4, while generating, are expected to supply or absorb reactive power to help

regulate voltage in the 230 kV and 500 kV switchyards in accordance with TSO voltage schedule criteria. VEGP maintains switchyard voltage such that steady state voltage on the 26 kV generator terminals is within 0.95–1.05 p.u. of its nominal value. VEGP provides the TSO with a nuclear plant interface agreement that specifies the detailed voltage and other requirements necessary to ensure safe and reliable operation of VEGP. The minimum and maximum switchyard voltage at VEGP is maintained in accordance with this interface agreement. These voltage levels are maintained without any reactive power support from VEGP Units 3 and 4.

The NRC staff finds the above information to be consistent with the recommendations of RG 1.206 and acceptable.

VEGP SUP 8.2-2, VEGP SUP 8.2-3, and VEGP SUP 8.2-4

With regard to VEGP SUP 8.2-2, the applicant provided the following information:

> An agreement between VEGP and SCT sets the requirements for transmission grid studies and analyses. These analyses demonstrate the capability of the offsite power system to support plant start up and shutdown.

The staff finds the above information to be in accordance with RG 1.206 and acceptable.

With regard to VEGP SUP 8.2-3, the applicant provided the following information:

> SCT conducts planning studies of the transmission grid on an ongoing basis. Model data used to perform simulation studies of projected future conditions is maintained and updated as load forecasts and future generation/transmission changes evolve. Studies are updated periodically to assess future system performance in accordance with NERC Reliability Standards. These studies form a basis for identifying future transmission expansion needs.

The NRC staff has reviewed the information on conducting planning studies of the transmission grid on an ongoing basis and concludes that the information provided by the applicant satisfies the recommendations of RG 1.206 and is acceptable.

With regard to VEGP SUP 8.2-4, the applicant provided the following information:

> The agreement between VEGP and SCT demonstrates protocols are in place for the plant to remain cognizant of grid vulnerabilities so that they can make informed decisions regarding maintenance activities critical to the electrical system. As part of its operational responsibilities, the PCC [Power Coordination Center] continuously monitors real-time power flows and assesses contingency impacts through the use of a state-estimator tool. The PCC/GCC [Georgia Transmission Control Center] continuously monitors and evaluates grid reliability and switchyard voltages, and informs plant operations of any potential grid instability or voltage inadequacies. They also work to maintain local voltage requirements as required by VEGP. Operational planning studies are also performed using offline power flow study tools to assess near term operating conditions under varying load, generation, and transmission topology patterns. If a condition arises where the SBAA transmission grid cannot supply adequate offsite power, plant operators are notified and appropriate actions are taken.

> VEGP plant operations reviews input from the GCC/PCC to make informed decisions regarding plant activities that may affect plant reliability or impacts to the transmission grid. In addition, plant operators inform the PCC/GCC of changes in generation ramp rates and notify them of any developing problems that may impact generation.

With regard to grid stability analysis results for events in addition to turbine trip, the applicant stated:

> In addition to turbine trip, the grid stability analysis also considered normally cleared three-phase faults on the transmission system and three-phase faults followed by breaker failure at the VEGP 500 kV and 230 kV switchyards. A 500 kV line out for maintenance with a normally cleared fault on another 500 kV line was also studied. The results demonstrate that the grid remains stable for the loss of the most critical transmission line, the loss of the largest load, and the loss of the largest generating unit. For these contingencies, the generator bus voltages and switchyard voltages (after fault clearing) remain well within the required limits.
>
> The grid stability analysis confirmed that the interface requirements for steady state load, nominal voltage, allowable voltage regulation, nominal frequency, allowable frequency fluctuation, maximum frequency decay rate, and limiting under frequency value for RCP have been met.

The NRC staff has reviewed the information provided by the applicant on the functions of PSO/TSO who establishes a voltage schedule for the VEGP switchyards and also maintains switchyard voltage such that steady state voltage on the generator bus is within 0.95–1.05 p.u. of its nominal value. Based on its review, the NRC staff concludes that the applicant has demonstrated that protocols are in place for the VEGP to remain cognizant of grid vulnerabilities in order to make informed decisions regarding maintenance activities critical to the electric system. This is consistent with the recommendations of RG 1.206 and GL 2006-2, "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power," of which one of the provisions is to reduce the likelihood of losing offsite power.

- VEGP SUP 8.2-5

With regard to VEGP SUP 8.2-5 the applicant provided the average grid availability for the two transmission voltages from January 1, 1992 to November 30, 2007. The West McIntosh and Scherer 500 kV transmission lines for VEGP have an availability of 99.9 percent with 25 forced outages and the five 230 kV transmission lines for VEGP have an availability of 99.6 percent with 26 forced outages. The NRC staff finds that this information satisfies RG 1.206 and is acceptable.

- VEGP SUP 8.2-6

The applicant provided additional information in VEGP SUP 8.2-6 to resolve COL Information Item 8.2-2, which states:

> The Combined License applicant will address the technical interfaces listed in Table 1.8-1 and Section 8.2.2. These technical interfaces include those for ac

power requirements from offsite and the analysis of the offsite transmission system and the setting of protective devices.

The commitment was also captured as COL Action Items 8.2.3.1-2 in Appendix F of NUREG-1793, which states:

> The COL applicant will set the protective devices controlling the switchyard breakers in such a way as to preserve the grid connection following a turbine trip.

The NRC staff's evaluation of the resolution to COL information item, VEGP SUP 8.2-6, related to the transmission system stability analysis and switchyard circuit breaker protective device settings is addressed in the "Interface Requirements" section of this SER.

Site-Specific Information Replacing Conceptual Design Information (CDI)

- VEGP CDI

The CDI information provided by the applicant regarding the transformer area located next to each unit's turbine building is consistent with the AP1000 DCD and satisfies the applicable requirements of GDC 17

Interface Requirements

The plant interfaces for the standard design of the AP1000 are discussed in DCD Tier 2, Section 8.2.5, and in Items 8.1, 8.2, and 8.3 of DCD Tier 2, Table 1.8-1, where they are identified as 'non-nuclear safety (NNS)' interfaces.

The applicant incorporated by reference Section 1.8 of the DCD. This section of the DCD identifies certain interfaces with the standard design that have to be addressed in accordance with 10 CFR 52.47(a)(1)(vii).[24] As required by 10 CFR 52.79(d)(2), the COL application must demonstrate how these interface items have been met.

In order to satisfy plant Interface Item 8.1 in AP1000 DCD Tier 2, Table 1.8-1, the applicant provided the design criteria, RGs, and Institute of Electrical and Electronics Engineers (IEEE) standards in Section 8.1.4.3 of the VEGP COL FSAR. The NRC staff finds the information to be consistent with Section 8.1 of NUREG-0800 and acceptable. Therefore, this interface item for offsite power system has been met.

In order to satisfy plant Interface Item 8.2 in AP1000 DCD Tier 2, Table 1.8-1, the applicant provided the steady-state load, inrush kVA for motors, nominal voltage, allowable voltage regulation, nominal frequency, allowable frequency fluctuation, maximum frequency decay rate, and limiting under frequency values for RCP in Revision 2 of the VEGP COL FSAR. This information was included in Table 8.2-201, "Grid Stability Interface Evaluation," which confirms that the above interface items for RCPs have been met.

In order to satisfy plant Interface Item 8.3 in AP1000 DCD Tier 2, Table 1.8-1, the applicant did not provide a statement affirming that "the protective devices controlling the switchyard breakers are set with consideration given to preserving the plant grid connection following a turbine trip." In RAI 8.2-12, the staff asked the applicant to provide a reference to where this issue is

[24] Following the update to 10 CFR Part 52 (72 *Federal Register* [FR] 49517), this provision has changed to 10 CFR 52.47(a)(25).

discussed in the VEGP application, or to provide a proposed revision to the application to address the issue. In a letter dated August 31, 2009, the applicant stated that the SNC letter dated July 16, 2009, included a proposed revision to the FSAR and the addition of a new Table 1.8-205, titled "Summary of FSAR Discussions of AP1000 Plant Interfaces." Within this table, Interface Item 8.3 addresses the requirements for protective devices controlling the switchyard breakers and FSAR Sections 8.2.2 and 14.2.9.4.23 were identified as satisfying that portion of the interface. Additional changes to the FSAR were incorporated in Revision 2 as VEGP SUP 8.2-6 stating "The protective devices controlling the switchyard breakers are set with consideration given to preserving the plant grid connection following a turbine trip." The NRC staff concludes that the switchyard arrangement, the protection of lines by independent high speed relaying, and breaker failure would preserve the VEGP's connection to the grid following a turbine trip satisfying the requirements of GDC 17; therefore, the staff finds this interface has been met.

The NRC staff has reviewed the information supplied by the applicant and concludes that the applicant has adequately addressed Interface Items 8.1, 8.2, and 8.3 of AP1000 DCD Tier 2, Table 1.8-1.

8.2.5 Post Combined License Activities

There are no post-COL activities related to this section.

8.2.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the offsite power system, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of GDC 17 and GDC 18. The staff based its conclusion on the following:

- VEGP COL 8.2-1, the applicant provided sufficient information involving the design details of the plant site switchyard, its interface with the local transmission grid, protective device settings, and its testing and inspection plan in accordance with the guidelines of RG 1.206.

- VEGP COL 8.2-2, the applicant provided sufficient information to demonstrate that the grid will remain stable to maintain RCP operation for three seconds following a turbine trip in accordance with the guidelines of RG 1.206.

- VEGP CDI in Section 8.2.1 of the VEGP COL FSAR, the applicant provided sufficient information concerning the transformer area located next to each unit's turbine building in accordance with the guidelines of RG 1.206. VEGP SUP 8.2-1, the applicant provided sufficient information involving offsite power distribution system, plant site switchyard, and the VEGP transmission system in accordance with the guidelines of RG 1.206.

- VEGP SUP 8.2-2, the applicant provided sufficient information describing the agreement between VEGP and SCT setting the requirements for transmission system studies and analyses in accordance with the guidelines of RG 1.206.

- VEGP SUP 8.2-3, the applicant provided sufficient information describing SCT's responsibility for maintaining transmission system reliability and conducting planning studies on an ongoing basis in accordance with the guidelines of RG 1.206.

- VEGP SUP 8.2-4, describing the agreement between VEGP and SCT demonstrating that protocols are in place for VEGP to remain cognizant of grid vulnerabilities in order to make informed decisions regarding maintenance activities critical to the electric system in accordance with the guidelines of RG 1.206 and GL 2006-02.

- VEGP SUP 8.2-5, the applicant provided sufficient information regarding causes of outages of the transmission line over the past 15 years in accordance with the guidelines of RG 1.206.

- VEGP SUP 8.2-6, the applicant provided sufficient information to satisfy the interface item regarding ac power requirements and the analysis of the offsite transmission system and the setting of protective devices controlling the switchyard in accordance with the guidelines of RG 1.206.

- The applicant provided sufficient information regarding the interfaces for standard design from the generic AP1000 DCD, Table 1.8-1, Items 8.1, 8.2, and 8.3.

8.2.A Site-Specific ITAAC for Offsite Power Systems

8.2.A.1 *Introduction*

This section specifically addresses the site-specific inspections, tests, analyses and acceptance criteria (SS-ITAAC), that the applicant proposed related to the offsite power system that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will operate in conformance with the COL, the provisions of the Atomic Energy Act, and NRC regulations.

8.2.A.2 *Summary of Application*

Section 14.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 14.3 of the AP1000 DCD, Revision 19.

In addition, in VEGP COL FSAR Section 14.3, the applicant provided the following:

Supplemental Information

- STD SUP 14.3-1

The applicant provided supplemental information related to the offsite power system in Standard (STD) SUP 14.3-1 in VEGP COL FSAR Section 14.3.2.3.

License Condition

- License Condition 1, regarding offsite power system ITAAC

8.2.A.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for ITAAC are given in Section 14.3 of NUREG-0800.

The applicable regulatory requirements for electrical SS-ITAAC are in 10 CFR 52.80(a), "Contents of applications; additional technical information."

8.2.A.4 *Technical Evaluation*

The NRC staff reviewed Section 14.3 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to SS-ITAAC for offsite power systems. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 8.2A-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 8.2.A.4 of the BLN SER:

Supplemental Information

- *STD SUP 14.3-1, addressing SS-ITAACs*

ITAAC Screening Summary Table 14.3-201 of the BLN FSAR identified the transmission switchyard and offsite power system as a site-specific system and selected them for ITAAC, but the table indicated "title only, no entry for COLA." Consequently, Section 2.6.12 of Part 10 of Appendix B, "License Conditions and ITTAC" of the BLN COL application (COLA) provided no ITAAC information for the transmission switchyard and offsite power system. The COL applicant must provide this site-specific ITAAC for compliance with 10 CFR 52.79(d) and 10 CFR 52.80(a). In RAI 14.3-1, the NRC staff stated that RG 1.206, CIII.7.2, Site-Specific ITAAC, recommends that applicants develop ITAAC for the site-specific systems that are designed to meet the significant interface requirements of the standard certified design, that is, the site-specific systems that are needed for operation of the plant (e.g., offsite power). Therefore, the applicant should justify why there is no ITAAC entry associated with offsite power, or revise Table 14.3-201 of the BNL FSAR to include ITAAC entries for the transmission switchyard and the offsite power system.

By letter dated June 24, 2008, the applicant stated that approved DCD Section 14.3 refers to the selection criteria and processes used for developing the AP1000 Certified Design Material (CDM) and identifies no interfaces (e.g., systems for storm drain, raw water, and closed circuit TV system, etc.) meeting this definition. Thus, according to the applicant, the CDM does not include ITAAC or a requirement for COL developed ITAAC for the offsite power interface system. The staff found the above response to be inconsistent with the requirements of 10 CFR 52.80(a), and guidance of NUREG-0800 Section 14.3 and RG 1.206.

Several discussions were held between the applicant and the NRC staff to discuss this issue. The staff pointed out that the offsite power system performs an important function in the passive designs as it provides power to the safety-related loads through battery chargers during normal, abnormal and accident conditions. It also provides power to those active systems that provide defense-in-depth capabilities for reactor coolant make-up and decay heat removal.

These active systems are the first line of defense to reduce challenges to the passive systems in the event of plant transients. The above function of the offsite power system in passive designs supports the need for ITAAC for these systems so that the staff can verify that (1) the designed and installed systems, structures, or components of the offsite power systems will perform as designed and (2) the required single circuit from the transmission network satisfies the requirements of GDC 17.

Subsequently, in a letter dated May 11, 2009, the applicant revised its response to RAI 14.3-1 and provided an ITAAC for the offsite power system to verify that

the as-built offsite portion of the power supply from the transmission network to the interface with the onsite ac power system will satisfy the applicable provisions of GDC 17. Specifically, the ITAAC shall verify:

(1) A minimum of one offsite circuit supplies electric power from the transmission network to the interface with the onsite portions of the ac power system.

(2) Each offsite circuit interfacing with the onsite ac power system is adequately rated to supply assumed loads during normal, abnormal and accident conditions

(3) During steady state operation, each offsite circuit is capable of supplying required voltage to the interface with the onsite ac power system that will support operation of assumed loads during normal, abnormal and accident conditions.

(4) During steady state operation, each offsite circuit is capable of supplying required frequency to the interface with the onsite ac power system that will support operation of assumed loads during normal, abnormal and accident conditions.

(5) The fault current contribution of each offsite portion circuit is compatible with the interrupting capability of the onsite ac power system fault current interrupting devices.

(6) The reactor coolant pumps continue to receive power from either the main generator or the grid for a minimum of 3 seconds following a turbine trip.

To ensure that the requirements of GDC 17 for the adequacy of the offsite power source within the standard design scope are met, the proposed ITAAC would verify the capacity and capability of the offsite source to feed the onsite power system. The proposed ITAAC provides for the inspection of the connection of the offsite source to the onsite power system.

Additionally, the applicant identified all associated changes that will be made in a future revision of the Bellefonte FSAR. On the basis of its review, the staff finds that the applicant has adequately addressed the site-specific ITAAC for the offsite power system so that the staff can verify that the designed and installed systems, structures, or components of the offsite power system will perform as designed. Therefore, the staff concludes that the applicant meets the requirements of 10 CFR 52.79(d) and 10 CFR 52.80(a), and the guidance of SRP 14.3 and RG 1.206. The applicant will revise the BLN COL FSAR to include the proposed ITAAC for offsite power system. This is identified as ***Confirmatory Item 8.2A-1****, pending NRC review and approval of the revised BLN COL FSAR.*

Resolution of Standard Content Confirmatory Item 8.2A-1

The applicant proposed a license condition in Part 10 of the VEGP COL application, which will incorporate the ITAAC identified in Appendix B. Appendix B includes ITAAC for the offsite power system. The license condition's proposed text is evaluated in Chapter 1 of this SER.

Confirmatory Item 8.2A-1 required the applicant to update its FSAR to include proposed ITAAC for the offsite power system. The NRC staff verified that the VEGP COL application was appropriately updated. The ITAAC associated with the offsite power system are shown in VEGP COL Part 10, Appendix B, Table 2.6.12-1. Table 8.2A-1 of this SER reflects this table. As a result, Confirmatory Item 8.2A-1 is resolved. Therefore, the staff will include the ITAAC for the offsite power system in the license.

8.2.A.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following ITAAC for the offsite power system:

- The licensee shall perform and satisfy the ITAAC defined in Table 8.2A-1, "Offsite Power System."

8.2.A.6 *Conclusion*

The staff concludes that the relevant information presented in the VEGP COL FSAR, including STD SUP 14.3-1, is acceptable and meets the requirements of GDC 17 and GDC 18.

8.3 Onsite Power Systems

8.3.1 AC Power Systems

8.3.1.1 *Introduction*

The onsite ac power system includes those standby power sources, distribution systems, and auxiliary supporting systems provided to supply power to safety-related equipment or equipment important to safety for all normal operating and accident conditions. In the AP1000 passive reactor design used at VEGP, the onsite ac power system is a non-Class 1E system that provides reliable ac power to the various system electrical loads. It does not perform any safety-related functions. These loads enhance an orderly shutdown under emergency conditions when offsite power is not available. Additional loads for investment protection can be manually loaded on the standby power supplies. Diesel generator sets are used as the standby power source for the onsite ac power systems.

8.3.1.2 *Summary of Application*

Section 8.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 8.3 of the AP1000 DCD, Revision 19. Section 8.3 of the AP1000 DCD includes Section 8.3.1.

In addition, in VEGP COL FSAR Section 8.3.1, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 8.3-1

VEGP COL 8.3-1 describes: 1) the grounding grid system design within the plant boundary; and 2) a lightning protection risk assessment for the buildings comprising VEGP Units 3 and 4.

- STD COL 8.3-2

STD COL 8.3-2 describes the details of: 1) plant procedures for preoperational testing to verify proper operation of ac power systems; and 2) procedures for the periodic testing of penetration overcurrent protective devices.

Supplemental Information

- VEGP SUP 8.3-1

VEGP SUP 8.3-1 describes the site conditions provided in Section 2.3 of the FSAR that are bounded by the standard site conditions used to rate the diesel engine and the associated generator in AP1000 DCD Section 8.3.1.1.2.3.

- VEGP SUP 8.3-2

VEGP SUP 8.3-2 provides supplemental information describing the site-specific switchyard and power transformer voltage.

- VEGP SUP 8.3-4

VEGP SUP 8.3-4 provides supplemental information regarding periodic verification of the onsite ac power system's capability to transfer between the preferred power supply and the maintenance power supply.

8.3.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the ac power systems are given in Section 8.3.1 of NUREG-0800.

The regulatory basis for acceptance of VEGP COL 8.3-1, addressing the grounding and lightning protection systems are the guidelines of:

- RG 1.204, "Guidelines for Lightning Protection of Nuclear Power Plants"
- IEEE Standard 80, "Guide for Safety in AC Substation Grounding"
- IEEE Standard 665, "Guide for Generating Station Grounding"

The bases for acceptance of the part of STD COL 8.3-2 addressing the recommendations in operation, inspection, and maintenance procedures for the onsite standby diesel generators are standards commonly used in the industry.

The regulatory bases for acceptance of the part of STD COL 8.3-2, addressing procedures for penetration protective device testing, are the guidelines of:

- RG 1.63, "Electric Penetration Assemblies in Containment Structures for Nuclear Power Plants," Revision 3

8.3.1.4 *Technical Evaluation*

The NRC staff reviewed Section 8.3.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the onsite ac power systems. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 8.3.1-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Items

- VEGP COL 8.3-1

The NRC staff reviewed VEGP COL 8.3-1 related to COL Information Item 8.3-1. COL Information Item 8.3-1 states:

> Combined License applicants referencing the AP1000 certified design will address the design of grounding and lightning protection.

The commitment was also captured as COL Action Item 8.3.1.6-1 in Appendix F of NUREG-1793, which states:

> The COL applicant will provide the design of the site-specific grounding and lightning protection.

The NRC staff reviewed the resolution to COL information item, VEGP COL 8.3-1, related to the ground grid system and lightning protection included under Section 8.3 of the VEGP COL FSAR. The NRC staff's evaluation is described below.

The applicant states that "a grounding grid system design within the plant boundary includes step and touch potentials near equipment that are within the acceptable limit for personnel safety. Actual resistivity measurements from soil samples taken at the plant site were analyzed to create a soil model. The ground grid conductor size was then determined using the methodology outlined in IEEE Standard 80 and a grid configuration for the site was created. The grid configuration was modeled in conjunction with the soil model. The resulting step and touch potentials are within the acceptable limits" for personnel safety. Based on the above, the staff concludes that IEEE Standard 80 provides an acceptable method for determining the right size for ground conductors; therefore, the COL information item provided by the applicant on station grounding grid is acceptable.

With regard to lightning protection, the applicant stated that in accordance with IEEE Standard 665, a lightning protection risk assessment for the buildings was performed based on the methodology in National Fire Protection Association (NFPA) 780, "Standard for the Installation of Lightening Protection." "The tolerable lightning frequency for each of the buildings was determined to be less than the expected lightning frequency; therefore, lightning protection is required for the VEGP Units 3 and 4 based on the design in accordance with NFPA 780. The zone of protection is based on the elevations and geometry of the structures. It includes the space covered by a rolling sphere having a radius sufficient enough to cover the building to be protected. The zone of protection method is based on the use of ground masts, air terminals and shield wires. Either copper or aluminum is used for lightning protection. Lightning protection grounding is interconnected with the station or switchyard grounding system." Based on the above, the staff concludes that IEEE Standard 665 and NFPA 780 provide an acceptable method for lightning protection; therefore, the supplemental information provided by the applicant on lightning protection is acceptable.

The following portion of this technical evaluation section is reproduced from Section 8.3.1.4 of the BLN SER:

- *STD COL 8.3-2*

The NRC staff reviewed STD COL 8.3-2 related to COL Information Item 8.3-2. COL Information Item 8.3-2 states (in part):

The Combined License applicant will establish plant procedures as required for:

- *Periodic testing of penetration protective devices*
- *Diesel generator operation, inspection and maintenance in accordance with manufacturers' recommendations*

The commitment was also captured as COL Action Items 8.3.1.2-1 and 8.4.1-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which state:

The COL applicant will establish plant procedures for preoperational testing to verify proper operation of the ac power system. (COL Action Item 8.3.1.2-1)

The COL applicant will establish plant procedures for periodic testing of penetration protective devices. (COL Action Item 8.4.1-1)

A part of standard information item, STD COL 8.3-2, was provided by the applicant describing the bases of the recommendations in operation, inspection, and maintenance procedures for the onsite standby diesel generators. This part of STD COL 8.3-2 is addressed in BLN COL FSAR Section 8.3.1.1.2.4.

A part of standard information item, STD COL 8.3-2, was provided by the applicant describing procedures for the testing of penetration protective devices. This portion of STD COL 8.3-2 is addressed in BLN COL FSAR Section 8.3.1.1.6.

The NRC staff reviewed the resolution to COL information item, STD COL 8.3-2, related to testing procedures for standby diesel generators and electrical penetrations included under Section 8.3 of the BLN COL FSAR. The NRC staff's evaluation follows.

For the operation, inspection and maintenance for diesel generators, the applicant's procedures will consider both the diesel generator manufacturer and industry diesel working group recommendations.

In RAI 8.3.1-2, the NRC staff stated that COL Action Item 8.3.1.2-1 in the NRC's FSER for the AP1000 DCD (NUREG-1793), contains the following discussion:

> *Preoperational tests are conducted to verify proper operation of the ac power system. The preoperational tests include operational testing of the diesel load sequencer and diesel generator capacity testing. The diesel generators are not*

safety-related and will be maintained in accordance with the requirements of the overall plant maintenance program. This program will cover the preventive, corrective, and predictive maintenance activities of the plant systems and equipment and will be presented in the COL application. This COL information is discussed in DCD Tier 2, Section 8.3.3, "Combined License Information for Onsite Electrical Power."

In RAI 8.3.1-2, the applicant was asked to provide a reference to where the preoperational testing program and the preventive, corrective, and predictive maintenance activities for the diesel generators are discussed in the application, or provide a proposed revision to the application to address this issue.

In a letter dated April 6, 2009, the applicant stated that COL Action Item 8.3.1.2-1 in Appendix F of the FSER does not indicate that "pre-operational testing" of the diesel generators has been addressed in the DCD. Pre-operational testing of the ac power system is described in FSER Section 14, DCD Section 14, and BLN COL FSAR Chapter 14. Specifically, DCD Sections 14.2.9.2.15 and 14.2.9.2.17 address the onsite ac power system and diesel generator testing, including diesel generator capacity and sequencer tests. BLN COL FSAR Section 14.2.9.4.23 describes testing of the offsite power system. The NRC staff agrees that pre-operational testing of the diesel generators is addressed in DCD Section 14.2.9.2.17 and was found acceptable by the staff as indicated in FSER NUREG-1793 Section 14.2.9. Based on the above, the NRC staff finds that the applicant's response to the portion of the RAI regarding COL areas of responsibility is acceptable.

In addition, the applicant stated that BLN COL FSAR Section 8.3.1.1.2.4 will be revised to include inspection and maintenance (including preventive, corrective, and predictive maintenance) procedures considering both the diesel generator manufacturer's recommendations and industry diesel working group recommendations.

The NRC staff concludes that following the manufacturer and industry diesel generator working group recommendations for onsite standby diesel generator inspection and maintenance including preventive, corrective, and predictive maintenance provides reasonable assurance that the diesel generators will be adequately maintained. Therefore, DCD COL Information, Item 8.3-2 and FSER COL Action Item 8.3.1.2-1 are resolved subject to the verification that the BLN COL FSAR has been updated to include applicable portions of the RAI response. This is identified as ***Confirmatory Item 8.3.1-1****.*

With regard to establishing plant procedures for periodic testing of protective devices that provide penetration overcurrent protection, the applicant will implement procedures to periodically test a sample of each different type of overcurrent device. Testing includes:

- *Verification of thermal and instantaneous trip characteristics of molded case circuit breakers*

- *Verification of long time, short time, and instantaneous trips of medium voltage air circuit breakers*

- *Verification of long time, short time, and instantaneous trips of low voltage air circuit breakers*

Because the above testing is consistent with the recommendation of RG 1.63, the NRC staff concludes that the above information satisfies COL Information Item 8.3-2 and FSER COL Action Item 8.3.1.6-1, and that these items are resolved.

Resolution of Standard Content Confirmatory Item 8.3.1-1

Confirmatory Item 8.3.1-1 required the applicant to update its FSAR to specify that onsite standby diesel generator inspection and maintenance (including preventive, corrective, and predictive maintenance) procedures will consider both the diesel generator manufacturer's recommendations and industry diesel working group recommendations. The NRC staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 8.3.1-1 is resolved.

Supplemental Information

- VEGP SUP 8.3-1

The applicant stated in VEGP SUP 8.3-1 that its site conditions provided in Section 2.3 were bounded by the standard site conditions in AP1000 DCD Section 8.3.1.1.2.3 used to rate the diesel generators. The staff agrees that the VEGP site conditions are bounded by the standard site conditions used to determine the rating.

- VEGP SUP 8.3-2

The applicant provided information in VEGP SUP 8.3-2 describing the site-specific switchyard and power transformer voltage. The staff found this statement of fact acceptable; therefore, no evaluation is required.

- VEGP SUP 8.3-4

For evaluation of the subject of this item, see the evaluation of VEGP COL 8.2-2 regarding conformance to GDC 18.

8.3.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

8.3.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to onsite ac power systems, and there is no outstanding information expected to be addressed in the VEGP

COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff has compared the COL information items, the supplemental information, the interfaces for standard design, and the proposed design changes and corrections in the application to the relevant NRC regulations, guidance in NUREG-0800, Section 8.3.1, and other NRC regulatory guides and concludes that the applicant is in compliance with the NRC regulations. The staff based its conclusion on the following:

- VEGP COL 8.3-1, the applicant provided sufficient information related to the grounding grid system design and lightning protection consistent with the recommendations of RGs 1.206 and 1.204.

- STD COL 8.3-2, the applicant provided sufficient information related to preoperational testing of the diesel generators and periodic testing of the penetration overcurrent protective devices consistent with industry standards and the recommendations of RG 1.63.

- VEGP SUP 8.3-1, the applicant demonstrated its site-specific conditions are bounded by the standard site conditions in the AP1000 DCD for rating the diesel generator.

- VEGP SUP 8.3-4, the applicant will implement procedures for periodic verification of offsite power system capacity for automatic and manual transfer from the preferred power supply to maintenance power supply and vice-versa to satisfy the requirements of GDC 18.

8.3.2 DC Power Systems

8.3.2.1 *Introduction*

The direct current (dc) power systems include those dc power sources and their distribution systems provided to supply motive or control power to safety-related equipment. Batteries and battery chargers serve as the power sources for the dc power system and inverters convert dc from the dc distribution system to ac instrumentation and control power, as required. These three components, when combined, provide an uninterruptible power supply (UPS) that furnishes a continuous, highly reliable source of ac supply.

The AP1000 dc power system is comprised of independent Class 1E and non-Class 1E dc power systems. Each system consists of ungrounded stationary batteries, dc distribution equipment, and UPS.

8.3.2.2 *Summary of Application*

Section 8.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 8.3 of the AP1000 DCD, Revision 19. Section 8.3 of the AP1000 DCD includes Section 8.3.2. The advanced safety evaluation (ASE) with confirmatory items for Section 8.3.2 was based on the VEGP COL FSAR, Revision 2 and DCD Revision 17. After submitting DCD Revision 17 to the NRC, Westinghouse revised the COL Information Item (COL 8.3-2) and the applicant took a

departure (STD DEP 8.3-1) to address the revised COL information item. This COL information item has been incorporated into Revision 18 of the DCD; however, the discussion of the COL information item below did not change.

In addition, in VEGP COL FSAR Section 8.3.2, the applicant provided the following:

Tier 2 Departure

- STD DEP 8.3-1

In a letter dated October 15, 2010, the applicant proposed the following Tier 2 departure related to a proposed revision to AP1000 DCD Section 8.3.2.2. In that letter, the applicant stated that the Class 1E battery chargers are designed to limit the input (ac) current to an acceptable value under faulted conditions on the output side; however, the voltage regulating transformers do not have active components to limit current; therefore, the Class 1E voltage regulating transformer maximum current is determined by the impedance of the transformer. The voltage regulating transformer in combination with fuses and/or breakers will interrupt the input or output (ac) current under faulted conditions on the output side. Since AP1000 DCD Section 8.3.2.2 states that the Class 1E voltage regulating transformers are designed to limit the input (ac) current to an acceptable value under faulted conditions on the output side, the use of the breakers/fuses for the regulating transformers for isolation function, in lieu of current limiting characteristics as presented in the AP1000 DCD, is a departure for VEGP.

AP1000 COL Information Item

- STD COL 8.3-2

STD COL 8.3-2 describes the details of: 1) procedures for inspection, maintenance, and testing of Class 1E batteries; and 2) the clearing of ground faults on the Class 1E dc power system. In a letter dated October 15, 2010, the applicant proposed to revise STD COL 8.3-2 by adding information related to periodic testing for the battery chargers and voltage regulating transformers.

Supplemental Information

- STD SUP 8.3-3

The applicant provided supplemental information stating that there is no site-specific non-Class 1E dc loads connected to the Class 1E dc system.

8.3.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the dc power systems are given in Section 8.3.2 of NUREG-0800.

The regulatory basis for acceptance of COL information item STD COL 8.3-2 and STD SUP 8.3-3 is established in:

- GDC 17
- GDC 18
- RG 1.206
- RG 1.129, "Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," Revision 2
- IEEE Standard 450, "Recommended Practice for the Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications"
- RG 1.75, "Physical Independence of Electrical Systems," Revision 3

8.3.2.4 *Technical Evaluation*

The NRC staff reviewed Section 8.3.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the dc power systems. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1, to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.
- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.
- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 8.3.2-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

Although the staff concluded that the evaluation performed for the standard content is directly applicable to the VEGP COL application, there were differences in the response provided by the VEGP applicant from that provided by the BLN applicant regarding the standard COL and supplemental information items. These differences are evaluated by the staff below, following the standard content material.

The following portion of this technical evaluation section is reproduced from Section 8.3.2.4 of the BLN SER:

> *AP1000 COL Information Item*
>
> - *STD COL 8.3-2, involving the inspection, maintenance, and testing of Class 1E batteries and clearing of ground faults on the Class 1E dc system.*
>
> *The NRC staff reviewed STD COL 8.3-2 related to COL Information Item 8.3-2. COL Information Item 8.3-2 states (in part):*
>
> > *The Combined License applicant will establish plant procedures as required for:*
> >
> > – *Clearing ground fault on the Class 1E dc system*
> >
> > – *Checking sulfated battery plates or other anomalous conditions through periodic inspections*
> >
> > – *Battery maintenance and surveillance (for battery surveillance requirements, refer to DCD Chapter 16, Section 3.8)*
>
> *The commitment was also captured as COL Action Item 8.4.1-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:*
>
> > *The COL applicant will establish plant procedures for periodic testing of penetration protective devices. (COL Action Item 8.4.1-1)*
>
> *The Class 1E 125 volts direct current (Vdc) system components undergo periodic maintenance tests to determine the condition of the system. The applicant has established procedures for inspection and maintenance of Class 1E batteries and non-Class 1E batteries. Class 1E battery maintenance and service testing is performed in conformance with RG 1.129. Batteries are inspected periodically to verify proper electrolyte levels, specific gravity, cell temperature and battery float voltage. Cells are inspected in conformance with IEEE 450 and vendor recommendations. In addition, the applicant has established procedures for clearing of ground faults on the Class 1E dc system. The battery testing procedures are written in conformance with IEEE 450 and the Technical Specifications. The NRC staff concludes that the applicant has established procedures for inspection and maintenance of Class 1E and non-Class 1E batteries to satisfy COL Information Item 8.3-2; therefore, this item is resolved.*

With regard to periodic testing of electrical penetration protective devices (COL Action Item 8.4.1-1) for dc systems, the applicant has not addressed periodic testing of the penetration over load protective devices related to dc systems. In RAI 8.3.1-1, the staff requested that the applicant address the periodic testing of the electrical penetration primary and backup protective devices protecting Class 1E and non-Class 1E dc circuits. In a letter dated January 2, 2009, the applicant stated that the BLN COL FSAR will be revised in the next COLA submittal to include periodic testing of the electrical penetration primary and backup protective devices protecting Class 1E and non-Class 1E dc circuits, as well as control of protective devices. The staff has reviewed the information in the applicant's response, which provided for the testing of Class 1E and non-Class 1E dc penetration overload protection devices. The staff also reviewed the proposed change to BLN COL FSAR Section 8.3.1.1.6 and concludes that COL Action Item 8.4.1-1 is resolved subject to the verification that the BLN COL FSAR has been updated to include portions of the RAI response. This is identified as ***Confirmatory Item 8.3.2-1****.*

Resolution of Standard Content Confirmatory Item 8.3.2-1

Confirmatory Item 8.3.2-1 required the applicant to update its FSAR to provide for the testing of Class 1E and non-Class 1E dc penetration overload protection devices. The NRC staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 8.3.2-1 is resolved.

Evaluation of Tier 2 Departure STD DEP 8.3-1 and Revised STD COL 8.3-2

In a letter dated June 18, 2010, Westinghouse provided a response to Open Item OI-SRP8.3.2-EEB-09, Revision 3, related to the periodic testing of battery chargers and voltage regulating transformers. The response included a COL information item to be added to AP1000 DCD Section 8.3.3 to ensure that periodic testing is performed on the battery chargers and voltage regulating transformers. Specifically, this section will be revised to include the following COL information item:

> The Combined License applicant will establish plant procedures as required for:
>
> > Combined License applicants referencing the AP1000 certified design will ensure that periodic testing is performed on the battery chargers and voltage regulating transformers.

In a letter dated October 15, 2010, the applicant submitted its response to address the above identified AP1000 DCD revision to the Section 8.3.3 COL information item regarding battery charger and voltage regulating transformer testing. The applicant stated that procedures are established for periodic testing of the Class 1E battery chargers and the Class 1E regulating transformers in accordance with the manufacturer recommendations. The battery chargers and regulating transformers are tested periodically in accordance with manufacturer recommendations. Circuit breakers in the Class 1E battery chargers and Class 1E voltage regulating transformers that are credited for an isolation function are tested through the use of breaker test equipment. This verification confirms the ability of the circuit to perform the designed coordination and corresponding isolation function between Class 1E and non-Class 1E components. Circuit breaker testing is done as part of the MR program and testing frequency is determined by that program. Fuses/fuse holders that are included in the

isolation circuit are visually inspected. Class 1E battery chargers are tested to verify current limiting characteristic utilizing manufacturer recommendation and industry practices. Testing frequency is in accordance with that of the associated battery.

The applicant clarified that the voltage regulating transformers do not have active components to limit current and, therefore, the voltage regulating transformer in combination with fuses and/or breakers will interrupt the input or output (ac) current under faulted conditions on the output side. The NRC staff finds this to be inconsistent with AP1000 DCD Section 8.3.2.2, which states that Class 1E voltage regulating transformers are designed to limit the input (ac) current to an acceptable value under faulted conditions on the output side. As such the use of the breakers/fuses for regulating transformers for isolation function in lieu of current limiting characteristics as presented in the AP1000 DCD is a departure for VEGP. The applicant stated that Part 7 of the COL application will be revised to include a departure from AP1000 DCD Section 8.3.2.2 clarifying the current limiting feature of voltage regulating transformers. The applicant has included, in its response, the appropriate changes related to the above departure that will be included in VEGP COL FSAR Sections 8.3.2.1.4 and 8.3.2.2, in Chapter 1, Table 1.8-201 and in Part 7 of the VEGP COL application. These changes will be included in a future revision to the VEGP COL application.

The NRC staff has reviewed the proposed changes to the VEGP COL application and concludes that the applicant has provided sufficient information regarding the isolation function and the periodic inspection and testing of the isolating devices for the Class 1E battery chargers and Class 1E voltage regulating transformers. In addition, the staff finds that, although the use of the breakers/fuses for regulating transformers isolation function in lieu of current limiting characteristics as presented in the AP1000 DCD is a departure for VEGP, the departure is acceptable because the use of the breakers/fuses for regulating transformers for isolation function is consistent with the recommendations in IEEE-384, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," endorsed by RG 1.75. Therefore, AP1000 COL Information Item STD DEP 8.3-1 and the revised STD COL 8.3-2 are resolved subject to NRC staff verification of the revision to the VEGP COL FSAR sections discussed above. This is being tracked as **Confirmatory Item 8.3.2-2**.

Resolution of Standard Content Confirmatory Item 8.3.2-2

Confirmatory Item 8.3.2-2 is an applicant commitment to revise its FSAR Table 1.8-201 and Section 8 3.2.1.4 to address COL Information Item STD COL 8.3-2 and a departure, STD DEP 8.3-1. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 8.3.2-2 is now closed.

The following portion of this technical evaluation section is reproduced from Section 8.3.2.4 of the BLN SER:

> *Supplemental Information*
>
> - *STD SUP 8.3-1*
>
> *STD SUP 8.3-1 was provided by the applicant indicating that there are no site-specific non-Class 1E dc loads connected to the Class 1E dc system. The staff finds this acceptable because it is consistent with the guidance in RG 1.206.*

Evaluation of Site-specific Response to Standard Content

In VEGP COL FSAR, Revision 2, the VEGP applicant changed the number of the supplemental information item from STD SUP 8.3-1 to STD SUP 8.3-3. The associated VEGP COL FSAR, Revision 2 text, which is identical to the BLN COL FSAR, Revision 1 text accepted by the staff, was not changed. Therefore, the staff concludes that this difference is not relevant and that the staff's evaluation of STD SUP 8.3-1 for BLN applies to STD SUP 8.3-3 for VEGP.

8.3.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

8.3.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to dc power systems, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the relevant NRC regulations, guidance in NUREG-0800, Section 8.3.2, and other NRC regulatory guides and concludes that the applicant is in compliance with the NRC regulations. The staff based its conclusion on the following:

- STD COL 8.3-2, the applicant provided sufficient information involving the inspection, maintenance, and testing of Class 1E batteries, the clearing of ground faults on the Class 1E dc system, and periodic testing of the battery chargers and voltage regulating transformers.

- STD SUP 8.3-3, the applicant made a commitment that there are no site-specific non-Class 1E dc loads connected to the Class 1E dc system.

- STD DEP 8.3-1, the applicant provided sufficient information involving the use of breakers/fuses for regulating transformers for isolation function that is consistent with IEEE-384, endorsed by RG 1.75.

Table 8.2A-1. Offsite Power System

Design Commitment	Inspections, Tests, and Analyses	Acceptance Criteria
1. A minimum of one offsite circuit supplies electric power from the transmission network to the interface with the onsite ac power system.	Inspections of the as-built offsite circuit will be performed.	At least one offsite circuit is provided from the transmission switchyard interface to the interface with the onsite ac power system.
2. Each offsite power circuit interfacing with the onsite ac power system is adequately rated to supply assumed loads during normal, abnormal and accident conditions.	Analyses of the offsite power system will be performed to evaluate the as-built ratings of each offsite circuit interfacing with the onsite ac power system against the load assumptions.	A report exists and concludes that each as-built offsite circuit is rated to supply the load assumptions during normal, abnormal and accident conditions.
3. During steady state operation, each offsite power source is capable of supplying required voltage to the interface with the onsite ac power system that will support operation of assumed loads during normal, abnormal and accident conditions.	Analyses of the as-built offsite circuit will be performed to evaluate the capability of each offsite circuit to supply the voltage requirements at the interface with the onsite ac power system.	A report exists and concludes that during steady state operation each as-built offsite circuit is capable of supplying the voltage at the interface with the onsite ac power system that will support operation of assumed loads during normal, abnormal and accident conditions.
4. During steady state operation, each offsite circuit is capable of supplying required frequency to the interface with the onsite ac power system that will support operation of assumed loads during normal, abnormal and accident conditions.	Analyses of the as-built offsite circuit will be performed to evaluate the capability of each offsite circuit to supply the frequency requirements at the interface with the onsite ac power system.	A report exists and concludes that during steady state operation each as-built offsite circuit is capable of supplying the frequency at the interface with onsite ac power system that will support operation of assumed loads during normal, abnormal and accident conditions.
5. The fault current contribution of each offsite circuit is compatible with the interrupting capability of the onsite short circuit interrupting devices.	Analyses of the as-built offsite circuit will be performed to evaluate the fault current contribution of each offsite circuit at the interface with the onsite ac power system.	A report exists and concludes the short circuit contribution of each as-built offsite circuit at the interface with the onsite ac power system is compatible with the interrupting capability of the onsite fault current interrupting devices
6. The reactor coolant pumps continue to receive power from either the main generator or the grid for a minimum of 3 seconds following a turbine trip.	Analyses of the as-built offsite power system will be performed to confirm that power will be available to the reactor coolant pumps for a minimum of 3 seconds following a turbine trip when the buses powering the reactor coolant pumps are aligned to either the UATs or the RATs.	A report exists and concludes that voltage at the high-side of the GSU, and the RATs, does not drop more than 0.15 pu from the pre-trip steady-state voltage for a minimum of 3 seconds following a turbine trip when the buses powering the reactor coolant pumps are aligned to either the UATs or the RATs.

9.0 AUXILIARY SYSTEMS

The auxiliary systems provide support systems that support the safe shutdown of the plant or the protection of the health and safety of the public. This area covers a wide range of systems including fuel storage and handling, water systems, compressed air, process sampling, drains, heating, ventilation, and air conditioning (HVAC), fire protection, communications, lighting, and emergency diesel generator support systems.

9.1 Fuel Storage and Handling

9.1.1 New Fuel Storage (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.1.1, "Criticality Safety of Fresh and Spent Fuel Storage and Handling," and C.I.9.1.2, "New and Spent Fuel Storage")

The new fuel storage facilities include the fuel assembly storage racks, the concrete storage pit that contains the storage racks, and auxiliary components including the spent fuel handling crane and pit cover. The storage facilities must maintain the new fuel in subcritical arrays during all credible storage conditions. In addition, new fuel must remain subcritical during fuel handling.

Section 9.1 of the Vogtle Electric Generating Plant (VEGP) combined license (COL) Final Safety Analysis Report (FSAR), Revision 5, incorporates by reference, with no departures or supplements, Section 9.1.1, "New Fuel Storage," of Revision 19 of the AP1000 Design Control Document (DCD). The Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[25] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements.

9.1.2 Spent Fuel Storage (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.1.1, "Criticality Safety of Fresh and Spent Fuel Storage and Handling," and C.I.9.1.2, "New and Spent Fuel Storage")

9.1.2.1 *Introduction*

The spent fuel storage facilities include the spent fuel storage racks, the spent fuel storage pool that contains the storage racks, and the associated equipment storage pits. The storage facilities must maintain the spent fuel in subcritical arrays during all credible storage conditions. In addition, spent fuel must remain subcritical during fuel handling.

9.1.2.2 *Summary of Application*

Section 9.1 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.1 of the AP1000 DCD, Revision 19. Section 9.1 of the DCD includes Section 9.1.2.

[25] See Section 1.2.2 for a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification (DC).

In addition, in VEGP COL FSAR Section 9.1.6, the applicant provided the following:

AP1000 COL Information Item

- STD COL 9.1-7

The applicant provided additional information in standard STD COL 9.1-7 to address COL Information Item 9.1-7.

License Condition

- Part 10, License Condition 2, Item 9.1-7

The applicant proposed a license condition related to STD COL 9.1-7 that sets the implementation milestone for the Metamic Coupon Monitoring Program.

- Part 10, License Condition 6

The applicant proposed, in a letter dated April 23, 2010, a license condition to provide a schedule to support the NRC's inspection of operational programs and proposes to add the Metamic Monitoring Program to this list.

9.1.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the fuel storage and handling are given in Section 9.1.2 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)."

The regulatory basis for acceptance of the COL information and supplementary information items are established in:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic licensing of production and utilization facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criteria (GDC) 4, "Environmental and Dynamic Effects Design Bases"

- GDC 61, "Fuel Storage and Handling and Radioactivity Control"

9.1.2.4 *Technical Evaluation*

The NRC staff reviewed Section 9.1.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required

information relating to spent fuel storage. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this safety evaluation report (SER) provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the Bellefonte Nuclear Plant (BLN), Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 9.1-1) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 9.1.2.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 9.1-7*

COL Information Item 9.1-7 states:

> *The Combined License holder will implement a spent fuel rack Metamic coupon monitoring program when the plant is placed into commercial operation. This program will include tests to monitor bubbling, blistering, cracking, or flaking; and a test to monitor for corrosion, such as weight loss measurements and or visual examination.*

STD COL 9.1-7 states:

> *A spent fuel rack Metamic coupon monitoring program is to be implemented when the plant is placed into commercial operation. This program includes tests to monitor bubbling, blistering,*

cracking, or flaking; and a test to monitor for corrosion, such as weight loss measurements and or visual examination.

The NRC staff reviewed STD COL 9.1-7 related to the Metamic coupon monitoring program included under Section 9.1 of the BLN COL FSAR. No additional details on the Metamic Coupon Monitoring Program are provided in Section 9.1 of the FSAR.

Since the applicant's proposed resolution of COL Information Item 9.1-7 was a restatement of the text of the COL information item from the DCD, the staff required additional information to be able to evaluate the applicant's closure of the item. An additional Request for Additional Information (RAI) response related to AP1000 DCD Section 9.1.2 (ML091120720) proposed a modification to the text of COL Information Item 9.1-7. The modified wording added neutron attenuation and thickness testing to the list of tests to be included in the Metamic monitoring program to be implemented by the COL holder. In RAI 9.1.2-1, the NRC staff requested that the applicant describe in detail the implementation of the aspects of the Metamic coupon monitoring program that are listed in STD COL 9.1-7, as modified by the additional AP1000 RAI response. In response to RAI 9.1.2-1, the applicant proposed modified wording for STD COL 9.1-7 as follows:

STD COL 9.1-7

A spent fuel rack Metamic coupon monitoring program is to be implemented when the plant is placed into commercial operation. This program includes tests to monitor bubbling, blistering, cracking, or flaking; and a test to monitor for corrosion, such as weight loss measurements and / or visual examination. The program will also include tests to monitor changes in physical properties of the absorber material, including neutron attenuation and thickness measurements.

This proposed wording matches the proposed revised text for AP1000 COL Information Item 9.1-7. However, the proposed wording is still a restatement of the COL information item and does not contain the level of detail needed by the staff to evaluate the adequacy of the Metamic monitoring program. Therefore, in RAI 9.1.2-2, the staff requested that the applicant describe the methodology and acceptance criteria for the tests listed, provide the corrective action requirements and provide the administrative controls applicable to the program. Additionally, the applicant should confirm the number of coupons and the withdrawal schedule will be the same as recommended in the DCD or provide an alternative. The staff has identified this as ***Open Item 9.1-1*** *to track resolution of this issue and to ensure that the additional details are included in the BLN COL FSAR.*

Resolution of Standard Content Open Item 9.1-1

To resolve Open Item 9.1-1, the VEGP applicant provided additional information in a letter dated April 23, 2010, which superseded the original response to Open Item 9.1-1 provided in a letter dated December 30, 2009.

With respect to the number of coupons and the withdrawal schedule, the applicant confirmed that the number of coupons and the withdrawal schedule will be the same as stated in AP1000 DCD, Section 9.1.2.2.1. The applicant further stated that since AP1000 DCD Section 9.1 is incorporated by reference into the FSAR, no additional FSAR change would be required. The staff finds the applicant's response regarding the number of coupons and withdrawal schedule acceptable, because the applicant has confirmed the number of coupons and schedule will be the same as described in the AP1000 DCD.

With respect to methodology and acceptance criteria, corrective actions and administrative controls, the applicant stated that since the Metamic Coupon Monitoring Program has not yet been established, the level of detail requested is not completely available. The applicant further stated, "As stated in FSAR Subsection 9.1.6, a Metamic monitoring program will be implemented when the plant is placed into commercial operation. This program will include methodology to be employed, acceptance criteria, corrective actions and a description of administrative controls based on vendor recommendations and industry operating experience."

The applicant additionally stated that the VEGP COL FSAR will be revised to add the following to the end of the STD COL 9.1-7 discussion:

> The program will include the methodology and acceptance criteria for the tests listed and provide corrective action requirements based on vendor recommendations and industry operating experience. The program will be implemented through plant procedures.
>
> Metamic Monitoring Acceptance Criteria:
>
> - Verification of continued presence of the boron is performed by neutron attenuation measurement. A decrease of no more than 5 percent in Boron-10 content, as determined by neutron attenuation, is acceptable. This is equivalent to a requirement for no loss in boron within the accuracy of the measurement.
>
> - Coupons are monitored for unacceptable swelling by measuring coupon thickness. An increase in coupon thickness at any point of no more than 10 percent of the initial thickness at that point is acceptable.
>
> Changes in excess of either of the above two acceptance criteria are investigated under the corrective action program and may require early retrieval and measurement of one or more of the remaining coupons to provide validation that the indicated changes are real. If the deviation is determined to be real, an engineering evaluation is performed to identify further testing or any corrective action that may be necessary.
>
> Additional parameters are examined for early indications of the potential onset of Metamic degradation that would suggest a need for further attention and possibly a change in the coupon withdrawal schedule. These include visual inspection for surface pitting, blistering, cracking, corrosion or edge deterioration, or unaccountable weight loss in excess of the measurement accuracy.

The NRC staff concludes that the above information to be added to the VEGP COL FSAR provides the necessary level of detail for the Metamic Monitoring Program, including the methodology and acceptance criteria for the tests listed, the corrective action requirements, and the administrative controls applicable to the program.

The applicant proposed a markup of the VEGP COL application, Part 10, License Condition 6, adding a line item for the Metamic Monitoring Program. After the addition of this line item, the version of License Condition 6 included in Part 10 of the COL application, Revision 2, would be:

> The licensee shall develop a schedule that supports planning for and conduct of NRC inspection of the operational program listed in VEGP COL FSAR Table 13.4-201, "Operational Program Required by NRC Regulations." This schedule must be available to the NRC staff no later than 12 months after issuance of the COL. The schedule shall be updated every 6 months until 12 months before scheduled fuel load, and every month thereafter until the operational programs listed in VEGP COL FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first. This schedule shall address:
>
> a. the implementation of site-specific Severe Accident Management Guidance.
>
> b. the reactor vessel pressurized thermal shock evaluation at least 18 months prior to initial fuel load.
>
> c. the approved preoperational and startup test procedures in accordance with FSAR Section 14.2.3.
>
> d. the flow accelerated corrosion (FAC) program implementation, including the construction phase activities.
>
> #. the spent fuel rack Metamic coupon monitoring program implementation.
>
> (Where # will be replaced with the next sequential number in the final version of this license condition.)

The inclusion of the Metamic Coupon Monitoring Program in License Condition 6 ensures that the program will be treated as an operational program with respect to providing a schedule to support the NRC's inspection; thus, the applicant must submit and update the schedule for program implementation following the issuance of the COL, in order to support planning of NRC inspections. The staff, therefore, finds the applicant's proposed resolution of **Open Item 9.1-1** acceptable because the applicant will modify proposed License Condition 6 to ensure the appropriate information is available for the staff's review of the details of the Metamic Monitoring Program prior to the start of plant operation. **Open Item 9.1-1** is, therefore, resolved. Incorporation of the proposed revision to Chapter 9 of the VEGP COL FSAR and to License Condition 6 in the VEGP COL application is being tracked as **Confirmatory Item 9.1-1**.

Resolution of Standard Content Confirmatory Item 9.1-1

Confirmatory Item 9.1-1 is an applicant commitment to revise its FSAR Section 9.1.6 to include a requirement for inclusion of methodology, acceptance criteria and corrective action in the Metamic Coupon Monitoring Program. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 9.1-1 is now closed.

9.1.2.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license condition associated with spent fuel storage:

- License Condition (9-1) – Prior to initial fuel load, the licensee shall implement the spent fuel rack Metamic Coupon Monitoring Program. No later than 12 months after issuance of the COL, the licensee shall submit to the Director of the Office of New Reactors (NRO) a schedule that supports planning for and conduct of NRC inspections of the spent fuel rack Metamic Coupon Monitoring Program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the spent fuel rack Metamic Coupon Monitoring Program has been fully implemented.

9.1.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to spent fuel storage, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Section 9.1.2 of NUREG-0800. The staff based its conclusion on the following:

- STD COL 9.1-7 is acceptable because the necessary level of detail for the Metamic Coupon Monitoring Program has been provided by the applicant, including the methodology and acceptance criteria for the tests listed, the corrective action requirements, and the administrative controls applicable to the program.

9.1.3 Spent Fuel Pool Cooling System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.1.3, "Spent Fuel Pool Cooling and Cleanup System")

The spent fuel pool cooling system is designed to remove decay heat, which is generated by stored fuel assemblies from the water in the spent fuel pool. This is done by pumping the high temperature water from within the fuel pool through a heat exchanger, and then returning the water to the pool. A secondary function of the spent fuel pool cooling system is clarification and purification of the refueling water and the spent fuel pool.

Section 9.1.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.1.3, "Spent Fuel Pool Cooling System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.1.4 Light Load Handling System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.1.4, "Light Load Handling System (Related to Refueling)")

9.1.4.1 *Introduction*

The light-load handling system (LLHS) consists of the equipment and structures needed for the refueling operation. This equipment is comprised of fuel assemblies, core component and reactor component hoisting equipment, handling equipment, and a dual basket fuel transfer system. The structures associated with the fuel handling equipment are the refueling cavity, the transfer canal, the fuel transfer tube, the spent fuel pool, the cask loading area, the new fuel storage area, and the new fuel receiving and inspection area.

9.1.4.2 *Summary of Application*

Section 9.1 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.1 of the AP1000 DCD, Revision 19. Section 9.1 of the DCD includes Section 9.1.4.

In addition, in VEGP COL FSAR Section 9.1.4, the applicant provided the following:

AP1000 COL Information Items

- STD COL 9.1-5

The applicant provided additional information in STD COL 9.1-5 to address COL Information Item 9.1-5 (COL Action Item 9.1.6-5).

- STD COL 9.1-6

The applicant provided additional information in STD COL 9.1-6 to address COL Information Item 9.1-6 (COL Action Item 9.1.6-6).

9.1.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the LLHS are given in Section 9.1.4 of NUREG-0800.

The regulatory basis for acceptance of the COL information items are established in:

- GDC 61

- American National Standards Institute/American Nuclear Society (ANSI/ANS) 57.1-1992, "Design Requirements for LWR Fuel Handling Systems"

9.1.4.4 *Technical Evaluation*

The NRC staff reviewed Section 9.1.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the

complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the LLHS. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one open item (Open Item 9.1-2) related to the standard content in the BLN SER. Its resolution is addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 9.1.4.4 of the BLN SER:

AP1000 COL Information Items

- *STD COL 9.1-5*

COL Information Item 9.1-5 states:

> *The Combined License applicant is responsible for a program for inservice inspection of the light load handling system as specified in subsection 9.1.4.4 and the overhead heavy load handling system in accordance with ANSI B30.2, ANSI B30.9, ANSI N14.6, and ASME [American Society of Mechanical Engineers] NOG-1 as specified in subsection 9.1.5.4.*

The commitment was also captured as COL Action Item 9.1.6-5 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The Combined License applicant is responsible for a program for inservice inspection of the light load handling system as specified*

in DCD Tier 2, Section 9.1.4.4 and the overhead heavy load handling system in accordance with ANSI B30.2, ANSI B30.9, ANSI N14.6, and ASME NOG-1 as specified in DCD Tier 2, Section 9.1.5.4.

STD COL 9.1-5 states:

> *The above requirements are part of the plant inspection program for the light load handling system, which is implemented through procedures. In addition to the above inspections, the procedures reflect the manufacturers' recommendations for inspection.*

The staff reviewed STD COL 9.1-5, which addresses COL Information Item 9.1-5 on the inservice inspection (ISI) program for the LLHS. The applicant stated that the inspection program for the LLHS is implemented through procedures and reflect the manufacturer's recommendations. RAI 9.1.4-1 requested that the applicant provide a copy of the procedures for verification by the staff or provide the schedule in relation to fuel loading for issuance of the procedures.

The applicant stated in its response to RAI 9.1.4-1, that an inspection and testing program will be developed to address the LLHS. Procedures defining the program will address the testing and inspection requirements outlined in Section 9.1.4.4, "Inspection and Test Requirements," of the AP1000 DCD and the procedures will include applicable manufacturer's recommendations and industry standards. The applicant stated that procedure development is tracked by the overall plant construction and test schedule. The applicant further stated that details of the implementation milestones for development of procedures are not currently available and are not expected to be available until a detailed construction schedule has been developed. When it becomes available, scheduling information will be provided to the NRC as necessary to support timely completion of NRC inspection and audit functions.

Although the response to RAI 9.1.4-1 states that the plant inspection program schedule information will be provided when available, BLN COL FSAR Table 1.8-202 lists STD COL 9.1-5 as having been completed by the applicant. The staff notes that STD COL 9.1-5 has not been fully addressed. The applicant is asked to revise BLN COL FSAR Table 1.8-202 to commit in the BLN COL FSAR to implementing the plant inspection program for the LLHS before receipt of fuel. This is ***Open Item 9.1-2****.*

- *STD COL 9.1-6*

COL Information Item 9.1-6 states:

> *The Combined License applicant is responsible to ensure an operating radiation monitor is mounted on any crane or fuel handling machine when it is handling fuel.*

The commitment was also captured as COL Action Item 9.1.6-6 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant/holder will ensure that an operating radiation monitor is mounted on any crane or fuel handling machine when it is handling fuel.*

STD COL 9.1-6 states:

> *Plant procedures require that an operating radiation monitor is mounted on any machine when it is handling fuel. Refer to DCD Subsection 11.5.6.4, "Fuel Handling Area Criticality Monitors," for a discussion of augmented radiation monitoring during fuel handling operations.*

The NRC staff reviewed STD COL 9.1-6, which addresses COL Information Item 9.1-6 related to radiation monitoring included under Section 9.1.4 of the BLN COL FSAR. The proposed mounting of an operating radiation monitor on any crane or fuel handling machine during fuel handling is included under Section 9.1.4.3.8 of the BLN COL FSAR. The applicant committed to develop plant procedures that will specify that an operating radiation monitor be mounted on any fuel handling machine when it is handling fuel. DCD Section 11.5.6.4 specifies the need to augment area radiation monitoring during fuel handling operations by a portable radiation monitor on the machine handling fuel. The staff finds that with the addition of the portable radiation monitor to any fuel handling machine when it is handling fuel, the BLN COL FSAR meets the applicable requirements of 10 CFR Part 50, Appendix A, GDC 61 for the prevention of unacceptable radiation exposure.

The staff finds that the applicant has adequately addressed COL Information Item 9.1-6 which would ensure that an operating portable radiation monitor is mounted on any fuel handling machine in the LLHS when it is handling fuel.

Resolution of Standard Content Open Item 9.1-2

To resolve **Open Item 9.1-2**, in a letter dated December 30, 2009, the applicant, proposed a change to VEGP COL FSAR Section 9.1.4.4 in response to this open item instead of a revision to Table 1.8-202. The applicant proposed a revision to FSAR Section 9.1.4.4 to clarify that the LLHS, including system inspections, is implemented prior to receipt of fuel onsite. The staff finds this acceptable since the commitment provided will ensure that these procedures will be in place prior to fuel movement. Therefore, **Open Item 9.1-2** is resolved. Incorporation of the proposed revision in the VEGP COL FSAR is being tracked as **Confirmatory Item 9.1-2**.

Resolution of Standard Content Confirmatory Item 9.1-2

Confirmatory Item 9.1-2 is an applicant commitment to revise its FSAR Section 9.1.4.4 to include an inspection of the LLHS prior to receipt of fuel. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 9.1-2 is now closed.

Correction of Error in the Standard Content Evaluation Text

The NRC staff identified an error in the text reproduced above from Section 9.1.4.4 of the BLN SER that requires correction. The BLN SER provides quoted material for COL Action Item 9.1.6-5, citing Appendix F of NUREG-1793 as the source. The source of the quoted material for COL Action Item 9.1.6-5 is in fact from Chapter 9 (Section 9.1.6) of NUREG-1793.

9.1.4.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation above, the following FSAR commitment is identified as the responsibility of the licensee:

- The light load handling program, including system inspections, will be implemented prior to receipt of fuel onsite.

9.1.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to LLHS and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Section 9.1.4 of NUREG-0800. The staff based its conclusion on the following:

- STD COL 9.1-5 is acceptable because the staff finds that the relevant information in the VEGP COL FSAR provided clarification that ISI of the LLHS is part of the plant inspection program for the LLHS, which is implemented through procedures.

- STD COL 9.1-6 is acceptable because the staff finds that the relevant information in the VEGP COL FSAR meets the applicable requirements of 10 CFR Part 50, Appendix A, GDC 61.

9.1.5 Overhead Heavy Load Handling Systems (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.1.5, "Overhead Load Handling System")

9.1.5.1 *Introduction*

The overhead heavy-load handling system (OHLHS) is used to lift loads whose weight is greater than the combined weight of a single spent fuel assembly and its handling device. The principal equipment is the containment polar crane, equipment hatch hoist, maintenance hatch hoist, and the cask handling crane. The OHLHS is designed to ensure that inadvertent operations or equipment malfunctions, separately or in combination, will not cause a release of radioactivity, a criticality accident, inability to cool fuel within the reactor vessel or spent fuel pool, or prevent safe shutdown of the reactor.

9.1.5.2 *Summary of Application*

Section 9.1 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.1 of the AP1000 DCD, Revision 19. Section 9.1 of the AP1000 DCD includes Section 9.1.5.

In addition, in VEGP COL FSAR Section 9.1.5, the applicant provided the following:

Supplemental Information

- STD SUP 9.1-1

The applicant provided supplemental (SUP) information in Section 9.1.5.3, "Safety Evaluation," describing heavy-load lifts outside those already described in the AP1000 DCD.

- STD SUP 9.1-2

The applicant provided supplemental information in Section 9.1.5, "Overhead Heavy Load Handling Systems," describing key elements of the heavy-loads handling program and a quality assurance program.

- STD SUP 9.1-3

The applicant provided supplemental information in Section 9.1.5.5, "Load Handling Procedures," describing load handling operations for heavy loads in the vicinity of irradiated fuel and safe shutdown equipment.

AP1000 COL Information Items

- STD COL 9.1-5

The applicant provided additional information in STD COL 9.1-5 to address COL Information Item 9.1-5 (COL Action Item 9.1.6-5).

- STD COL 9.1-6

The applicant provided additional information in STD COL 9.1-6 to address COL Information Item 9.1-6 (COL Action Item 9.1.6-6).

9.1.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the OHLHS are given in Section 9.1.5 of NUREG-0800.

The regulatory basis for acceptance of STD SUP 9.1-1, STD SUP 9.1-2 and STD SUP 9.1-3 addressing planned heavy-load lift programs include the following:

- GDC 4
- GDC 61
- NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants"

The regulatory basis for acceptance of STD COL 9.1-5, addressing the ISI program for the OHLHS is based on GDC 4 and the guidelines of NUREG-0612, which references ANSI B30.2, "Overhead and Gantry Cranes"; ANSI N14.6, "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds or More," ASME NOG-1, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)"; and ANSI B30.9, "Slings."

The regulatory basis for acceptance of STD COL 9.1-6, addressing operating radiation monitor on any crane handling fuel is based on the requirements of GDC 61.

9.1.5.4 *Technical Evaluation*

The NRC staff reviewed Section 9.1.5 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to OHLHS. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were two open items (Open Item 9.1-3 and 9.1-4) related to the standard content in the BLN SER. Their resolutions are addressed in this SER.

The following portion of this technical evaluation section is reproduced from Section 9.1.5.4 of the BLN SER:

Supplemental Information

- *STD SUP 9.1-1, STD SUP 9.1-2, and STD SUP 9.1-3*

The staff reviewed the information provided by the applicant for STD SUP 9.1-1. The applicant stated that it did not provide an itemized list of heavy load lifts outside the scope of heavy loads described in the AP1000 DCD because no such heavy load lifts are currently planned. The applicant provided a general description for addressing heavy load movements outside the planned scope if needed in the future. However, the applicant did not address all the program elements and detail listed in NUREG-0612 Section 5.1.1 and NUREG-0800 Section 9.1.5, nor did it provide a schedule for implementation of the heavy load handling program. A heavy load handling program that meets the guidelines of NUREG-0612 and NUREG-0800 Section 9.1.5, needs to be in place at a time before there is a possibility that a load drop could cause a release of radioactivity, a criticality accident, inability to cool fuel within the reactor vessel or spent fuel pool, or prevent safe shutdown of the reactor. The staff asked the applicant in RAI 9.1.5-1 to provide the program elements specified in NUREG-0612 Section 5.1.1 and NUREG-0800 Section 9.1.5, and a schedule for implementation.

In BLN COL FSAR, Revision 1, the applicant provided the missing and necessary information specified in NUREG-0612 Section 5.1.1 and NUREG-0800 Section 9.1.5. The applicant provided a description of the key elements of the heavy load handling system program in BLN COL FSAR Section 9.1.5. The key elements are: 1) Listing of heavy loads; 2) Listing of handling equipment; 3) Safe load paths definition, location and evaluation; 4) Procedures and maintenance manuals; 5) Inspection and testing; 6) Personnel qualification and training; and 7) Quality Assurance (QA) program to monitor and implement the heavy loads program. Also, the BLN COL FSAR, Revision 1 Section 9.1.5 describes the heavy loads handling system procedures. Because Section 9.1.5 of the BLN COL FSAR includes the key elements identified in NUREG-0612, the staff finds the aspects of RAI 9.1.5-1 regarding the key elements of the heavy loads program resolved. Therefore, the staff finds the applicant meets the applicable requirements of 10 CFR Part 50, Appendix A, GDC 4.

In its response to RAI 9.1.5-1, the applicant stated that details of the implementation milestones for the development of heavy load handling procedures and related engineering documents are not currently available, nor are the implementation milestones expected to be available until after a detailed construction schedule has been developed. The applicant stated that appropriate scheduling information will be provided, when available, to the NRC as necessary to support timely completion of inspection and audit functions. The applicant did not provide any schedule for when the heavy load handling program will be completed for the implementation of an approved heavy load handling program (including OHLHS procedures). The applicant is asked to revise

BLN COL FSAR Table 1.8-202 to commit in the BLN COL FSAR to implementing the heavy load handling program before receipt of fuel. This is ***Open Item 9.1-3****.*

AP1000 COL Information Items

- *STD COL 9.1-5*

The applicant provided additional information in STD COL 9.1-5 to address COL Information Item 9.1-5. COL Information Item 9.1-5 states:

> *The Combined License applicant is responsible for a program for inservice inspection of the light load handling system as specified in subsection 9.1.4.4 and the overhead heavy load handling system in accordance with ANSI B30.2, ANSI B30.9, ANSI N14.6, and ASME NOG-1 as specified in subsection 9.1.5.4.*

The commitment was also captured as COL Action Item 9.1.6-5 in Chapter 9 of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The Combined License applicant is responsible for a program for inservice inspection of the light load handling system as specified in DCD Tier 2, Section 9.1.4.4 and the overhead heavy load handling system in accordance with ANSI B30.2, ANSI B30.9, ANSI N14.6, and ASME NOG-1 as specified in DCD Tier 2, Section 9.1.5.4.*

The staff reviewed STD COL 9.1-5, which addresses COL Information Item 9.1-5 on the plant inspection program for the OHLHS. The applicant stated that the inspection program for the OHLHS is implemented through procedures and reflect the manufacturer's recommendations and the recommendations of NUREG-0612. The staff asked the applicant in RAI 9.1.5-2 to provide a copy of the procedures for verification by the staff.

In its response to RAI 9.1.5-2, the applicant stated that a plant inspection program for the OHLHS will be created using the manufacturer's recommendations and will meet the requirements outlined in applicable industry standards. The staff confirmed that BLN COL FSAR Section 9.1.5.4 was revised to provide additional information related to the description of implementing procedures. On the basis of its review, the staff finds the applicant adequately addressed that the OHLHS plant inspection program procedures will follow the equipment manufacturer's recommendations and will meet the requirements in applicable industry standards. With the addition to BLN COL FSAR Section 9.1.5.4 of a descriptive list of the minimum elements required to be addressed in the overhead heavy load handling equipment plant inspection program procedures, in addition to the other guidelines specified in Section 9.1.5 of NUREG-0800, the staff finds the applicant meets the applicable requirements of 10 CFR Part 50, Appendix A, GDC 4.

In the RAI response, the applicant stated that the schedule for issuing the procedures that implement the plant inspection program for the OHLHS are not yet available. The applicant also stated that implementation milestones are not

expected to be available until after a detailed construction schedule has been developed, but will be provided to the NRC when available to support timely completion of inspection and audit functions. Although the response to RAI 9.1.5-2 states that the plant inspection program schedule information will be provided when available, BLN COL FSAR Table 1.8-202 lists STD COL 9.1-5 as having been completed by the applicant. The staff notes that STD COL 9.1-5 has not been fully addressed. The applicant is asked to revise BLN COL FSAR Table 1.8-202 to commit in the BLN COL FSAR to implementing the plant inspection program for the OHLHS before receipt of fuel. This is ***Open Item 9.1-4****.*

- *STD COL 9.1-6*

The applicant provided additional information in STD COL 9.1-6 to address COL Information Item 9.1-6. COL Information Item 9.1-6 states:

> *The Combined License applicant is responsible to ensure an operating radiation monitor is mounted on any crane or fuel handling machine when it is handling fuel.*

The commitment was also captured as COL Action Item 9.1.6-6 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant/holder will ensure that an operating radiation monitor is mounted on any crane or fuel handling machine when it is handling fuel.*

The NRC staff reviewed STD COL 9.1-6, which addresses COL Information Item 9.1-6 related to radiation monitoring included under Section 9.1.5 of the BLN COL FSAR. The proposed mounting of an operating radiation monitor on any crane or fuel handling machine during fuel handling is included under Section 9.1.5.3 of the BLN COL FSAR. The applicant committed to develop plant procedures that will specify that an operating radiation monitor be mounted on any fuel handling machine when it is handling fuel. DCD Section 11.5.6.4 specifies the need to augment area radiation monitoring during fuel handling operations by a portable radiation monitor on the machine handling fuel. The staff finds that with the addition of the portable radiation monitor to any fuel handling machine when it is handling fuel, the BLN COL FSAR meets the applicable requirements of 10 CFR Part 50, Appendix A, GDC 61 for the prevention of unacceptable radiation exposure.

The staff finds that the applicant has adequately addressed COL Information Item 9.1-6 which would ensure that an operating portable radiation monitor is mounted on any crane when it is handling fuel.

Resolution of Standard Content Open Items 9.1-3 and 9.1-4

The VEGP applicant responded to **Open Items 9.1-3 and 9.1-4** in a letter dated December 30, 2009. The letter proposed a change to VEGP COL FSAR Section 9.1.5.4 in response to these open items instead of revising Table 1.8-202. The applicant proposed a revision to FSAR Section 9.1.5.4 to clarify that the OHLHS, including system inspections, will be

implemented prior to receipt of fuel onsite. The staff finds this acceptable since the commitment provided will ensure that the procedures will be in place and the plant inspection program will be implemented for the OHLHS prior to fuel movement. Therefore, **Open Items 9.1-3 and 9.1-4** are resolved. Incorporation of the proposed revision in the FSAR is being tracked as **Confirmatory Item 9.1-3**.

Resolution of Standard Content Confirmatory Item 9.1-3

Confirmatory Item 9.1-3 is an applicant commitment to revise its FSAR Section 9.1.5.4 to include an inspection of the OHLHS prior to receipt of fuel. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 9.1-3 is now closed.

9.1.5.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation above, the following FSAR commitment is identified as the responsibility of the licensee:

- The overhead heavy-load handling program, including system inspections, will be implemented prior to receipt of fuel onsite.

9.1.5.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to OHLHS and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Section 9.1.5 of NUREG-0800. The staff based its conclusion on the following:

- STD SUP 9.1-1, STD SUP 9.1-2, and STD SUP 9.1-3 are acceptable because the staff finds that the applicant provided supplemental information in accordance with NUREG-0612, NUREG-0800 Section 9.1.5, and Regulatory Guide (RG) 1.206, Combined License Applications for Nuclear Power Plants (LWR Edition), Section C.I.9.1.5 guidance to describe the program and schedule for the implementation of the program governing heavy-load handling.

- STD COL 9.1-5 is acceptable because the staff finds that the relevant information in the VEGP COL FSAR provided clarification that ISI of the OHLHS is part of the plant inspection program for the OHLHS, which is implemented through procedures.

- STD COL 9.1-6 is acceptable because the staff finds that the relevant information in the VEGP COL FSAR meets the applicable requirements of 10 CFR Part 50, Appendix A, GDC 61.

9.2 Water Systems

9.2.1 Service Water System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.2.1, "Station Service Water System (Open, Raw Water Cooling Systems)")

9.2.1.1 *Introduction*

The service water system (SWS) is a nonsafety-related system that supplies cooling water to remove heat from the nonsafety-related component cooling water system (CCS) heat exchangers in the turbine building. The SWS is arranged into two trains of components and piping. Each train includes one service water pump, one strainer, and a cooling tower cell as its heat sink. The heat sink for both trains is provided by a single cooling tower with two cells and a divided basin. Each train is capable of providing 100-percent of the required SWS flow for normal full power operation.

9.2.1.2 *Summary of Application*

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.2 of the AP1000 DCD, Revision 19. Section 9.2 of the DCD includes Section 9.2.1.

In addition, in VEGP COL FSAR Section 9.2.1, the applicant provided the following:

Supplemental Information

- VEGP SUP 9.2-5

The applicant provided supplemental information in Section 9.2.1.2.2, "Component Description," by adding additional text to address the SWS Cooling Tower potential interactions.

9.2.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

Although the SWS (including heat sink) is not safety-related, it is considered to be important to safety because it supports the normal (defense-in-depth) capability of removing reactor and spent fuel decay heat, it is part of the first line of defense for reducing challenges to passive safety systems in the event of transients and plant upsets, and its cooling function is important for reducing shutdown risk when the reactor coolant system (RCS) is open (e.g., during mid-loop conditions). The risk importance of the SWS makes it subject to regulatory treatment of nonsafety systems (RTNSS) in accordance with the Commission's policy for passive reactor plant designs in SECY 94-084, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs."

The NRC staff's evaluation of the SWS focuses primarily on confirming that the SWS is capable of performing its defense-in-depth and RTNSS functions; that it will not adversely impact safety-related structures, systems and components (SSCs); and that inspections, tests, analyses, and acceptance criteria (ITAAC), test program specifications, and RTNSS availability controls for the SWS are appropriate.

The regulatory basis for acceptance of VEGP SUP 9.2-5, addressing the SWS cooling tower are the guidelines of the associated acceptance criteria given in Sections 9.2.1 and 9.2.5 of NUREG-0800.

9.2.1.4 *Technical Evaluation*

The NRC staff reviewed Section 9.2.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the SWS. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 9.2-5

The cooling capability of the SWS cooling towers for the VEGP units can be adversely affected by interactions that exist between the two cooling towers. Adverse interactions can occur due to localized atmospheric influences caused by siting and relative proximity considerations. Because this is not a factor for single cooling towers, it is not addressed by the AP1000 DCD. In RAI 9.2.5-1, the NRC staff requested that the applicant address potential adverse interactions between the cooling towers for the two units and to describe in the VEGP COL FSAR any additional design provisions that are necessary, as appropriate.

In its response dated November 4, 2008, the applicant stated that VEGP Units 3 and 4 are located on the same property as the existing and operating VEGP Units 1 and 2. VEGP Units 1 and 2 are pressurized-water reactor (PWR) nuclear power plants that are also equipped with mechanical draft cooling towers. The shortest distance between the existing mechanical draft cooling towers and the AP1000 mechanical draft cooling towers is between the Unit 3 and Unit 2 cooling towers. The VEGP Unit 3 SWS mechanical draft cooling tower is located approximately 488 meters (1600 feet) from the westernmost Unit 2 mechanical draft cooling tower. The large Unit 3 turbine building structure, as well as other plant support buildings, is located between these units. The distance and obstructing buildings will disperse the plume and minimize interference effects.

In addition, the applicant stated that each AP1000 unit at VEGP conforms to the standard AP1000 plant design, which locates the SWS cooling towers immediately adjacent to the turbine building just west of the associated unit. VEGP Units 3 and 4 are separated by approximately 244 meters (800 feet), with the Unit 4 turbine building located between the Units 3 and 4 SWS cooling towers. To create a cross-unit interference condition, an SWS cooling tower plume would not only be required to travel the 244 meters (800 feet) separating the cooling towers, but also would be required to circumvent the large turbine building structure separating the towers of both units. The applicant stated that the distance and obstructing buildings will disperse the plume and minimize interference effects. Unit separation also minimizes any effects from air restriction on a two-unit site. The standard plant yard layout for a single unit locates the SWS cooling tower much closer to the associated unit's building than the distances separating the

tower from the buildings on the adjacent unit. It also should be noted that air restriction conditions between an SWS cooling tower and the buildings on its own unit lie within the scope of the standard design.

The staff's review of this RAI response, which has been incorporated into the VEGP COL FSAR, found this acceptable. The applicant adequately addressed the interactions between the existing cooling towers and the proposed cooling towers when one unit is in Mode 4 cooldown and the adjacent affected unit is operating in Mode 5 or 6 under the conditions described in AP1000 DCD, Chapter 16 availability controls. There is a minimal probability that an SWS cooling tower plume could travel to the vicinity of an SWS cooling tower on an adjacent unit. The staff concludes, based on cooling tower location, distances and spacing, yard layout, and design margins that there are no adverse impacts; therefore, RAI 9.2.5-1 is closed.

9.2.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.2.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to SWS, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Sections 9.2.1 and 9.2.5 of NUREG-0800. The staff based its conclusion on the following:

- VEGP SUP 9.2-5 is acceptable because the design of the SWS cooling towers meets the guidance in Sections 9.2.1 and 9.2.5 of NUREG-0800, with respect to consideration of adverse interactions between the SWS cooling towers on the VEGP site.

9.2.2 Component Cooling Water System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.2.2, "Cooling System for Reactor Auxiliaries (Closed Cooling Water Systems")

The CCS provides a closed loop of cooling water for reactor system components, reactor shutdown equipment, ventilation equipment, and components of the emergency core cooling system.

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.2.2, "Component Cooling Water System (CCS)," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.2.3 Demineralized Water Treatment System

The demineralized water treatment system provides the required supply of reactor coolant purity water to the demineralized water transfer and storage system. This system does not perform any safety-related function or accident mitigation, and its failure would not reduce the safety of the plant.

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.2.3, "Demineralized Water Treatment System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.2.4 Demineralized Water Transfer and Storage System

The demineralized water transfer and storage system supplies demineralized water to fill the condensate storage tank and to the plant systems that demand a demineralized water supply. This system has no safety-related function other than containment isolation, and its failure does not affect the ability of safety-related systems to perform their safety-related functions.

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.2.4, "Demineralized Water Transfer and Storage System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.2.5 Potable Water System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.2.4, "Potable and Sanitary Water Systems")

9.2.5.1 *Introduction*

The potable water system (PWS) supplies clean water from the raw water system (RWS) for domestic use and human consumption. The portion of the PWS specified in the COL application is nonsafety-related and includes design provisions for controlling the release of water containing radioactive material and preventing contamination of the PWS.

9.2.5.2 *Summary of Application*

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.2 of the AP1000 DCD, Revision 19. Section 9.2 of the AP1000 DCD includes Section 9.2.5, "Potable Water System," which addresses Section 9.2.4, "Potable and Sanitary Water Systems," of NUREG-0800.

In addition, in VEGP COL FSAR Section 9.2.5, the applicant provided the following:

Tier 2 Departure

- VEGP DEP 9.2-1

The applicant addressed the proposed departure in Section 9.2.5.3 of the VEGP COL FSAR and in Part 7 of the VEGP COL application. The AP1000 DCD states that filtered water is supplied from a site-specific water source for the PWS. For VEGP, the PWS is supplied by the well water subsystem of the RWS. The applicant states that filtration of the PWS source is not required.

AP1000 COL Information Items

- VEGP COL 9.2-1

The applicant provided additional information in VEGP COL 9.2-1 to address COL Information Item 9.2-1 in VEGP COL FSAR Sections 9.2.5.2.1, "General Description," 9.2.5.2.2, "Component Description," 9.2.5.3, "System Operation," 9.2.5.6, "Instrumentation Applications," and 9.2.12.1, "Potable Water," by providing information concerning the source of water for the PWS.

- VEGP COL 10.4-3

The applicant provided additional information in VEGP COL 10.4-3 to address COL Information Item 10.4-3 in VEGP COL FSAR Section 9.2.5.3, by providing information concerning the PWS.

9.2.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the PWS are given in Section 9.2.4 of NUREG-0800.

The regulatory basis for the review of the COL information items is established in 10 CFR Part 50, Appendix A, GDC 60, "Control of Releases of Radioactive Materials to the Environment."

The regulatory basis for the review of VEGP DEP 9.2-1 is established in 10 CFR Part 52, "Licenses, certifications, and approvals for nuclear power plants," Appendix D, "Design Certification Rule for the AP1000 Design," Section VIII.B.5.

9.2.5.4 *Technical Evaluation*

The NRC staff reviewed Section 9.2.5 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required

information relating to the PWS. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Tier 2 Departure

- VEGP DEP 9.2-1

The NRC staff reviewed VEGP DEP 9.2-1 included under Section 9.2.5.3 of the VEGP COL FSAR and in Part 7 of the VEGP COL application.

In VEGP DEP 9.2-1, the applicant proposes the source of water for the PWS as unfiltered water from the site well water subsystem of the RWS. The AP1000 DCD states that filtered water is supplied from a site-specific water source for the PWS. The unfiltered PWS source meets applicable Georgia Environmental Protection Division standards for safe drinking water; therefore, filtration of the PWS source is not necessary.

The applicant's evaluation in accordance with 10 CFR Part 52, Appendix D, Section VIII.B.5 determined that this departure did not require prior NRC approval. The NRC staff concludes that the criteria specified in Section VIII.B.5 have been satisfied and that this departure does not require prior NRC approval.

AP1000 COL Information Items

- VEGP COL 9.2-1

The applicant provided additional information in VEGP COL 9.2-1 to resolve COL Information Item 9.2-1. COL Information Item 9.2-1 states:

> The Combined License applicant will address the components of the potable water system outside of the power block, including supply source required to meet design pressure and capacity requirements, specific chemical selected for use as a biocide, and any storage requirements deemed necessary. A biocide such as sodium hypochlorite is recommended. Toxic gases such as chlorine are not recommended. The impact of toxic gases on the main control room habitability is addressed in Section 6.4.

The NRC staff reviewed the resolution to COL Information Item 9.2-1 on the source of water for the PWS included under Sections 9.2.5.2.1, 9.2.5.2.2, 9.2.5.3, 9.2.5.6 and 9.2.12.1 of the VEGP COL FSAR. In these sections, the applicant proposes to use unfiltered water from the site well water subsystem of the RWS as the source of potable water. The PWS meets or exceeds the pressure, capacity, and quality requirements of the AP1000 DCD. A discussion of the biocide used to treat the potable water is found in VEGP COL 10.4-3 and is discussed below. The staff finds this an acceptable resolution of COL Information Item 9.2-1 because the applicant has ensured the potable water supply source and the pressure requirements from the AP1000 DCD are met. The AP1000 DCD states that no interconnections exist between the PWS and any potentially radioactive system or any system using water for purposes other than domestic water service. The site-specific information provided in VEGP COL 9.2-1 is outside the power

block and not potentially contaminated by radioactive water. Therefore, the staff finds that GDC 60 is satisfied with respect to preventing contamination by radioactive water.

The staff's evaluation of control room habitability is addressed in Section 6.4 of this SER.

- VEGP COL 10.4-3

The NRC staff reviewed VEGP COL 10.4-3 related to COL Information Item 10.4-3 included under Section 9.2.5.3 of the VEGP COL FSAR, by providing information concerning the PWS. COL Information Item 10.4-3 states:

> The Combined License applicant will address the chemistry requirements for the source of potable water. A biocide such as sodium hypochlorite is recommended. In addition, if a municipal site-specific source is not utilized, toxic gases such as chlorine are not recommended. The impact of toxic gases on the main control room habitability is addressed in [AP1000 DCD] Section 6.4.

Well water from the RWS is disinfected at the potable water storage tank using sodium hypochlorite as recommended in the AP1000 DCD. A minimum residual chlorine level of 0.2 parts per million (ppm) is maintained in the system in accordance with Georgia Safe Drinking Water standards. The AP1000 DCD states that no interconnections exist between the PWS and any potentially radioactive system or any system using water for purposes other than domestic water service. The information provided in VEGP COL 10.4-3 is not related to, and does not affect the PWS regarding prevention of contamination by radioactive water. Therefore, the staff finds that compliance with GDC 60 is satisfied with respect to preventing contamination by radioactive water.

9.2.5.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.2.5.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to PWS, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidance in Section 9.2.4 of NUREG-0800. The staff based its conclusion on the following:

- VEGP COL 9.2-1 is acceptable because the applicant has provided sufficient information on the source of water for the PWS to satisfy GDC 60, with respect to preventing contamination by radioactive water.

- VEGP COL 10.4-3 is acceptable because it is not related to, and does not affect the prevention of PWS contamination by radioactive water and compliance with GDC 60.

- VEGP DEP 9.2-1 is acceptable because the staff concurs that this departure does not require prior NRC approval.

9.2.6 Sanitary Drains (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.2.4, "Potable and Sanitary Water Systems")

9.2.6.1 *Introduction*

The portion of the sanitary drain system specified in the COL application is nonsafety-related. It collects sanitary wastes from plant restrooms and locker room facilities. The system design ensures that there is no possibility for radioactive contamination of the sanitary drains.

9.2.6.2 *Summary of Application*

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.2 of the AP1000 DCD, Revision 19. Section 9.2 of the AP1000 DCD includes Section 9.2.6, "Sanitary Drains," which addresses Section 9.2.4, "Potable and Sanitary Water Systems," of NUREG-0800.

In addition, in VEGP COL FSAR Section 9.2.6, the applicant provided the following:

Supplemental Information

- VEGP SUP 9.2-1

The applicant provided supplemental information by adding text to the end of Sections 9.2.6, "Sanitary Drainage System," 9.2.6.2.1, "General Description," and 9.2.6.5, "Instrumentation Application," to address the waste treatment plant being the VEGP Units 1 and 2 sewage treatment plant.

9.2.6.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for VEGP SUP 9.2-1 are given in Section 9.2.4 of NUREG-0800.

The regulatory basis for acceptance of the supplementary information is established in:

- GDC 60

9.2.6.4 *Technical Evaluation*

The NRC staff reviewed Section 9.2.6 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to sanitary drains. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Supplemental Information

- VEGP SUP 9.2-1

The NRC staff reviewed the location of the waste treatment plant included under Sections 9.2.6, 9.2.6.2.1, and 9.2.6.5 of the VEGP COL FSAR. In Sections 9.2.6.2.1 and 9.2.6.5 of the VEGP COL FSAR, the applicant proposes to treat sanitary waste onsite at the existing VEGP Units 1 and 2 sewage treatment plant. It is stated that the sewage treatment plant has sufficient capacity to treat waste from VEGP Units 3 and 4. The AP1000 DCD states that there are no interconnections between the sanitary drainage system and systems having the potential for containing radioactive material, and that the sanitary drainage system does not service facilities in radiologically controlled areas. Therefore, the staff finds the proposed location of the waste treatment plant acceptable as it does not affect compliance with GDC 60 with respect to preventing contamination by radioactive water.

9.2.6.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.2.6.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to sanitary drains, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the requirements of NRC regulations, and the acceptance criteria in NUREG-0800, Section 9.2.4. The staff based its conclusion on the following:

- VEGP SUP 9.2-1 is acceptable because the applicant has provided sufficient information on the location of the waste treatment plant to satisfy GDC 60, with respect to preventing contamination by radioactive water.

9.2.7 Central Chilled Water System (Related to RG 1.206 Section C.III.1, Chapter 9, C.I.9.2.2, "Cooling System for Reactor Auxiliaries (Closed Cooling Water Systems)")

The central chilled water system is a nonsafety system that provides chilled water to the cooling coils of the supply air handling units and unit coolers of several radiologically controlled areas of the plant.

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.2.7, "Central Chilled Water System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review

confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.2.8 Turbine Building Closed Cooling Water System

9.2.8.1 *Introduction*

The turbine building closed cooling water system (TCS) is a nonsafety system that provides closed-loop cooling for the removal of heat from heat exchangers in the turbine building and rejects the heat to either the circulating water system (CWS) or the RWS. The system consists of two 100-percent capacity pumps, three 50-percent capacity heat exchangers (connected in parallel), one surge tank, one chemical addition tank, and associated piping, valves, controls, and instrumentation. Back-washable strainers are provided upstream of each TCS heat exchanger.

9.2.8.2 *Summary of Application*

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.2 of the AP1000 DCD, Revision 19. Section 9.2 of the DCD includes Section 9.2.8.

In addition, in VEGP COL FSAR Section 9.2.8, the applicant provided the following:

Site-Specific Information Replacing Conceptual Design Information

- VEGP CDI

The applicant provided additional information to replace conceptual design information (CDI) in the AP1000 DCD with information indentifying the source of cooling water for the VEGP TCS heat exchangers.

9.2.8.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the TCS are given in Section 9.2.2 of NUREG-0800.

9.2.8.4 *Technical Evaluation*

The NRC staff reviewed Section 9.2.8 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the TCS. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

Site-Specific Information Replacing Conceptual Design Information

The AP1000 DCD states that the applicant is to provide a source of cooling water, such as circulating water, for the removing heat from the TCS heat exchangers. The AP1000 DCD leaves it up to the COL applicant to specify a specific source of cooling water for plant-specific applications. The VEGP design specifies use of the CWS for this purpose. This arrangement was reviewed and approved by the NRC during its evaluation of the AP1000 standard plant. The VEGP design is consistent with the AP1000 licensing basis as approved by the staff, which includes conformance with NUREG-0800 Section 9.2.2 (as applicable). Therefore, the supplementary design information that was provided for the VEGP TCS is acceptable.

Revision 0 of VEGP COL FSAR Section 9.2.8.2.3, "System Operations," stated that the TCS is placed in operation during the plant startup sequence prior to the operation of systems that required TCS water flow. AP1000 DCD Section 9.2.8.2.3 states that the TCS is placed in operation during the plant startup sequence [after the CWS is in operation but] prior to the operation of systems that require TCS cooling water flow. Since the VEGP deviated from the AP1000 DCD, the staff generated RAI 9.2.2-1 to address this issue.

In its response dated December 2, 2008, the applicant stated that the VEGP COL FSAR would be changed back to reflect the AP1000 DCD bracketed information related to the CWS. A COL FSAR markup was provided.

The staff's review of this change determined it is acceptable since the AP1000 DCD and the COL application are consistent. The change has been correctly incorporated in Revision 2 of the VEGP COL FSAR; therefore, RAI 9.2.2-1 is closed.

9.2.8.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.2.8.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to TCS, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines of the associated acceptance criteria given in Section 9.2.2 of NUREG-0800. The staff based its conclusion on the following:

- VEGP CDI is acceptable because the design of the TCS meets the guidance in Section 9.2.2 of NUREG-0800, with respect to the source of cooling water for the removing heat from the TCS heat exchangers.

9.2.9 Waste Water System (Related to RG 1.206 Section C.III.1, Chapter 9, C.I.9.3.3, "Equipment and Floor Drainage System"

9.2.9.1 *Introduction*

The portion of the waste water system (WWS) specified in the COL application is nonsafety-related. The system collects and processes the waste water from the equipment and floor drains in the nonradioactive building areas during plant operations and outages. The waste water from the turbine building sumps flows to a waste water retention basin, if required, for settling of suspended solids and treatment before discharge. The wastewater retention basin transfer pumps discharge the basin effluent to the blowdown sump prior to discharge to the Savannah River via the outfall piping. The design of the system precludes inadvertent discharge of radioactively contaminated drainage.

9.2.9.2 *Summary of Application*

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.2 of the AP1000 DCD, Revision 19. Section 9.2 of the AP1000 DCD includes Section 9.2.9, "Waste Water System," which addresses Section 9.3.3, "Equipment and Floor Drainage System," of NUREG-0800.

In addition, in VEGP COL FSAR Section 9.2, the applicant provided the following:

AP1000 COL Information Item

- VEGP COL 9.2-2

The applicant provided additional information in VEGP COL 9.2-2 to address COL Information Item 9.2-2, by including additional design information to the waste water retention basin portion of AP1000 DCD Sections 9.2.5, 9.2.9.2.1, 9.2.9.2.2 and 9.2.11.2.

Supplemental Information

- VEGP SUP 9.2-2

The applicant provided a cross-reference in Section 9.2.9.2.1 to supplemental information regarding the design and routing of the condenser waterbox drains in Section 10.4.5.2.2 of the VEGP COL FSAR.

- VEGP SUP 9.2-3

The applicant added supplemental information regarding the blowdown sump in AP1000 DCD Section 9.2.9.2.2.

9.2.9.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the WWS are given in Section 9.3.3 of NUREG-0800.

The regulatory basis for acceptance of the COL information item is established in:

- GDC 4
- GDC 60

9.2.9.4 *Technical Evaluation*

The NRC staff reviewed Section 9.2.9 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the WWS. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the information in the VEGP COL FSAR:

AP1000 COL Information Item

- VEGP COL 9.2-2

The applicant provided additional information in VEGP COL 9.2-2 to resolve COL Information Item 9.2-2. COL Information Item 9.2-2 states:

> The Combined License applicant will address the final design and configuration of the plant waste water retention basins and associated discharge piping, including piping design pressure, basin transfer pump size, basin size, and location of the retention basins.

The NRC staff reviewed the resolution to VEGP COL 9.2-2 with respect to the design of the plant waste water retention basin (WWRB) and associated components included under Section 9.2.9.2.1, "General Description" and Section 9.2.9.2.2, "Component Description" of the VEGP COL FSAR. To address VEGP COL 9.2-2, details were provided for the location of the waste water retention basin and routing configuration.

The wastewater from the WWRB is discharged to the Savannah River through a blowdown sump with inputs from the wastewater basin and CWS cooling tower blowdown. The method for forwarding the wastewater from the basin to the blowdown sump is by use of two submersible-type basin transfer pumps. In the event of oily waste leakage into the retention basin, a recirculation line is provided to recycle the oil/water waste from the basin to the oil separator. In the event of radioactive contamination, this same line can be used to send the contents of the basin to the liquid radioactive waste system (WLS).

In order to meet GDC 60, the applicant needs to demonstrate suitable control of the release of radioactive materials in liquid effluent. Upon review of VEGP COL 9.2-2, the staff requested the applicant, in RAI 9.3.3-1, to provide a discussion on whether all site-specific potentially radioactive fluid draining into and downstream of the water basin will be monitored prior to disposition or provide a justification for not providing radiation monitoring. The staff also requested the applicant to provide the additional details of the associated components (i.e., transfer pumps, size of basin, etc.) as requested in the COL item.

In a letter dated April 15, 2010, the applicant provided detailed information on radiation monitoring, level instrumentation and components for the WWS. The WWRB is a lined basin with two compartments and is constructed such that its contents, dissolved or suspended, do not penetrate the liner and leach into the ground. The applicant confirmed that the potentially contaminated fluids entering the WWRB from the turbine building sumps are monitored with a radiation monitor on the common discharge piping. As indicated in the RAI response, there are several effluent lines within the scope of the certified design that bypass this radiation monitor. The RAI response clarifies that these lines do not come in contact with radioactive sources or are monitored for radiation prior to discharge into WWRB. Wastewater can also be sampled prior to discharge from the WWRB. The applicant indicated that for VEGP Units 3 and 4, there are no additional "site–specific" influent streams to the WWRB outside of those associated with the certified design.

Two 100 percent capacity submersible-type pumps send waste water from the WWRB to a blowdown sump. Each pump is sized to meet the maximum expected influent flow to prevent overflow of the basin.

The blowdown sump, common to both VEGP Units 3 and 4, receives input from the WWRB and the CWS cooling tower blowdown and is located to the northeast of VEGP Units 3 and 4, outside of the protected area. A connection with the river water subsystem of the RWS provides an alternate dilution source to the blowdown sump.

The effluent then flows from the blowdown sump to the outfall structure, and then finally to the Savannah River. Effluent from the blowdown sump mixes downstream with a small waste stream from the liquid radioactive waste system monitor tanks and is discharged eastward to the Savannah River. The liquid radwaste is monitored for radiation and is addressed in detail in Section 11.2. To prevent radioactive contamination of the blowdown sump, the location of the tie-in between the liquid radwaste and the outfall is downstream and below the bottom elevation of the blowdown sump. Therefore, there is no potential for contamination of the blowdown sump via the WLS piping. Based on the content in VEGP COL FSAR Section 9.2.9 and the RAI 9.3.3-1 response, the staff concludes that the design of the WWS complies with GDC 60, with respect to control of radiation release to environment.

To protect against flooding, level instrumentation is provided at the WWRB and controls are provided for automatic or manual operation of the pumps based on the level of the retention basin. Each WWRB is located northwest of the associated power block and the normal WWRB water level is at or below grade. In response to RAI 9.3.3-1, the applicant indicated that site grading ensures that there will be no adverse impact on safety-related or RTNSS SSCs in the unlikely event of an overflow of the WWRB.

The outfall pipe is sized with adequate capacity to gravity drain the blowdown sump at the highest anticipated influent flow rate. Therefore, no level instrumentation is provided at the blowdown sump. As clarified in RAI 9.3.3-1 response, the blowdown sump is located well away from the power block (approximately 2500 feet) and site drainage features ensure that there will be no impact on safety-related or RTNSS SSCs in the unlikely event of an overflow of the sump. Based on the content in VEGP COL FSAR Section 9.2.9 and the RAI 9.3.3-1 response, the staff concludes that the design of the WWS complies with GDC 4, with respect to flood protection.

In regard to the location of the WWRB and associated plant outfall, the applicant provided a detailed description of the location of the WWS components in the RAI 9.3.3-1 response. The

RAI response states, “Although not labeled, the WWRBs and the blowdown sump are shown in FSAR Figure 1.1-202. The Unit 3 WWRB is a rectangular structure centered at approximate coordinates E75+00, N82+00. The Unit 4 WWRB is a rectangular structure centered at approximate coordinates E67+00, N82+00. The blowdown sump is a small, square structure centered at approximate coordinates E87+00, N104+00. The full routing of the outfall piping, although not shown in the figure, roughly follows the road eastward from the blowdown sump to the river, where the outlet is shown and labeled as the ‘Discharge Line Units 3 & 4’."

Based on the information provided in VEGP COL FSAR Section 9.2.9 and the response to RAI 9.3.3-1, the staff finds that the VEGP COL FSAR adequately addresses COL information item VEGP COL 9.2-2. The staff finds that GDC 4 is met based on the WWS arrangement to prevent flooding that could affect safety-related SSCs adversely. The staff also finds that the WWS meets GDC 60 requirements for controlling the release of radioactive materials by preventing the inadvertent transfer of contaminated fluids to system portions for non-contaminated drainage. Therefore, RAI 9.3.3-1 is closed and incorporation of the proposed markup into a future revision of the VEGP COL FSAR is identified as **Confirmatory Item 9.2-1**.

Resolution of VEGP Site-specific Confirmatory Item 9.2-1

Confirmatory Item 9.2-1 is an applicant commitment to revise its FSAR Section 9.2.9 to include additional clarification and details to more fully address VEGP COL 9.2-2. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 9.2-1 is now closed.

Supplemental Information

- VEGP SUP 9.2-2

The applicant provided a cross-reference in Section 9.2.9.2.1 to supplemental information regarding the design and routing of the condenser waterbox drains in Section 10.4.5.2.2 of the VEGP COL FSAR. The waterbox drain configuration is addressed as part of VEGP COL 10.4-1 in Section 10.4.5 of this SER.

- VEGP SUP 9.2-3

The applicant added supplemental information regarding the blowdown sump and plant outfall in AP1000 DCD Section 9.2.9.2.2. The additional content describes components in the final site design and configuration. This supplemental information is reviewed above in this SER section and does not affect the WWS function.

9.2.9.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.2.9.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff’s review confirmed that the applicant addressed the required information relating to the WWS, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff’s technical evaluation of the information

incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Section 9.3.3 of NUREG-0800. The staff based its conclusion on the following:

- VEGP COL 9.2-2 is acceptable because the staff finds that the relevant information in the VEGP COL FSAR meets the applicable requirements of GDC 4 and GDC 60.

- VEGP SUP 9.2-3 is acceptable because the staff finds that the relevant information in the VEGP COL FSAR meets the applicable requirements of GDC 4 and GDC 60.

9.2.10 Hot Water Heating System

The hot water heating system is a nonsafety-related system that supplies heated water to selected nonsafety air handling units and unit heater in the plant during cold weather operation, and to the containment recirculation fan coil units during plant outages in cold weather.

Section 9.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.2.10 of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.2.11 Raw Water System

9.2.11.1 *Introduction*

The RWS is a nonsafety-related system that consists of two subsystems: the RWS river water subsystem and the RWS well water subsystem.

The RWS river water subsystem draws water from the Savannah River for makeup to the CWS natural draft cooling tower basins for the VEGP units and provides dilution water for radwaste when the CWS is not available. Major components include an intake canal and intake structure, trash racks, traveling screens, screen wash pumps, river water pumps, piping and controls. The intake canal and intake structure are shared between the two units. Each unit has three intake structure pump wells, three 50-percent capacity river water pumps, and associated supply piping. The RWS river water subsystem pump discharge piping can be cross-connected between the two VEGP units.

The RWS well water subsystem pumps water from two wells to supply water to the well water storage tank and is shared between the two VEGP units. Water from the well water storage tank is used to replenish the mechanical draft cooling tower basins for the SWS and to supply water to the demineralized water treatment system, the primary and secondary fire water storage tanks, and the PWS. Other miscellaneous uses include lubrication and cooling water for the CWS pumps.

9.2.11.2 *Summary of Application*

Section 9.2.11 of the VEGP COL FSAR, Revision 5, provides information concerning the RWS design basis, system description, system operation, safety evaluation, tests and inspections, and instrumentation. The RWS was referred to in the AP1000 DCD in relation to the CWS, SWS, DTS, and fire protection system (FPS), but an RWS section was not included in the AP1000 DCD for the NRC staff to evaluate.

In addition, Table 1.7-2 in the AP1000 DCD indicates that the RWS is "wholly out of scope." The RWS is needed in order to operate the VEGP units and consequently, the applicant has provided a complete description of this system in the VEGP COL FSAR for the VEGP units.

In VEGP COL FSAR Section 9.2.11, the applicant provided the following:

Interface Requirements

The plant interfaces for the RWS are identified in Table 1.8-205 of the VEGP COL FSAR as Item 9.4, "Plant makeup water quality," and Item 9.5, "Requirements for location and arrangement of raw water system." These items are identified as "non-nuclear safety (NNS)" interfaces.

Supplemental Information

- VEGP SUP 9.2-4

The applicant provided supplemental information by adding the new Section 9.2.11 after AP1000 DCD Section 9.2.10.

9.2.11.3 *Regulatory Basis*

Because the RWS was not considered within the scope of the AP1000 DCD, a regulatory basis for this system was not established for the standard plant design. The regulatory basis of the RWS for the VEGP units is provided in this section.

The acceptance criteria that pertain to CWS and RWS evaluations are given in NUREG-0800, Sections 10.4.5, "Circulating Water System"; 9.2.1, "Station Service Water System"; 9.2.5, "Ultimate Heat Sink"; 3.4.1, "Flood Protection"; and 3.5, "Barrier Design for Missile Protection."

The regulatory bases for acceptance of the supplemental information and interface items are established in:

- GDC 2, "Design Basis for Protection Against Natural Phenomena"
- GDC 4
- RG 1.29, "Seismic Design Classification," Revision 4, Position C2
- 10 CFR 20.1406, "Minimization of Contamination"

9.2.11.4 *Technical Evaluation*

The staff reviewed the information provided in Section 9.2.11 of the VEGP COL FSAR that describes the RWS for the VEGP units, including the information provided by Figure 9.2-201, "Raw Water System Well Water Subsystem." The staff's evaluation in this section focuses primarily on RWS failure considerations and on the capability and reliability of the RWS to perform its cooldown function. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The remainder of this SER section evaluates both VEGP SUP 9.2-4 and Interface Items 9.4 and 9.5.

A. GDC 2, GDC 4, and RG 1.29

The staff's review of the information in VEGP COL FSAR Section 9.2.11 is to confirm that RWS failures will not adversely affect SSCs that are safety-related or designated for RTNSS, or impact the control room occupants. Although VEGP COL FSAR Section 9.2.11.1.1, "Safety Design Basis," states that failures of the RWS or its components will not affect the ability of safety-related systems to perform their intended functions, the staff felt that more detailed information was needed to adequately describe the consequences of RWS failures and to explain why safety-related SSCs are not affected. Likewise, the staff determined that additional information was needed to explain why a failure of the RWS will not adversely affect RTNSS systems and components or impact the control room occupants. Because the applicant did not identify and address these considerations, the staff was unable to confirm compliance with GDC 2, GDC 4, and passive plant policy considerations. Consequently, the staff requested in RAI 9.2.1-1, and supplemental RAI 9.2.1-4, that the applicant revise VEGP COL FSAR Section 9.2.11 to address the impact of RWS failures, including development of plant-specific ITAAC and test program specifications, as appropriate.

In a letter dated March 12, 2009, for RAI 9.2.1-4, the applicant provided a detailed response to the GDC 2, GDC 4, and ITAAC and testing questions. In its response, the applicant stated that failure of the RWS piping located in the yard and inside the turbine building were considered. A summary of the applicant's response is described below.

1. River Water Subsystem

   The river water subsystem of the RWS does not directly interface with any safety-related or Class D system. The piping is routed underground from the river intake structure to the main cooling towers. The aboveground portions of the RWS are at the river intake structure and at the CWS cooling tower basins. Other above ground portions include branch lines that provide alternate dilution flow to the blowdown sump. The river water subsystem piping system is not routed in close proximity to any safety-related or Class D SSCs, and the only RTNSS system that is in close proximity is the SWS. A resultant flood from a break in the RWS river water subsystem piping is bounded by the analysis for a break in the CWS piping. AP1000 DCD Tier 2, Section 3.4.1.1.1, "Protection from External Flooding," indicates that a failure of the CWS cooling tower, the SWS piping, or the CWS piping under the yard could result in a potential flood source. However, these potential sources are located far from safety-related structures, and the consequences of a failure in the yard would be enveloped by the analysis described in AP1000 DCD

Section 10.4.5, “Circulating Water System,” for failure of the CWS, and the site grading would carry water away from safety-related or AP1000 Class D systems.

2. Well Water Subsystem

The well water subsystem of the RWS interfaces with the SWS, which is a Class D system. The well water subsystem is supplied from two wells located south of the CWS cooling towers that pipe water to the 1,135,000 liters (300,000 gallons) well water storage tank, also located south of the CWS cooling towers. Well water from the storage tank is then pumped by the well water transfer pumps to the various system demand points located throughout the power block and yard area. The well water transfer pumps are located in the well water pump house, located near the well water storage tank. The majority of the well water subsystem piping is routed underground. The only aboveground portions are at the deep wells, the well water pump house and where the piping interfaces with the demand point. The RWS interfaces with the CWS, the yard fire water system (YFS), the PWS and the FPS are located outside of the plant in the yard. This piping is not routed in close proximity to safety-related SSCs.

3. Other Considerations

The interfaces with the FPS are in relatively close proximity to the buried CWS pipes. A break in the RWS well water piping in the yard area is bounded by a break in the CWS. As discussed in AP1000 DCD Tier 2, Section 3.4.1.1.1, a failure of the cooling tower, the SWS or the CWS piping under the yard could result in a potential flood source. The consequences of a failure in the yard would be enveloped by the analysis described in AP1000 DCD Tier 2, Section 10.4.5, for failure of the CWS. Site grading will carry the water away from safety-related or important to safety SSCs.

Chemical treatment is not anticipated for the RWS at VEGP Units 3 and 4; therefore, there are no control room habitability concerns related to a chemical release associated with the RWS. In addition, the RWS does not have the potential to be a flow path for radioactive fluids as indicated in VEGP COL FSAR Section 9.2.11.1.1 and as shown in VEGP COL FSAR Figure 9.2-201, Sheets 1 and 2 because it has no interconnection with any system that contains potentially radioactive fluids. The RWS river water subsystem operates at a higher system pressure than those systems with which it directly interfaces (at the point of interface) and, therefore, in-leakage is not feasible. Although the RWS river water subsystem supplies an alternate source of dilution water to the WWS blowdown sump, the piping configuration precludes contamination of the RWS via the WLS. The discharge from the blowdown sump is directed to the river by an outfall pipe that discharges the water by gravity to the river. The WLS discharges its waste approximately 30.5 meters (100 feet) below the elevation of the blowdown sump. Additionally, the blowdown sump is open to atmosphere and receives the RWS dilution flow. Because of the elevation differential of approximately 30.5 meters (100 feet) and piping configuration, the possibility of releasing radioactivity from the RWS is not credible.

As described in VEGP COL FSAR Section 14.2.9.4.24, “Raw Water System,” initial testing, which is to be performed on the RWS, included system performance and structural and pressure integrity of system components.

The staff finds the applicant's response to RAI 9.2.1-4 acceptable. Failure of the RWS or its components will not affect the ability of any safety-related systems to perform their intended safety functions nor will it adversely affect any RTNSS. Postulated breaks in the RWS piping will not impact safety-related components because the RWS is not located in the vicinity of any safety-related equipment, and the water from the postulated break will not reach any safety-related equipment or result in impact to the control room occupants. Testing of the RWS has been properly addressed. As described in VEGP COL FSAR Section 14.2.9.4.24, "Raw Water System," initial testing to be performed on the RWS will include system performance and structural and pressure integrity of system components. RWS instrumentation requirements have been satisfied based on the staff's review of the instrumentation application of the RWS as described in VEGP COL FSAR Section 9.2.11.6, "Instrumentation Application," and Figure 9.2-201 (Sheets 1 and 2). The plant operators have sufficient indications of system alarms to identify component failures such as traveling screens, strainers, water level, and system pressures. Since the RWS is not safety-related and its failure does not lead to the failure of any safety-related systems, the staff has concluded that the requirements of GDC 2 and 4 have been satisfied; therefore, RAIs 9.2.1-1 and 9.2.1-4 are closed.

B. Cold Shutdown

The RWS is relied upon for achieving and maintaining cold shutdown conditions, which is necessary for satisfying technical specification requirements. In particular, the RWS is relied upon for cooling the RCS from Mode 4 to Mode 5 conditions within 36 hours. The staff found that VEGP COL FSAR Section 9.2.11 did not provide a clearly defined design basis with respect to the RWS cooldown function, and the reliability and capability of the RWS to perform this function for the most limiting situations were not described and addressed in this regard. For example, the minimum RWS flow rate, water inventory, temperature limitations, and corresponding bases for providing SWS makeup for the two VEGP units were not described. Also, the suitability of RWS materials for the plant-specific application and measures being implemented to resolve vulnerabilities and degradation mechanisms to assure RWS functionality over time were not addressed. Because the applicant did not adequately define and address RWS design-bases considerations with respect to its cooldown function, the staff was unable to confirm that the cooldown and policy considerations that apply to passive plant designs were satisfied. Consequently, the staff requested in RAI 9.2.1-2 and supplemental RAI 9.2.1-5 that the applicant revise VEGP COL FSAR Section 9.2.11 accordingly, and to develop plant-specific ITAAC and initial test program specifications, as appropriate.

In a letter dated March 12, 2009, for RAI 9.2.1-5, the applicant stated that the VEGP RWS was designed to be a "highly reliable and robust system" capable of operating during a loss of normal alternating current (ac) power to provide RWS makeup flow under normal and abnormal conditions. A summary of the applicant's response is described below.

> The RWS river water subsystem provides river water for makeup to the CWS cooling tower, provides dilution water to the Units 3 and 4 blowdown sump, and fill water for the CWS piping. The RWS well water subsystem provides well water for makeup to the SWS, PWS, YFS, and DTS. The well water subsystem also provides lubrication and cooling water to the CWS pumps and well water for miscellaneous plant uses. Because the RWS river water subsystem does not have a direct interface with any other system identified in the AP1000 design, which is safety-related, designated RTNSS or designated Class D, this response specifically focuses on the RWS well water subsystem interface with the SWS.

As described in AP1000 DCD Section 5.4.7.1.2.1, “Shutdown Heat Removal,” the normal residual heat removal system (RNS) in conjunction with its associated support systems, CCS and SWS, are used for shutdown heat removal. The RWS provides indirect support for this function by providing a source of makeup water to the SWS cooling tower basins to compensate for evaporation, drift, and blowdown. The RWS provides this makeup water to support the cooling requirements for SWS. During a normal plant cooldown, RNS and CCS reduce the temperature of the RCS from approximately 177 °Celsius (C) (350 °Fahrenheit (F)) to approximately 52 °C (125 °F) within 96 hours after shutdown. In addition, SWS has short-term availability controls as described in AP1000 DCD Table 16.3-2, “Investment Protection Short-term Availability Controls.” The availability controls are applicable in Mode 5 with the RCS pressure boundary open and in Mode 6 with the upper internals in place or cavity level less than full.

In the unlikely event of a failure of the RWS to provide adequate makeup flow to the SWS cooling tower basins during the short time period in which the SWS is performing an RTNSS function as stated above, the remaining water inventory in the service water cooling tower basins and the stored water, which is available in the upper region of the secondary fire water tank provide at least 24 hours to restore the RWS makeup flow or take the procedural actions necessary to exit the conditions for applicability controls. However, the RWS is designed to be a highly reliable and robust system, capable of operating during a loss of normal ac power to provide RWS makeup flow under normal and abnormal conditions. Procedural controls, which provide for continued operation of the RWS or re-establishment of operations under off-normal conditions, will be included in the operating procedures, where appropriate.

As noted in the VEGP Early Site Permit Application (ESP) Site Safety Analysis Report (SSAR) Section 2.4.12.2, “Regional and Local Groundwater Use,” the makeup well water pumps draw water from the Cretaceous aquifer, which has sufficient capacity to support operation of the makeup well water pumps to support cooldown to cold shutdown conditions and maintain VEGP Units 3 and 4 in Mode 5 for greater than 7 days.

The RWS well water subsystem is designed to provide ample makeup flow to both unit’s SWS cooling tower basins during these conditions using the makeup well water pumps and the well water transfer pumps. Each makeup well water pump is capable of providing 5,678 liters per minute (lpm) (1,500 gallons per minute (gpm)) to the well water tank. Each of the four well water transfer pumps is capable of providing 2,839 lpm (750 gpm) to the RWS distribution piping and will automatically start as required to support demand.

Based on Westinghouse’s AP1000 design data, the maximum makeup requirement for the SWS for both units is 6,284 lpm (1,660 gpm) (3,142 lpm – (830 gpm per unit), which includes a blowdown flow of 776 lpm (205 gpm) per unit. This flow represents a design maximum, occurring four hours after a simultaneous shutdown of both units, when the maximum SWS heat load decreases during cooldown with an accompanying decrease in makeup requirements. There are two makeup well water pumps, each with a design flow rate of 5,678 lpm (1,500 gpm). In the event of a pump failure, a single makeup well water pump is sufficient to support SWS makeup to both units by adjusting the blowdown rate as required. There are four 2,839 lpm (750 gpm) capacity well water transfer pumps. A failure of one well water transfer pump leaves 8,517 lpm (2,250 gpm)

of pumping capacity, which is more than adequate to provide for SWS makeup. The Westinghouse AP1000 design data also indicates that an RWS flow of approximately 409 lpm (108 gpm) will provide sufficient makeup to account for evaporation and drift losses from the SWS cooling tower following the first 28 hours of a loss of offsite power (LOOP) scenario. This would equate to 818 lpm (216 gpm) for two units. This value is well within the 5,678 lpm (1,500 gpm) capability of a single makeup well water pump and 2,839 lpm (750 gpm) capacity of a single well water transfer pump. Therefore, as stated in VEGP COL FSAR Section 9.2.11.3.2, "RWS Well Water Subsystem," one well water pump and one well water transfer pump will support both units in a LOOP scenario.

If cooldown to cold shutdown (Mode 5) is required within 36 hours to comply with a limiting condition of operation (LCO) in accordance with the Technical Specifications, heat will be transferred from the RCS via the steam generators to the main steam system for a longer period of time, allowing RNS to be placed in service at a lower temperature with lower decay heat levels. Because of the reduced RNS heat removal requirements associated with this cold shutdown sequence, the required RWS makeup flow to the SWS cooling towers is less than normal cooldown requirements. An ample inventory of water is available to provide makeup to the SWS cooling tower basins for both VEGP Units 3 and 4 simultaneously.

The underground RWS piping will be designed and installed to American Society of Mechanical Engineers (ASME) B31.1, "Power Piping," and made from high-density polyethylene (HDPE), which is not susceptible to corrosion. Heat tracing has been provided on aboveground pipe lines that are susceptible to freezing.

The well water subsystem is designed to prevent transient water hammer associated with the restart of system pumps following a loss of normal power. The majority of the system piping is buried below grade; whereas, the system demand points and the well water tank are located above grade. Therefore, drainage of large sections of pipe is precluded. In addition, the well water subsystem is equipped with check valves and air release valves as required to prevent the formation of voids within the piping.

The lack of designation of the RWS as RTNSS or Class D indicates there is no performance requirement for the system during a LOOP or in the event of a single active failure. Nonetheless, a single failure of an active component in the RWS would not affect normal plant cooldown. A 1,135,000-liter (300,000-gallon) well water tank provides operational flexibilities should both makeup well water pumps becomes unavailable. Only one of the two makeup deep well water pumps, which are separated by a minimum of 305 meters (1000 feet), and two of the four well water transfer pumps are required to support makeup to the SWS cooling tower basins for both VEGP units during all modes of SWS operation. Failure of an operating pump or electrically-operated valve in the makeup path to the SWS would not prevent the RWS from providing makeup to either of the SWS cooling towers. In addition, the power supplies for the makeup well water pumps, the well water transfer pumps and the components supporting this function are powered from the offsite retail power system normal ac power system, specifically, the Plant Wilson loop, and have a backup power supply from a dedicated well water pump house package diesel generator, with a capacity sufficient to power all necessary pumps and components simultaneously. This package diesel also supplies backup power to the PWS. In the event of a loss of normal

ac power, all components are automatically transferred to the diesel power feed. Operator actions are proceduralized to manipulate SWS blowdown and RWS makeup supply control valves as required.

The staff finds the applicant's response to RAI 9.2.1-5 acceptable. The staff finds that the RWS is designed with adequate materials, redundant pumps and with the provision of single failure since the RWS well water subsystem components can be supplied with backup power from the package well water pump house diesel generator as necessary. Buried HDPE will be designed and installed in accordance with industry codes such as ASME B31.1 and American Water Works Association (AWWA) C906, "Polyethylene (PE) Pressure Pipe and Fittings, 4 in (100mm) through 63 in (1,575mm), for Water Distribution and Transmission." This material is an industry-proven material that is corrosion resistant inside and out, hydraulically smooth, and tends to resist buildup (biofouling) so the inner surface usually remains in this condition throughout the service life of the pipe. In addition, HDPE has a life expectancy of approximately 50 years. Ultraviolet protection is of no concern since the RWS HDPE piping will be buried. HDPE materials are well within the temperature and pressures ranges in which the RWS piping system will be exposed to during operations.

During a loss of station power, RWS makeup to the SWS is not required for 12 hours due to existing cooling tower basin inventory. After 12 hours, onsite makeup capacity from the fire protection storage tank is available for more than an additional 12 hours. In addition, the RWS is considered highly reliable and able to supply required water for the SWS for greater than 7 days due to the redundancies of pumps and other well water subsystem components. As part of the response to RAI 9.2.1-5, the applicant also provided an extensive markup of VEGP COL FSAR Section 9.2.11. Based on the staff's review of the supplied markup of the VEGP COL FSAR, which was correctly incorporated into Revision 2 of the VEGP COL FSAR, the RWS has been adequately addressed for cold shutdown consideration; therefore, RAIs 9.2.1-2 and 9.2.1-5 are closed.

C. Regulatory Treatment of Nonsafety-Related System

The RWS supports the SWS cooling function by providing makeup water to the SWS cooling tower basins. The staff noted that while the SWS is designated for RTNSS during reduced reactor inventory conditions, the RWS is evidently not needed to support the SWS cooling function when the reactor water inventory is reduced because RWS is not designated for RTNSS. However, there was no explanation in VEGP COL FSAR Section 9.2.11 as to why this is the case. Also, because the SWS cooling tower basins are very limited in their capacity, it was not clear why RWS makeup is not required for this situation. Consequently, the staff requested in RAI 9.2.1-6 that the applicant revise VEGP COL FSAR Section 9.2.11 to explain why RWS makeup is not needed during reduced reactor inventory conditions and in particular, to describe controls that will be implemented to ensure that assumptions remain valid.

In a letter dated March 12, 2009, related to RTNSS questions, the applicant stated that the RWS does not have a direct interface with any other system identified in the AP1000 design, which is safety-related; designated for RTNSS, or as designated as AP1000 Class D. The RWS provides a water fill/makeup function for the SWS, and the SWS has investment protection short-term availability controls as described in AP1000 DCD Table 16.3-2, "Investment Protection Short-Term Availability Controls," which are applicable in Mode 5 with the RCS pressure boundary open and in Mode 6 with the upper internals in place or cavity level less than full. Under these conditions, the SWS is directly providing active core cooling and was evaluated and determined to meet the RTNSS criteria as documented in NUREG-1793 and

Westinghouse Commercial Atomic Power (WCAP)-15985, "AP1000 Implementation of the Regulatory Treatment of Nonsafety-Related System Process." Unlike the SWS, RWS does not directly provide core cooling and was evaluated in WCAP-15985 and determined to not meet the RTNSS criteria and to not require investment protection short-term availability controls. Neither the SWS nor RWS are required to establish and maintain the AP1000 plant in a safe shutdown condition since passive safety-related systems perform that function. This is explicitly recognized throughout the AP1000 DCD and NUREG-1973.

In its response to RAI 9.2.1-6, which references RAI 9.2.1-5, the applicant also stated that in the unlikely event of a failure of the RWS to provide makeup flow to the SWS cooling tower basis during the short time period (as stated above) that SWS is performing a RTNSS function, the remaining inventory in the SWS cooling tower basins and water in the secondary fire tank will provide more than 24 hours to restore RWS makeup flow or take procedural actions to exit the conditions for applicability.

In summary, the staff finds the applicant's response to RAI 9.2.1-6 acceptable because the NRC previously concluded in NUREG-1793 that the SWS meets the RTNSS criteria for provided active core cooling. The RWS does not directly provided core cooling. Therefore, the staff concludes the RWS need not be considered RTNSS and RAI 9.2.1-6 is closed.

D. System Design Consideration

As specified by 10 CFR 20.1406, COL applicants are required to describe how facility design and procedures for operation will minimize the generation of radioactive waste and contamination of the facility and environment, and facilitate eventual plant decommissioning. Although the RWS has no interconnections with any systems that contain radioactive fluids, industry experience has shown that this alone may not be sufficient to prevent the RWS from becoming contaminated. For example, unplanned leaks or release of contaminated fluids as a result of component failures or transport, drainage problems in contaminated areas, and the migration of contamination through soils and other porous barriers over time have caused systems and areas of the plant that are not directly connected with contaminated systems to become contaminated. Therefore, the staff requested in RAI 9.2.1-3 that the applicant provide additional information to describe design provisions and other measures that will be implemented to satisfy the requirements specified by 10 CFR 20.1406, including measures that will be implemented to monitor the RWS for contamination and corrective actions that will be taken to eliminate any radioactive contamination that is identified.

In a response dated November 4, 2008, the applicant indicated that:

> Contamination of the RWS piping is not plausible based on the RWS design and the configuration relative to potential sources of contamination. No unique design provisions or other features are required for RWS compliance with 10 CFR 20.1406. The only buried RWS piping which is located directly north of the power block is a short portion of the RWS well water subsystem supplying well water demands in the turbine building. The buried elevation of this piping is several feet above the auxiliary building lower floor evaluation and well above the groundwater table. The various well water demands, especially makeup to the SWS cooling tower basins, require the system to be in almost constant operation, even during plant outages. Because of this, the piping is almost constantly pressurized. Therefore, migration of any potential contamination from the power block into the piping is considered very unlikely.

> RWS well water makeup wells are located well to the south of the power block and are screened in the Cretaceous aquifer which is located below the Blue Bluff Marl. The Cretaceous aquifer is considered to be confined because of the low permeability of the Blue Bluff Marl (REF. ESP SSAR Subsection 2.4.13). Therefore, in the unlikely event of a radioactive fluids release into the groundwater above the Blue Bluff Marl, contamination of the RWS well water system is considered to be very unlikely.

The staff's evaluation of the RAI found this response was acceptable. The applicant adequately described that the contamination of the RWS is not credible due to its configuration relative to potential sources of contamination and meets the intent of 10 CFR 20.1406.

The groundwater monitoring program is described in Section 12 of this SER. VEGP COL FSAR Section 12AA.5.4.14, "Groundwater Monitoring Program," describes monitoring areas of the site in the event of groundwater contaminating. In a letter dated October 30, 2009, Southern Nuclear Operating Company addressed Chapter 12 open items, including standard Open Item 12.3-1. As a result of the response provided, standard COL application changes for the incorporation of the approved version of Nuclear Energy Institute (NEI) 08-08A, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination," was incorporated into the VEGP COL FSAR.

Related to fire protection, the well water pumps are not required for post-fire safe shutdown, and the well water pump house and packaged diesel are located in the outlying area south of the cooling tower, quite far away and/or separated by 3-hour rated fire barriers from other safety-related equipment, the combustible loading/fire hazards associated with this diesel generator is not a concern and is generically addressed in VEGP COL FSAR Section 9.5, Appendix 9A, for hazards in outlying areas.

Water quality of the RWS was addressed by the applicant in VEGP COL FSAR Section 9.2.11.2.1, "General Description," which states both the RWS well water subsystem and RWS river water subsystem do not require additional water treatment. Water from the cretaceous aquifer is supplied to the fire protection system (FPS) by the RWS well pumps. FPS water quality is further discussed in Section 9.5.1.

Based on the above technical evaluation, the NRC staff finds acceptable the information added to the VEGP COL FSAR to address VEGP SUP 9.2-4 and Interface Items 9.4 and 9.5.

9.2.11.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.2.11.6 *Conclusion*

The NRC staff has evaluated the RWS as described in VEGP COL FSAR Section 9.2.11. The staff's evaluation focused primarily on confirming that: (a) the design of the RWS complies with the requirements of GDC 2 and GDC 4 and conforms with the guidance in RG 1.29; (b) the RWS reliance for the support of SWS for achieving and maintaining cold shutdown conditions and RTNSS considerations is consistent with the guidance in SECY-94-084; (c) the RWS is not considered RTNSS; (d) other system design considerations meet the requirements of 10 CFR 20.1406; and (e) the interaction with the FPS has been properly evaluated.

Based upon the results of this evaluation, the staff concludes that the VEGP RWS, as described under VEGP SUP 9.2-4 in Section 9.2.11 of the VEGP COL FSAR, including Interface Items 9.4 and 9.5, is acceptable.

9.3 Process Auxiliaries

9.3.1 Compressed and Instrument Air System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.3.1, "Compressed Air Systems")

9.3.1.1 *Introduction*

The compressed and instrument air system delivers instrument air, service air, and high-pressure air. The instrument air subsystem provides high quality instrument air for plant use. The service air subsystem supplies plant breathing air. The high-pressure air subsystem produces air for high-pressure applications.

9.3.1.2 *Summary of Application*

Section 9.3 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.3 of the AP1000 DCD, Revision 19. Section 9.3 of the AP1000 DCD includes Section 9.3.1.

In addition, in VEGP COL FSAR Section 9.3, the applicant provided the following:

AP1000 COL Information Item

- STD COL 9.3-1

The applicant provided additional information in STD COL 9.3-1 to address COL Information Item 9.3-1 (COL Action Item 9.3.1-1).

9.3.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the compressed and instrument air system are given in Section 9.3.1 of NUREG-0800.

The regulatory basis for STD COL 9.3-1 addressing Generic Safety Issue (GSI) 43, "Reliability of Air Systems," as part of training and procedures include the following:

- GDC 1, "Quality Standards and Records," as it relates to the reliability of safety-related equipment actuated or controlled by compressed air.

9.3.1.4 *Technical Evaluation*

The NRC staff reviewed Section 9.3.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed

that the information in the application and incorporated by reference addresses the required information relating to the compressed and instrument air system. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside of the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no open or confirmatory items related to the standard content in the BLN SER.

The following portion of this technical evaluation section is reproduced from Section 9.3.1.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 9.3-1 (COL Action Item 9.3.1-1), involving air systems (NUREG-0933, "Resolution of Generic Safety Issues," Issue 43)*

The NRC staff reviewed STD COL 9.3-1 related to COL Information Item 9.3-1. COL Information Item 9.3-1 states:

> *The Combined License applicant will address DCD 1.9.4.2.3, Issue 43 as part of training and procedures identified in section 13.5.*

The commitment was also captured as COL Action Item 9.3.1-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will address NUREG-0933, Issue 43 as part of training and procedures.*

The applicant proposed to resolve STD COL 9.3-1 by providing training and procedures for operations and maintenance of the instrument air subsystem and

air operated valves. The methodology to develop system operating procedures, abnormal operating procedures, and alarm response procedures is reviewed in Section 13.5 of this SER. The training program for operators and maintenance personnel is reviewed in Section 13.2 of this SER. The applicant also stated that the compressed and instrument air system will be maintained and tested in accordance with the manufacturers' recommendations and procedures and that the system will be periodically tested to demonstrate conformance with the quality requirements of ANSI/ISA-7.3-1981.

NUREG-0933, Issue 43 discusses that possible solutions for this issue, include better operator training, operator awareness of the importance of compress air systems, and periodic testing and inspection of the compressed air systems. The NRC staff reviewed the applicant's proposed resolution to STD COL 9.3-1 and determined that the BLN COL FSAR meets the guidance in NUREG-0933, Issue 43; therefore, the staff finds STD COL 9.3-1 resolved.

9.3.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.3.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to compressed and instrument air system, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Section 9.3.1 of NUREG-0800

- STD COL 9.3-1, the staff evaluated Issue 43, "Reliability of Air Systems," as part of the training and procedures in accordance with the requirements of GDC 1, as it relates to the impact of a failure of the compressed and instrument air system on safety-related SSCs. Based on the results of this evaluation, the VEGP COL FSAR meets the guidance in NUREG-0933, Issue 43 and is acceptable.

9.3.2 Plant Gas System (Related to RG 1.206 Section C.III.1, Chapter 9, C.I.9.3.1, "Compressed Air Systems")

The plant gas system is a nonsafety system that supplies hydrogen, carbon dioxide, and nitrogen gasses to plant systems as required. Failure of the system does not compromise any safety-related system nor does it prevent safe reactor shutdown.

Section 9.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.3.2, "Plant Gas System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no

outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.3.3 Primary Sampling System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.3.2, "Process and Postaccident Sampling Systems")

The primary sampling system is used to collect samples during normal operations and following an accident. The system collects for analysis samples from the reactor coolant, auxiliary primary process streams, and containment atmosphere. Both the normal operation and post accident requirements are carried out by this single system.

Section 9.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.3.3, "Primary Sampling System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.3.4 Secondary Sampling System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.3.2, "Process and Postaccident Sampling Systems")

The secondary sampling system delivers representative samples of fluids from secondary systems to sample analyzer packages. Continuous online secondary chemistry monitoring detects impurity ingress and provides early diagnosis of system chemistry excursions in the plant.

Section 9.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.3.4, "Secondary Sampling System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.3.5 Equipment and Floor Drainage Systems (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.3.3, "Equipment and Floor Drainage System")

The equipment and floor drainage system collects liquid wastes from equipment and floor drains during normal operation, startup, shutdown, and refueling. The equipment and floor drainage system consists of two subsystems, radioactive waste drains and nonradioactive waste drains.

Section 9.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.3.5, "Equipment and Floor Drainage Systems," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.3.6 Chemical and Volume Control System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.3.4, "Chemical and Volume Control System (PWR) Including Boron Recovery System")

The chemical and volume control system (CVCS) maintains the required water inventory and quality in the RCS, provides pressurizer auxiliary spray, controls the boron neutron absorber concentration in the reactor coolant, provides a means for filling and pressure testing the RCS, controls the primary water chemistry and reduces coolant radioactivity level. Further, the system provides recycled coolant for demineralized water makeup for normal operation and provides borated makeup flow to the RCS in the event of some accidents, such as a small break loss-of-coolant accident.

Section 9.3 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.3.6, "Chemical and Volume Control System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.4 Air-Conditioning, Heating, Cooling, and Ventilation Systems

9.4.1 Nuclear Island Nonradioactive Ventilation System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.4.1, "Control Room Area Ventilation System")

9.4.1.1 *Introduction*

The nuclear island nonradioactive ventilation system (VBS), in conjunction with the main control room emergency habitability system described in Section 6.4, provides a controlled environment for the comfort and safety of control room personnel and assures the operability of control room and nearby components during normal operating, anticipated operational transient, and design-basis accident conditions.

9.4.1.2 *Summary of Application*

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.4 of the AP1000 DCD, Revision 19. Section 9.4 of the DCD includes Section 9.4.1, describing the VBS.

In addition, in VEGP COL FSAR Sections 9.4.1.4 and 9.4.12, the applicant provided the following:

AP1000 COL Information Items

- STD COL 9.4-1a

The applicant provided additional information in STD COL 9.4-1a to address the first part of COL Information Item 9.4-1 (COL Action Item 9.4.1-1), related to a program for inspections and testing applicable to the VBS.

In addition, in VEGP COL FSAR Section 9.4.12, the applicant provided the following:

- VEGP COL 9.4-1b

The applicant provided additional information in VEGP COL 9.4-1b to address the second part of COL Information Item 9.4-1 (COL Action Item 6.4-3). The local toxic gas services are evaluated to determine the need for monitoring for control room habitability.

9.4.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the VBS are given in Section 9.4.1 of NUREG-0800.

The applicable regulatory guidance for the VBS is as follows:

- RG 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," Revision 2

9.4.1.4 *Technical Evaluation*

The NRC staff reviewed Section 9.4.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the VBS. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no open or confirmatory items related to the standard content in the BLN SER.

The following portion of this technical evaluation section is reproduced from Section 9.4.1.4 of the BLN SER:

AP1000 COL Information Items

- *STD COL 9.4-1a*

The applicant provided additional information in STD COL 9.4-1a to resolve COL Information Item 9.4-1. COL Information Item 9.4-1a states:

> *The Combined License applicants referencing the AP1000 certified design will implement a program to maintain compliance with ASME AG-1, ASME N509, ASME N510 and Regulatory Guide 1.140 for portions of the nuclear island nonradioactive ventilation system and the containment air filtration system identified in subsection 9.4.1 and 9.4.7.*

The commitment was also captured as COL Action Item 9.4.1-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will develop a program to maintain operability of the nuclear island nonradioactive ventilation system and the containment air filtration system.*

The NRC staff reviewed STD COL 9.4-1a related to COL Action Item 9.4-1 included under Section 9.4.1.4 of the BLN COL FSAR. The NRC staff reviewed the resolution to STD COL 9.4-1a on the proposed implementation of a program to maintain compliance with industry standards and RGs for the VBS included under Section 9.4.1.4 and Section 9.4.12 of the BLN COL FSAR, and concludes that this item has been resolved for the VBS because the applicant has referenced the applicable regulatory guide and industry standards.

Correction of Error in the Standard Content Evaluation Text

The NRC staff identified an error in the text reproduced above from Section 9.4.1.4 of the BLN SER that requires correction. The BLN SER includes the following statement: "The NRC staff reviewed STD COL 9.4-1a related to COL Action Item 9.4-1 included under Section 9.4.1.4 of the BLN COL FSAR." COL Action Item 9.4-1 does not exist and should be replaced with COL Information Item 9.4-1.

- VEGP COL 9.4-1b

The applicant provided additional information in VEGP COL 9.4-1b to resolve the second part of COL Information Item 9.4-1. The second part of COL Information Item 9.4-1 states:

> The Combined License applicant will also provide a description of the [Main Control Room] MCR/TSC HVAC subsystem's recirculation mode during toxic emergencies, and how the subsystem equipment isolates and operates, as applicable, consistent with the toxic issues, including conformance with Regulatory Guide 1.78 to be addressed by the Combined License applicant as discussed in DCD subsection 6.4.7.

The commitment was also captured as COL Action Item 6.4-3 in Appendix F of NUREG-1793, which states:

> The COL applicant will determine the amount and location of possible sources of toxic chemicals in or near the plant and for seismic Category I Class 1E toxic gas monitoring, using methods discussed in RG 1.78.

The commitment was also captured as COL Action Item 9.4.1-1 in Appendix F of NUREG-1793, which states:

> The COL applicant will develop a program to maintain operability of the nuclear island nonradioactive ventilation system and the containment air filtration system.

The NRC staff review of VEGP COL 9.4-1b is addressed in Section 6.4 of this SER.

9.4.1.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.4.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the VBS, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

The applicant has provided sufficient information for satisfying Section 9.4.1 of NUREG-0800 and RG 1.140 related to the applicable inspection and testing standards. This addresses STD COL 9.4-1a for VBS.

Conclusions regarding VEGP COL 9.4-1b are discussed in Section 6.4 of this SER.

9.4.2 Annex/Auxiliary Buildings Nonradioactive HVAC System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.4.3, "Auxiliary and Radwaste Area Ventilation System")

The annex/auxiliary building nonradioactive HVAC system maintains ventilation, permits personnel access, and controls the concentration of airborne radioactive material in the nonradioactive personnel and equipment areas, electrical equipment rooms, clean corridors, the ancillary diesel generator room and demineralized water deoxygenating room in the annex building, and the main steam isolation valve compartments, reactor trip switchgear rooms, and piping and electrical penetration areas.

Section 9.4.2 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.4.2, "Annex/Auxiliary Buildings Nonradioactive HVAC System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.4.3 Radiologically Controlled Area Ventilation System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.4.2, "Spent Fuel Pool Area Ventilation System," and C.I.9.4.3, "Auxiliary and Radwaste Area Ventilation System")

The radiologically controlled area ventilation system maintains ventilation, permits personnel access, and controls the concentration of airborne radioactive material in the fuel handling area, the radiologically controlled areas of the auxiliary and annex buildings.

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.4.3, "Radiologically Controlled Area Ventilation System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.4.4 Balance-of-Plant Interface

This section not applicable to AP1000.

9.4.5 Engineered Safety Features Ventilation System

This section not applicable to AP1000.

9.4.6 Containment Recirculation Cooling System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.4.5, "Engineered Safety Feature Ventilation System")

The containment recirculation cooling system provides a suitable and controlled environment for the containment building during normal plant operation and shutdown.

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.4.6, "Containment Recirculation Cooling System", of Revision 19 of

the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.4.7 Containment Air Filtration System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.4.5, "Engineered Safety Feature Ventilation System")

9.4.7.1 *Introduction*

The containment air filtration system (VFS) serves no safety function, except containment isolation. The system conditions and filters outside air for the containment, the fuel handling area and the other radiologically controlled areas of the auxiliary and annex buildings, except for the hot machine shop and health physics areas, which are served by a separate ventilation system.

9.4.7.2 *Summary of Application*

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.4 of the AP1000 DCD, Revision 19. Section 9.4 of the DCD includes Section 9.4.7, "Containment Air Filtration System," which addresses Section 9.4.5, "Engineered Safety Feature Ventilation System," of NUREG-0800.

In addition, in VEGP COL FSAR Section 9.4.7.4, the applicant provided the following:

AP1000 COL Information Item

- STD COL 9.4-1a

The applicant provided additional information in STD COL 9.4-1a to address COL Information Item 9.4-1 related to a program for inspections and testing applicable to the VFS included under Section 9.4.7.4 of the VEGP COL FSAR.

9.4.7.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the containment air filtration system are given in Section 9.4.5 of NUREG-0800.

The applicable regulatory guidance for the containment air filtration system is as follows:

- RG 1.140

9.4.7.4 *Technical Evaluation*

The NRC staff reviewed Section 9.4.7 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed

that the information in the application and incorporated by reference addresses the required information relating to the containment air filtration system. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no open or confirmatory items related to the standard content in the BLN SER.

The following portion of this technical evaluation section is reproduced from Section 9.4.7.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 9.4-1a*

The applicant provided additional information in STD COL 9.4-1a to resolve COL Information Item 9.4-1. COL Information Item 9.4-1 states:

> *The Combined License applicants referencing the AP1000 certified design will implement a program to maintain compliance with ASME AG-1, ASME N509, ASME N510, and Regulatory Guide 1.140 for portions of the nuclear island nonradioactive ventilation system and the containment air filtration system identified in subsection 9.4.1 and 9.4.7. The Combined License applicant will also provide a description of the MCR/TSC HVAC subsystem's recirculation mode during toxic emergencies, and how the subsystem equipment isolates and operates, as applicable, consistent with the toxic issues, including conformance with Regulatory Guide 1.78, to be addressed by the Combined License applicant as discussed in DCD subsection 6.4.7.*

The commitment was also captured as COL Action Item 9.4.1-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will develop a program to maintain operability of the nuclear island nonradioactive ventilation system and the containment air filtration system.*

The NRC staff reviewed STD COL 9.4-1a related to COL Action Item 9.4-1 included under Section 9.4.7.4 of the BLN COL FSAR.

The NRC staff reviewed the resolution to STD COL 9.4-1a on the proposed implementation of a program to maintain compliance with industry standards and RGs for the VFS included under Section 9.4.7.4 of the BLN COL FSAR, and concludes that this item has been resolved for the VFS because the applicant has appropriately referenced the applicable regulatory guide and industry standards.

Correction of Error in the Standard Content Evaluation Text

The NRC staff identified an error in the text reproduced above from Section 9.4.7.4 of the BLN SER that requires correction. The BLN SER includes the following statement: "The NRC staff reviewed STD COL 9.4-1a related to COL Action Item 9.4-1 included under Section 9.4.7.4 of the BLN COL FSAR." COL Action Item 9.4-1 does not exist and should be replaced with COL Information Item 9.4-1.

9.4.7.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.4.7.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the containment air filtration system, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In conclusion, the applicant has provided sufficient information for satisfying Section 9.4.7 of NUREG-0800 and RG 1.140 related to the applicable inspection and testing standards. This addresses STD COL 9.4-1a for VFS.

9.4.8 Radwaste Building HVAC System

The radwaste building HVAC system serves the radwaste building, which includes the clean electrical/mechanical equipment room and the potentially contaminated HVAC equipment room, the packaged waste storage room, the waste accumulation room, and the mobile systems facility.

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.4.8, "Radwaste Building HVAC System," of Revision 19 of the

AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.4.9 Turbine Building Ventilation System

The turbine building ventilation system operates during startup, shutdown, and normal plant operations. The system maintains acceptable air temperatures in the turbine building for equipment operation and for personnel working in the building.

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.4.9, "Turbine Building Ventilation System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.4.10 Diesel Generator Building Heating and Ventilation System

The diesel generator building heating and ventilation system serves the standby diesel generator rooms, electrical equipment service modules, and diesel fuel oil day tank vaults in the diesel generator building and the two diesel oil transfer modules located in the yard near the fuel oil storage tanks. Local area heating and ventilation equipment is used to condition the air to the stairwell and security room.

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.4.10, "Diesel Generator Building Heating and Ventilation System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.4.11 Health Physics and Hot Machine Shop HVAC System

The health physics and hot machine shop HVAC system serves the annex building stairwell, S02; the personnel decontamination area, frisking and monitoring facilities, containment access corridor, and health physics facilities on the 100′-0″ elevation of the annex building and the hot machine shop on the 107′-2″ elevation of the annex building.

Section 9.4 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.4.11, "Health Physics and Hot Machine Shop HVAC System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.5 Other Auxiliary Systems

9.5.1 Fire Protection System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.1, Fire Protection Program)

9.5.1.1 *Introduction*

The fire protection system provides assurance, through a defense-in-depth philosophy, that the Commission's fire protection objectives are satisfied. These objectives are: 1) to prevent fires from starting; 2) to detect rapidly, control, and extinguish promptly those fires that do occur; and 3) to provide protection for SSCs important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant. In addition, fire protection systems must be designed such that their failure or inadvertent operation does not adversely impact the ability of the SSCs important to safety to perform their safety functions. These objectives are stated in NUREG-0800, Section 9.5.1, "Fire Protection Program," and are indentified as the Fire Protection Program goals and objectives in RG 1.189, "Fire Protection for Nuclear Power Plants," Revision 1.

9.5.1.2 *Summary of Application*

Section 9.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.5 of the AP1000 DCD, Revision 19. Section 9.5 of the AP1000 DCD includes Section 9.5.1.

In addition, in VEGP COL FSAR Section 9.5.1, the applicant provided the following:

Tier 2 Departure

- VEGP DEP 18.8-1

The applicant provided this departure from the AP1000 DCD to address the relocation of the Operations Support Center (OSC). This departure is evaluated in this SER section and in Section 13.3 of this SER.

AP1000 COL Information Items

- STD COL 9.5-1 and STD COL 9.5-3

The applicant provided additional information in STD COL 9.5-1 and STD COL 9.5-3 to resolve COL Information Items 9.5-1 and 9.5-3 (COL Action Item 9.5.1-1(a) through 9.5.1-1(o)) by establishing the site-specific implementation of the fire protection program in Section 9.5.1.8, "Fire Protection Program," and in Appendix 9A of the VEGP COL FSAR.

- STD COL 9.5-4

The applicant provided additional information in STD COL 9.5-4 to resolve COL Information Item 9.5-4 (COL Action Item 9.5.1-5) by establishing Table 9.5-201, "AP1000 Fire Protection Program Compliance with BTP CMEB 9.5-1," and Table 9.5-202, "Exceptions to NFPA Standard Requirements," of the VEGP COL FSAR.

- STD COL 9.5-8

The applicant provided additional information in STD COL 9.5-8 to resolve COL Information Item 9.5-8 (COL Action Item 9.5.1-3) by establishing an administrative control procedure to address fire barrier breaches.

- STD COL 9.5-6

The applicant provided additional information in STD COL 9.5-6 to resolve COL Information Item 9.5-6 (COL Action Item 9.5.1-6) by specifying a preoperational testing program to verify field installed fire barriers are as tested, and to provide disposition for any deviation.

- VEGP COL 9.5-2

The applicant provided additional information in VEGP COL 9.5-2 to resolve COL Information Item 9.5-2 (COL Action Item 9.5.1-2) by providing site-specific fire hazard analysis of the yard area and outlying buildings in Appendix 9A, Section 9A.3.3.

Supplemental Information

- STD SUP 9.5-1

The applicant provided supplemental information in Section 9.5.1.2.1.3, “Fire Water Supply System,” by adding additional text to address the piping threads compatibility requirement between onsite hydrants, hose couplings, and standpipe risers and equipment used by the offsite fire department.

License Conditions

- Part 10, License Condition 3, Items C.2, D.1 and G.6

The applicant proposed a license condition in Part 10 of the VEGP COL application addressing the Fire Protection Program implementation milestones.

- Part 10, License Condition 6

The applicant proposed a license condition in Part 10 of the VEGP COL application to provide a schedule to support the NRC’s inspection of operational programs, including the Fire Protection Program.

9.5.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the fire protection system are given in Section 9.5.1 of NUREG-0800.

The regulatory basis for acceptance of STD COL 9.5-1, STD COL 9.5-4, STD COL 9.5-8, STD COL 9.5-6, and STD COL 9.5-3 includes the following:

- RG 1.189
- Branch Technical Position (BTP) CMEB 9.5-1, in NUREG-0800, Revision 3
- 10 CFR 50.48, "Fire Protection"

The regulatory basis for acceptance of STD SUP 9.5-1 includes the following:

- RG 1.189

9.5.1.4 *Technical Evaluation*

The NRC staff reviewed Section 9.5.1 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the fire protection system. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There was one confirmatory item (Confirmatory Item 9.5-1) related to the standard content in the BLN SER and one item related to an additional license condition item. Their resolutions are addressed in this SER.

The following portion of this technical evaluation section is reproduced[26] from Section 9.5.1.4 of the BLN SER:

Supplemental Information

- *STD SUP 9.5-1 provided supplemental information within Section 9.5.1.2.1.3, "Fire Water Supply System," addressing compatibility of piping threads with equipment used by the off-site fire department.*

The NRC staff reviewed the information on the compatibility of piping threads with off-site equipment included under Section 9.5.1.2.1.3 of the BLN COL, and determined that the applicant conforms to the guidance of RG 1.189. In accordance with the applicant's response to RAI 14.2-9, the requirement to verify fire equipment hose thread compatibility, or alternatively, an adequate supply of readily available thread adapters will be verified. This was added to the Initial Test Program outlined in Section 14.2 of the BLN COL FSAR.

AP1000 COL Information Items

- *STD COL 9.5-1 (COL Action Item 9.5-1(a)), involving qualification requirements for the fire protection program*

The applicant provided additional information in STD COL 9.5-1 to resolve COL Information Item 9.5-1. COL Information Item 9.5-1 states:

> *The Combined License applicant will address qualification requirements for individuals responsible for development of the fire protection program, training of firefighting personnel, administrative procedures and controls governing the fire protection program during plant operation, and fire protection system maintenance.*

The commitment was also captured as COL Action Item 9.5-1(a) in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will establish a fire protection program at the facility for the protection of structures, systems, and components (SSCs) important to safety. The COL applicant will also establish the procedures, equipment, and personnel needed to implement the program.*

The NRC staff reviewed the resolution to STD COL 9.5-1 on the qualification requirements for the Fire Protection Program included under Section 9.5.1.6, Section 9.5.1.8, and Section 9.5.1.9 of the BLN COL application, and determined that the above sections provided adequate details to ensure conformance with the regulatory positions contained in RG 1.189 regarding the implementation of

[26] Only the BLN SER text relevant to VEGP is reproduced here. For example, the BLN SER included a discussion of BLN SUP 9.5-2 after the discussion of STD SUP 9.5-1. Since BLN SUP 9.5-2 does not apply to VEGP, it was not reproduced here. Also, the discussion of VEGP COL 9.5-2 (corresponds to BLN COL 9.5-2) was moved to the end of this technical evaluation section.

the BLN Fire Protection Program. Such details include personnel qualifications and training, organization and responsibilities, fire brigade training, etc.

- *STD COL 9.5-4 (COL Action Item 9.5.1-5), involving NFPA exceptions*

The applicant provided additional information in STD COL 9.5-4 to resolve COL Information Item 9.5-4. COL Information Item 9.5-4 states:

> *The Combined License applicant will address updating the list of NFPA exceptions in the plant-specific DCD, if necessary.*

The commitment was also captured as COL Action Item 9.5.1-5 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant is responsible for ensuring that any deviations from the applicable National Fire Protection Association (NFPA) codes and standards in addition to those in the DCD are incorporated into the final safety analysis report (FSAR) with appropriate technical justification.*

The NRC staff reviewed the resolution to STD COL 9.5-4 under Section 9.5.1.8.1.1 and Section 9.5.1.9.4 of the BLN COL. The applicant provided for BLN COL FSAR Table 9.5-202, Exceptions to NFPA Standard Requirement, to document and justify deviations from applicable NFPA codes and standards in addition to those identified in the DCD. This provision satisfies FSER Action Item 9.5.1-5. The staff also reviewed the exception to NFPA 804 related to the intake structure as documented in Table 9.5-202 although NFPA 804 is not formally endorsed by the NRC as a regulatory guidance document. Since the exception and the provided justification are consistent with the guidance of RG 1.189, the staff finds it acceptable. Based on the above, the staff concludes that FSER Action Item 9.5.1-5 is resolved.

- *STD COL 9.5-8 (COL Action Item 9.5.1-3), establishing procedures to minimize risk for fire areas breached during maintenance*

The applicant provided additional information in STD COL 9.5-8 to resolve COL Information Item 9.5-7. COL Information Item 9.5-7 states:

> *The Combined License applicant will establish procedures to minimize risk when fire areas are breached during maintenance. These procedures will address a fire watch for fire areas breached during maintenance.*

The commitment was also captured as COL Action Item 9.5.1-3 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will establish procedures to address a fire watch for fire areas breached during maintenance.*

The NRC staff reviewed the resolution to STD COL 9.5-8 on the establishment of procedures to minimize risk for fire areas breached during maintenance included

under Section 9.5.1.8.1.2 and Section 9.5.1.9.7 of the BLN COL, and determined that the applicant has adequately included a provision to have procedures and administrative controls in place, including fire watches, when fire barriers are breached.

- *STD COL 9.5-6 (COL Action Item 9.5.1-6), involving verification of field installed fire barriers, also designated as a COL information item*

The applicant provided additional information in STD COL 9.5-6 to resolve COL Information Item 9.5-6. COL Information Item 9.5-6 states:

> *The Combined License applicant will address the process for identifying deviations between the as-built installation of fire barriers and their tested configurations.*

The commitment was also captured as COL Action Item 9.5.1-6 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will establish the process for identifying deviations between the as-built installation of fire barriers and their tested configurations.*

The NRC staff reviewed the resolution to STD COL 9.5-6 under Section 9.5.1.8.6 and Section 9.5.1.9.6. The applicant provided that new installation or modification of fire barriers not part of the AP1000 DCD will be controlled through administrative procedures. These procedures impose inspection and testing requirements to ensure that the as-built fire barrier configurations match tested configurations. These procedures also describe the process for identifying and dispositioning deviations. Based on the above, the staff concluded that FSER Action Item 9.5.1-6 is resolved.

- *STD COL 9.5-3 (COL Action Items 9.5.1-1(b) through 9.5.1-1(o)), addressing regulatory conformance*

The applicant provided additional information in STD COL 9.5-3 to resolve COL Information Item 9.5-3. COL Information Item 9.5-3 states:

> *The Combined License applicant will address BTP CMEB 9.5-1 issues. The acronym 'WA' is the identifier in Table 9.5.1-1 for "will address."*

The commitment was also captured as COL Action Items 9.5.1-1(b) through 9.5.1-1(o) in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *9.5.1-1(b) – The COL applicant will implement the fire protection program prior to receiving fuel onsite for fuel storage areas, and for the entire unit prior to reactor startup.*

9.5.1-1(c) – The COL applicant will establish administrative controls to maintain the performance of the fire protection system and personnel.

9.5.1-1(d) – The COL applicant will establish a site fire brigade that is trained and equipped for fire fighting to ensure adequate manual fire fighting capability for all plant areas containing SSCs important to safety.

9.5.1-1(e) – The COL applicant will establish a quality assurance (QA) program to ensure that the guidelines for the design, procurement, installation, and testing, as well as the administrative controls for fire protection systems are satisfied.

9.5.1-1(f) – The COL applicant is responsible for the inspection and maintenance of fire doors, access to keys for the fire brigade, and the marking of exit routes.

9.5.1-1(g) – The COL applicant is responsible for the collection and sampling of water drainage from areas that may contain radioactivity.

9.5.1-1(h) – The COL applicant is responsible for controlling the use of compressed gases inside structures.

9.5.1-1(i) – The COL applicant is responsible for the use of portable radio communication by the plant fire brigade.

9.5.1-1(j) – The COL applicant is responsible for fire protection inside containment during refueling and maintenance.

9.5.1-1(k) – The COL applicant is responsible for controlling combustible materials in the remote shutdown workstation.

9.5.1-1(l) – The COL applicant is responsible for fire protection for cooling towers.

9.5.1-1(m) – The COL applicant is responsible for the proper storage of welding gas cylinders.

9.5.1-1(n) – The COL applicant is responsible for the proper storage of ion exchange resins.

9.5.1-1(o) – The COL applicant is responsible for the proper storage of hazardous chemicals.

The NRC staff reviewed the resolution to STD COL 9.5-3 provided in Section 9.5.1.8, Fire Protection Program, and Table 9.5-201 of the BLN COL application. The staff determined that the applicant has incorporated the appropriate portions of RG 1.189 into the BLN Fire Protection Program, pending some changes to be included in Revision 2 to the BLN COL FSAR. The

applicant provided the following clarifications related to the BLN Fire Protection Program:

(1) The applicant confirmed that no operator manual actions outside of the Main Control Room are credited or required for post-fire safe shutdown.

(2) The applicant stated that the wireless telephone system is credited as the portable communication system used by the fire brigade. In the applicant's response to RAI 9.5.1-12, the wireless telephone system was confirmed to be designed with multiple antennas (repeaters) throughout the plant to maintain communication capability if individual repeater(s) are damaged from fire. Also, preoperational and periodic testing during fire drills will be performed to verify that the fire brigade portable communication system operates without excessive interference at different locations inside and outside the plant.

(3) In its response to RAI 9.5.1-9, the applicant stated that a housekeeping program is provided in order to maintain cleanliness and minimize fire hazards in the Main Control Room areas.

(4) In its response to RAI 9.5.1-14, the applicant stated that no probabilistic risk assessment (PRA) or fire modeling results will be credited to demonstrate acceptable fire hazards or post-fire safe shutdown capability for specific fire areas or scenarios.

(5) In its response to RAI 9.5.1-15, the applicant confirmed that the supply of reserve air is sufficient to provide at least 6 hours of additional breathing air for "each" of the 10 self-contained breathing apparatus (SCBA) units.

(6) In its response to RAI 9.5.1-16, the applicant proposed a change to BLN COL FSAR Section 9.5.1.8.6 to clarify that testing and inspection of fire protection systems are to be performed per NFPA 25 and NFPA 72 as appropriate. This is ***Confirmatory Item 9.5-1****.*

(7) In its response to RAI 9.5.1-17, the applicant confirmed that the design pressure of the High Pressure Air Subsystem that is used to recharge fire brigade's SCBAs is 4000 psig, and that 2216 psig SCBAs are used to ensure that the cylinders are adequately charged to provide an operating life of at least 30 minutes.

<u>License Conditions</u>

- *License Condition 3, addressing the Fire Protection Program implementation milestones*
- *License Condition 6, addressing the Fire Protection Program implementation schedule*

In Part 10 of the BLN COL FSAR, License Condition 3, "Operational Program Implementation," the applicant proposed a license condition for the

implementation of operational programs as described in Table 13.4-201 of the FSAR. This license condition included implementation milestones for the Fire Protection Program, namely D.1 and G.6. Specifically:

- *Milestone D.1 states that the applicable portions of the Fire Protection Program will be implemented prior to initial receipt of fuel onsite.*

- *Milestone G.6 states that the Fire Protection Program will be implemented prior to initial fuel load.*

In Part 10 of the BLN COL FSAR, proposed License Condition 6, "Operational Program Readiness," the applicant states:

> *The licensee shall submit to the appropriate Director of the NRC, a schedule, no later than 12 months after issuance of the COL, that supports planning for and conduct of the NRC inspection of the operational programs listed in the operation program FSAR Table 13.4-201. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operation programs in the FSAR table have been fully implemented or the plant has been placed in commercial service.*

Based on the above, the staff concludes that the applicant satisfied the documentation and implementation requirements for the Fire Protection Program in accordance with RG 1.189 by identifying and providing the implementation schedule for each of the operational program aspects of the Fire Protection Program.

Correction of Error in the Standard Content Evaluation Text

The NRC staff identified an error in the text reproduced above from Section 9.5.1.4 of the BLN SER that requires correction. The BLN SER includes the following statement: "The applicant provided additional information in STD COL 9.5-8 to resolve COL Information Item 9.5-7. COL Information Item 9.5-7 states:" The reference to COL Information Item 9.5-7 should be to COL Information Item 9.5-8.

Resolution of Standard Content Confirmatory Item 9.5-1

To resolve Confirmatory Item 9.5-1, the VEGP applicant revised FSAR Section 9.5.1.8.6 to clarify that procedures governing the inspection, testing, and maintenance of fire protection alarm and detection systems, and water-based suppression and supply systems, use the guidance of NFPA 72, "National Fire Alarm and Signaling Code," and NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," as appropriate. NFPA 25 standard is also added to VEGP COL FSAR Section 9.5.5. The staff determined that these documentation changes satisfy the requirement of standard content Confirmatory Item 9.5-1; therefore Confirmatory Item 9.5-1 is resolved.

Resolution of VEGP DEP 18.8-1

The AP1000 Annex Building does not contain any system or equipment credited for achieving and maintaining post-fire safe shutdown. As such, the relocation of the OSC in the Annex

Building as prescribed in VEGP DEP 18.8-1 has no adverse impact on the post-fire safe shutdown capability. Therefore, the staff concluded that the proposed departure, relative to post-fire safe shutdown capability, is acceptable.

Resolution of Site-Specific RAIs

In addition to the review of the standard content, the staff also reviewed VEGP site-specific content and issued two site-specific RAIs, RAIs 9.5.1-1 and 9.5.1-2, related to the fire water supply system and the qualifications of the engineer in charge of fire protection, respectively.

In its response to the site-specific RAI related to the fire water supply system, the applicant stated that no filtration or water treatment is specifically needed for the well water subsystem, which services the fire water supply system, since the water is drawn from the same cretaceous aquifer that supplies the Units 1 and 2 fire water supply system with no significant issues related to bio-fouling or microbiologically-induced corrosion. Furthermore, the well water will be sampled upon initial installation and routinely monitored as required to support the proper operation of the water treatment system on the potable water and demineralized water system. If any water quality concerns are discovered as a result of the monitoring of the well water, appropriate actions will be taken to prevent or control bio-fouling and microbiologically-induced corrosion. Based on the above, the staff finds the VEGP fire water supply system satisfies RG 1.189 and, therefore, is acceptable.

In its response to the site-specific RAI related to the qualifications of the engineer in charge of fire protection, the applicant revised Section 13.1.2.1.1.6 to state that the engineer in charge of fire protection is trained and experienced in fire protection and nuclear safety or has available personnel who are trained and experienced in fire protection and nuclear plant safety. Based on the above, the staff finds the description of the fire protection engineer qualifications is in accordance with RG 1.189 and, therefore, is acceptable.

Proposed License Condition 3, Item C.2

The VEGP applicant proposed to add another implementation milestone associated with the Fire Protection System to License Condition 3. Specifically, the applicant added Milestone C.2, which states that the applicable portions of the Fire Protection Program will be implemented prior to initial receipt of byproduct, source, or special nuclear materials onsite (excluding Exempt Quantities as described in 10 CFR 30.18). The staff concludes that the applicant satisfied the documentation and implementation requirements for the Fire Protection Program in accordance with RG 1.189 by identifying and providing the implementation schedule for each of the operational program aspects of the Fire Protection Program.

AP1000 COL Information Item

- VEGP COL 9.5-2 (COL Action Item 9.5.1-2), involving fire protection analysis information

The applicant provided additional information in VEGP COL 9.5-2 to resolve COL Information Item 9.5-2. COL Information Item 9.5-2 states:

> The Combined License applicant will provide site-specific fire protection analysis information for the yard area, the administration building, and for other outlying buildings consistent with Appendix 9A.

The commitment was also captured as COL Action Item 9.5.1-2 in Appendix F of NUREG-1793, which states:

> The COL applicant will provide site-specific fire protection analysis information for the yard area, the administration building, and other outlying buildings.

The NRC staff reviewed the resolution to VEGP COL 9.5-2 on the site-specific fire protection analysis information included under Section 9.5.1.9.2 and Section 9A.3.3 of the VEGP COL FSAR, and determined that the yard area, administration building and other outlying areas are adequately described in the fire hazard analysis, which is, therefore acceptable.

9.5.1.5 *Post Combined License Activities*

For the reasons discussed in the technical evaluation section above, the staff proposes to include the following license conditions associated with the fire protection system:

- License Condition (9-2) - The licensee shall implement the Fire Protection (FP) Program or portions of the FP Program identified below on or before the associated milestones identified below.

    1. Applicable portions of the FP Program – prior to initial receipt of byproduct, source, or special nuclear materials onsite (excluding Exempt Quantities as described in 10 CFR 30.18).

    2. Applicable portions of the FP Program – prior to initial receipt of fuel onsite.

    3. FP Program – prior to initial fuel load.

- License Condition (9-3) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO schedule that supports planning for and conduct of NRC inspections of the FP Program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the FP Program has been fully implemented.

9.5.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the fire protection system, and there is no outstanding information expected to be addressed in the

VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidance in Section 9.5.1 of NUREG-0800 and RG 1.189. The staff based its conclusion on the following:

- STD SUP 9.5-1, addressing compatibility of piping threads with equipment used by the offsite fire department, is adequately addressed by the applicant and is resolved.

- STD COL 9.5-1, addressing the qualification and training requirements for the fire protection program at VEGP, is adequately addressed by the applicant and is resolved.

- STD COL 9.5-4, addressing the deviations from the applicable NFPA codes and standards and to those in the AP1000 DCD, is also adequately addressed by the applicant and is resolved.

- STD COL 9.5-6, addressing the establishment of a process for identifying deviations between the as-built installation of fire barriers and their tested configurations is adequately addressed by the applicant and is resolved.

- STD COL 9.5-8, addressing establishment of procedures to minimize risk for fire areas breached during maintenance is adequately addressed by the applicant and is resolved.

- STD COL 9.5-3, addressing the site-specific implementation of the FP Program is adequately addressed by the applicant and is resolved.

- VEGP COL 9.5-2, addressing the site-specific fire protection analysis information for the VEGP yard areas and outlying buildings is adequately addressed by the applicant and is resolved.

- VEGP DEP 18.8-1, addressing the relocation of the OSC relative to the post-fire safe shutdown capability, is adequately addressed by the applicant and is resolved.

9.5.2 Communication System

9.5.2.1 *Introduction*

The communication system provides intra-plant communications and plant-to-offsite communications during normal, maintenance, transient, fire, and accident conditions, including loss of offsite power.

9.5.2.2 *Summary of Application*

Section 9.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.5 of the AP1000 DCD, Revision 19. Section 9.5 of the DCD includes Section 9.5.2.

In addition, in VEGP COL FSAR Section 9.5.2, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 9.5-9, involving offsite interfaces

The applicant provided additional information in VEGP COL 9.5-9 to resolve COL Information Item 9.5-9 (COL Action Item 9.5.2-3).

- VEGP COL 9.5-10, involving emergency offsite communications

The applicant provided additional information in VEGP COL 9.5-10 to resolve COL Information Item 9.5-10 (COL Action Item 9.5.2-1).

- STD COL 9.5-11, involving security communications

The applicant provided additional information in STD COL 9.5-11 to resolve COL Information Item 9.5-11 (COL Action Item 9.5.2-2).

9.5.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the communications system are given in Section 9.5.2 of NUREG-0800.

The regulatory basis for VEGP COL 9.5-9, addressing interfaces to offsite locations, is based on:

- Appendix E, “Emergency Planning and Preparedness for Production and Utilization Facilities,” to 10 CFR Part 50, Part IV.E(9)

The regulatory basis for VEGP COL 9.5-10, addressing the emergency offsite communication system, including the crisis management radio system, is based on:

- 10 CFR 50.47(b)(8), “Emergency plans”

The regulatory basis for STD COL 9.5-11, addressing the description of the security communication system is based on:

- 10 CFR 73.45 (g)(4)(i), “Performance capabilities for fixed site physical protection systems-response”

- 10 CFR 73.46 (f), “Fixed site physical protection systems, subsystem, components, and procedures-communications subsystems”

- 10 CFR 73.55(e), “Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage-physical barriers”

- 10 CFR 73.55(f), "Requirements for physical protection of licensed activities in nuclear power reactors against radiological sabotage-target sets"

9.5.2.4 *Technical Evaluation*

The NRC staff reviewed Section 9.5.2 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the communications system. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no open or confirmatory items related to the standard content in the BLN SER.

In addition, in VEGP COL FSAR Section 9.5.2, the applicant provided the following:

AP1000 COL Information Items

- VEGP COL 9.5-9

The applicant provided additional information in VEGP COL 9.5-9 to resolve COL Information Item 9.5-9. COL Information Item 9.5-9 states:

> Combined License applicants referencing the AP1000 certified design will address interfaces to required offsite locations; this will include addressing the recommendations of BL-80-15 ([DCD] Reference 21) regarding loss of the emergency notification system due to a loss of offsite power.

The commitment was also captured as COL Action Item 9.5.2-3 in Appendix F of NUREG-1793, which states:

> The COL applicant will address interfaces to offsite locations; this will include addressing the recommendations of NRC Bulletin (BL) 80-15 regarding loss of the emergency notification system as a result of loss of offsite power.

The NRC staff reviewed VEGP COL 9.5-9 involving offsite interfaces included under Section 9.5.2.2.5 and Section 9.5.2.5.1 of the VEGP COL FSAR. Section 9.5.2.5.1 of the VEGP COL FSAR states that VEGP COL 9.5-9 is addressed in Section F of the Vogtle Early Site Permit (ESP) Application, Revision 5, Emergency Plan. Section F of the VEGP ESP Emergency Plan presents the following methods of communication between the site and the NRC:

- Emergency Notification System (ENS): The ENS is provided by the Federal Telecommunications System (FTS). The ENS is the primary means of communication between the site and the NRC. The ENS is backed up by commercial telephone lines and the Southern Company Communications network. The NRC Region II office in Atlanta, Georgia, may also be connected on the ENS through Rockville, Maryland.

- Health Physics Network (HPN): The HPN phone service is also provided by the FTS. HPN phones are located in the Technical Support Center (TSC) and Emergency Operating Facility (EOF). The HPN is also backed up by commercial telephone lines and the Southern Company Communications network.

- Emergency Response Data System (ERDS): The primary means by which plant parameters are transmitted to the NRC. The ERDS computer, when activated, periodically will transmit a predefined list of critical plant parameters over the dedicated ERDS FTS lines to the NRC Operations Center in Rockville, Maryland.

Communications among the control room, TSC, EOF, and Operations Support Center (OSC) will be completed using dedicated telephone circuits, normal plant telephones, and radio, using the plant network. The radio system will also be used for communications with the radiological monitoring teams.

The following offsite locations will have established communications with EOFs in the case of an emergency at the station:

- State of Georgia (GA): The primary means of communication between the site and the State of Georgia is the Emergency Notification Network (ENN). The ENN is a dedicated telephone system from the site to the State Emergency Operating Center (EOC). The ENN system is available on a 24 hour a day basis. Commercial telephones and Southern Company Communications in Atlanta provide backup for the dedicated telephone circuits. The plant telephone backup power is supplied by a battery system.

- Burke County (GA): The primary means of communication between the site and Burke County is the ENN, which provides a dedicated telephone system from the site to the Burke County EOC. The ENN is available on a 24 hour a day basis. Commercial telephone lines and the Burke County Emergency Management Agency (EMA) radio network provide backup communication means for the ENN.

- State of South Carolina (SC): The ENN provides a dedicated telephone system from the site to the State of South Carolina emergency response agencies and is the primary means of communications. The ENN is available on a 24 hour a day basis. Commercial telephones serve as the backup communication path to the ENN.

- Aiken, Barnwell and Allendale Counties (SC): The primary means of communication between the site and SC counties will be the ENN, which provides a dedicated telephone system to each county's emergency response agencies. Commercial telephone lines provide a backup means of communication.

- Savannah River Site: The ENN serves as the primary means of communication between the site and the Savannah River Site and is available on a 24 hour basis. Commercial telephones serve as a backup means of communication.

10 CFR Part 50, Appendix E, Section IV.E(9) requires at least one onsite and one offsite communications system; each system shall have a backup power source. In addition, NRC Bulletin 80-15, "Possible Loss of Emergency Notification System (ENS) with Loss of Offsite Power," states that the applicant should provide backup power sources for the ENS in case of loss of offsite power. The staff requested the applicant provide further details on the backup power sources for the onsite and offsite ENS and for the ENN, and how these backup power sources will provide continuity of communication in the event that the normal power source is lost. In a letter dated December 23, 2008, the applicant provided the following response to RAIs 9.5.2-1, 9.5.2-2, and 9.5.2-4:

> In June of 2000, Regulatory Information Summary (RIS) 00-011 informed the industry that the NRC would be transitioning to a new system for the Emergency Telecommunications System (ETS) which would include the ENS function. The replacement system (Federal Telecommunications System [FTS] 2001) service does not use local switches. Power for ENS site equipment is supplied by the offsite system and does not rely on station power.
>
> Back-up power for the ENS is provided by the FTS 2001 supplier (i.e., Federal Telephone System). Onsite systems supporting the FTS system are provided with multiple power sources including diesel and battery backup. ENS phones are located in the Control Room, TSC and EOF. Dedicated telephone communication links provided by the FTS, and their locations, include:
>
> - NRC Emergency Notification System (ENS)
>   - Control Room
>   - TSC
>   - EOF
>
> - NRC Health Physics Network (HPN)
>   - TSC
>   - EOF

- Reactor Safety Counterpart Link (RSCL)
  - TSC
  - EOF

- Protective Measures Counterpart Link (PMCL)
  - TSC
  - EOF

- Management Counterpart Link (MCL)
  - TSC
  - EOF

- Operations Center LAN (OCL)
  - TSC
  - EOF

> Detailed design features for the communication power supply are not yet completely determined. However, design specifications include provisions for multiple power sources for the communication system. The design provides for back-up power to be provided by a combination of diesel generator and/or battery supplied power. Communication system power supplies will be identified in Emergency Implementing Procedures.

The offsite communications interfaces with the site are described as follows:

> [The] design specifications [for the ENN] include provisions for multiple power sources for the communication system. The design provides for back-up power to be provided by a combination of diesel generator and/or battery supplied power. Communication system power supplies will be identified in Emergency Implementing Procedures.

In its response, the applicant proposed to modify VEGP COL FSAR Section 9.5.2.2.5, "Offsite Interfaces," to include the description of the offsite communications links, backup power sources, and supporting communications equipment. The staff finds the applicant's response acceptable in that the applicant has demonstrated sufficient means for onsite and offsite communications, with adequate backup power sources, to meet the requirements of 10 CFR Part 50, Appendix E, Section IV.E(9). In addition, the staff finds that the use of a battery system and a diesel generator to provide backup power to the ENS in case of loss of offsite power adequately addresses NRC Bulletin 80-15. Therefore, the staff concludes that COL Action Item 9.5.2-3 has been resolved. The staff also verified that the VEGP COL FSAR is revised to include the above. As a result, RAIs 9.5.2-1, 9.5.2-2, and 9.5.2-4 are closed.

- VEGP COL 9.5-10

The applicant provided additional information in VEGP COL 9.5-10 to resolve COL Information Item 9.5-10. COL Information Item 9.5-10 states:

> The emergency offsite communication system, including the crisis management radio system, will be addressed by the Combined License applicant.

The commitment was also captured as COL Action Item 9.5.2-1 in Appendix F of NUREG-1793, which states:

> The COL applicant will provide a description of the emergency offsite communication system, including the crisis management radio system.

The staff reviewed VEGP COL 9.5-10 concerning the emergency offsite communication system including the crisis management radio system under Section 9.5.2.5.2 of the VEGP COL FSAR.

The staff requested additional clarification on the design of the site's crisis management radio system. In a letter dated March 15, 2010, the applicant provided the following response to RAI 9.5.2-3:

> Communications among the Control Room, Technical Support Center (TSC), Operations Support Center (OSC), Emergency Operations Facility (EOF) and offsite agencies (state and local authorities) are accomplished using a combination of dedicated telephone circuits, normal plant telephones, and radios. The radio system available for emergency communications will have the following characteristics:
>
> - The radio system consists of several base stations and the associated cabling and antennas strategically located to afford the best possible coverage and accessibility with respect to maintenance, security and uninterrupted power.
>
> - For control of the base station, remotes are used in selected facilities. Some remotes are capable of channel selection as well as volume control.
>
> - Trunked Radios utilizing iDEN® (Integrated Digital Enhanced Network) and TDMA (Time Division Multiple Access). TDMA is a channel access method for shared medium networks. It allows several users to share the same frequency channel by dividing the signal into different time slots. The users transmit in rapid succession, one after the other, each using their own time slot. This allows multiple stations to share the same transmission medium (e.g. radio frequency channel) while using only a part of its channel capacity. TDMA is used in the digital 2G cellular systems such as Global System for Mobile Communications (GSM), IS-136, Personal Digital Cellular (PDC) and iDEN, and in the Digital Enhanced Cordless Telecommunications (DECT) standard for portable phones. It is also used extensively in satellite systems, and combat-net radio systems.
>
> - Hand-held radios form another part of the radio system. These are small portable battery operated radios capable of one or several channels.
>
> - Mobile radios are mounted in vehicles and use a 12V DC power source supplied by the vehicle's battery. Mobile radios are capable of one or several channels and have an external antenna mounted on the vehicle.

Radio controls such as volume, channel selection and microphone are provided.

Multiple radios are contained within the emergency communications radio system. These radios, collectively, constitute the crisis management radio system and are described below:

The In-plant Radio will be used for communications with in-plant Radiological Emergency Teams (RETs). The radio will be pre-programmed with channels for individual departments and/or functional areas of the emergency response. This radio is accessible from the Control Room, TSC (remote unit) and EOF Voice Over Internet Protocol (VOIP), Central Alarm Station (CAS) and Secondary Alarm Station (SAS).

The Field Monitoring Team Radio is used as a back-up communication device for communications with Radiological Field Monitoring Teams. The primary radio for this function is the Southern LINC radio system. Field Monitoring Teams will use mobile radios available in vehicles or hand-held units as needed. This radio is accessible from the Control Room, TSC (remote unit) and EOF.

The Security Team Radio is used for communications between in-plant Security personnel and operations personnel as appropriate. Tone remotes are located in the Control Room, the Central Alarm Station and the Secondary Alarm Station. Handheld radios are used through-out the plant site.

The Burke County Emergency Management Radio is used as a back-up to the ENN. This radio is accessible from the TSC (remote unit) and EOF (VOIP). Communications via this radio are direct between SNC and the Burke County Emergency Operations Center.

The South Carolina Emergency Management Division (SCEMD) Radio is used as a back-up to the ENN. This radio is accessible from the TSC (remote unit). Communications via this radio are direct between SNC and the SCEMD Emergency Operations Center (SEOC). This radio is accessible from the TSC (remote unit).

10 CFR 50.47(b)(8) requires that adequate emergency facilities and equipment to support the emergency response be provided and maintained. The staff finds the offsite communications systems described above are adequate in providing emergency communications equipment and facilities and thus meet the requirements of 10 CFR 50.47(b)(8). In addition, the staff finds the radio system adequately serves as the crisis management radio system. Therefore, the staff concludes that COL Action Item 9.5.2-1 has been resolved, pending incorporation of the proposed revision associated with the response to RAI 9.5.2-3 in Part 5 of the VEGP COL application, which is being tracked as **Confirmatory Item 9.5-2**.

Resolution of VEGP Site-specific Confirmatory Item 9.5-2

Confirmatory Item 9.5-2 is an applicant commitment to revise its Part 5 (Emergency Plan) of the application to describe the emergency offsite communication system. The staff verified that the Emergency Plan was appropriately revised. As a result, Confirmatory Item 9.5-2 is now closed.

The following portion of this technical evaluation section is reproduced from Section 9.5.2.4 of the BLN SER:

> *AP1000 COL Information Items*
>
> - *STD COL 9.5-11 (COL Action Item 9.5.2-2), involving security communications*
>
> *The applicant provided additional information in BLN COL 9.5-11 to resolve COL Information Item 9.5-11. COL Information Item 9.5-11 states:*
>
> > *Specific details for the security communication system are as discussed in Section 13.6.*
>
> *The commitment was also captured as COL Action Item 9.5.2-2 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:*
>
> > *The COL applicant will provide a description of the security communication system.*
>
> *The staff will review the resolution to BLN COL 9.5-11 on the security communications. This review will be documented in Section 13.6 of this SER.*

Correction of Errors in the Standard Content Evaluation Text

The NRC staff identified two errors in the text reproduced above from Section 9.5.2.4 of the BLN SER that require correction. First, the BLN SER includes the following statement: "The applicant provided additional information in BLN COL 9.5-11 to resolve COL Information Item 9.5-11." The reference to BLN COL 9.5-11 should be to STD COL 9.5-11. Second, the quoted material for COL Information Item 9.5-11 in the BLN SER is missing text. The correct quote for COL Information Item 9.5-11 is:

> Specific details for the security communication system are as discussed in separate security documents referred to in Section 13.6.

9.5.2.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.5.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the communication system, and there is no outstanding information expected to be addressed in the

VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Section 9.5.2 of NUREG-0800. The staff based its conclusion on the following:

- VEGP COL 9.5-9 has been adequately addressed by the applicant in that the onsite and offsite communications interfaces meet the communications requirements of 10 CFR Part 50, Appendix E, Section IV.E(9). In addition, the staff finds the emergency diesel generator capable of providing backup power for the emergency notification system in case of loss of offsite power, and thus meets the guidance in NRC Bulletin 80-15.

- VEGP COL 9.5-10 has been adequately addressed by the applicant in that the VEGP emergency offsite communications system is capable of providing for notification of personnel and implementation of evacuation procedures in case of emergency and meets the requirements of 10 CFR 50.47(b)(8).

- STD COL 9.5-11, which involves security communications, is documented in Section 13.6 of this SER.

9.5.3 Plant Lighting System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.3, "Lighting Systems")

The plant lighting system provides normal, emergency, panel, and security lighting. The normal lighting provides normal illumination during plant operating, maintenance, and test conditions. The emergency lighting provides illumination in areas where emergency operations are performed upon loss of normal lighting. The panel and security lighting is designed to provide the minimum illumination required.

Section 9.5 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.5.3, "Plant Lighting System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.5.4 Diesel Generator Fuel Oil System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.4, "Diesel Generator Fuel Oil Storage and Transfer System)

9.5.4.1 *Introduction*

The standby diesel generator fuel oil system maintains the fuel oil system for the diesel engines that provide backup onsite power. This system includes all piping up to the connection to the engine interface, fuel oil storage tanks, fuel oil transfer pumps, day tanks, and the tank storage vaults.

9.5.4.2 *Summary of Application*

Section 9.5 of the VEGP COL FSAR, Revision 5, incorporates by reference Section 9.5 of the AP1000 DCD, Revision 19. Section 9.5 of the AP1000 DCD includes Section 9.5.4.

In addition, in VEGP COL FSAR Section 9.5.4.5.2, the applicant provided the following:

AP1000 COL Information Item

- STD COL 9.5-13

The applicant provided additional information in STD COL 9.5-13 to resolve fuel oil sampling and testing to protect against degradation.

9.5.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the diesel generator fuel oil system are given in Section 9.5.4 of NUREG-0800.

9.5.4.4 *Technical Evaluation*

The NRC staff reviewed Section 9.5.4 of the VEGP COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the diesel generator fuel oil system. The results of the NRC staff's evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside of the scope of the DC and use this review in evaluation subsequent COL applications. To ensure the staff's findings on standard content that were documented in the SER with open items issued for the BLN Units 3 and 4 COL application were equally applicable to the VEGP Units 3 and 4 COL application, the staff undertook the following reviews:

- The staff compared the BLN COL FSAR, Revision 1 to the VEGP COL FSAR. In performing this comparison, the staff considered changes made to the VEGP COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the BLN SER with open items.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content (the BLN SER) evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff has completed its review and found the evaluation performed for the standard content to be directly applicable to the VEGP COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. There were no open or confirmatory items related to the standard content in the BLN SER.

The standby and ancillary diesel generators are classified as AP1000 Class D, nonseismic systems. As such, they incorporate standard industrial QA standards to provide integrity and function and are included in the AP1000 Investment Protection Short-Term Availability Controls (IPSAC) and Design Reliability Assurance Program (D-RAP) programs.

The following portion of this technical evaluation section is reproduced from Section 9.5.4.4 of the BLN SER:

AP1000 COL Information Item

- *STD COL 9.5-13*

The applicant provided additional information in STD COL 9.5-13 to resolve COL Information Item 9.5-13. COL Information Item 9.5-13 states:

> *Address the diesel fuel specifications grade and the fuel properties consistent with manufacturers' recommendations and the measures to protect against fuel degradation by a program of fuel sampling and testing.*

The commitment was also captured as COL Action Item 9.5.9-2 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant will develop site-specific factors in the fuel oil storage tank installation specification to reduce the effects of sun heat input into the stored fuel, as well as the diesel fuel specifications grade and fuel properties consistent with manufacturers' recommendations, and will develop a program of fuel sampling and testing to protect against fuel degradation.*

Revision 17 of the DCD addressed the requirement for limiting heat input by specifying a white epoxy-urethane coating system. Therefore, this information is no longer required from COL applicants.

The COL information in Revision 0 of the applicant's FSAR added Section 9.5.4.5.2, "Fuel Oil Quality." The new section addressed fuel quality as follows:

> *High fuel oil quality is provided by specification of the required grade and properties of the fuel oil for procurement, by testing of samples of new fuel oil prior to addition into the tanks, and by monitoring the fuel oil for contamination and degradation with periodic testing of samples from the storage tanks in accordance with manufacturer's recommendations.*
>
> *The fuel oil storage tanks are inspected at least once per 92 days to check for and remove accumulated water.*

The fuel oil quality is verified by sampling and testing from the storage tanks at least once per 92 days. New fuel oil is tested prior to its addition to the storage tanks to verify that the sample meets the following minimum requirements:

- *Water and sediment content of less than or equal to 0.05 volume percent.*

- *Kinematic viscosity at 40°C of greater than or equal to 1.9 mm2/s (1.9 centistokes), but less than or equal to 4.1 mm2/s (4.1 centistokes).*

- *Specific gravity as specified by the manufacturer at 16/16°C (60/60°F), or an API [American Petroleum Institute] gravity at 16°C (60°F), within limits established in accordance with manufacturer's recommendations.*

- *Tested impurity level of less than 2 mg of insolubles per 100 ml. The analysis is completed within 7 days after obtaining the sample, but may be performed after the addition of new oil.*

As a result of the staff's review of BLN COL FSAR Section 9.5.4.5.2, the staff identified two questions that were submitted to the applicant in RAIs.

In RAI 9.5.4-1(a), the staff requested that the applicant identify the controls in place to ensure the fuel oil quality program is implemented according to BLN COL FSAR Section 9.5.4.5.2. In response, the applicant stated that implementation of the fuel oil program according to the FSAR is ensured by the Quality Assurance Program Description (QAPD) described in Chapter 17 and Part 11 of the COL application. The applicant stated QAPD Part III, Section 1, contains quality controls for non-safety-related SSCs that would require and verify implementation of the fuel oil program based on the FSAR description. The staff reviewed the information provided and concludes the proposed quality control requirements can ensure implementation of the fuel oil program in accordance with the BLN COL FSAR.

In RAI 9.5.4-1(b), the staff requested that the applicant provide quality requirements for the periodic testing of stored fuel oil. Section 9.5.4.5.2 of the BLN COL stated that diesel fuel oil from the storage tanks is sampled and tested, but no requirements were listed. The application listed quality requirements that appeared to apply only to new fuel oil. In its response, the applicant proposed the following revised BLN COL FSAR Section 9.5.4.5.2:

The diesel fuel oil testing program requires testing both new fuel oil and stored fuel oil. High fuel oil quality is provided by specifying the use of ASTM [American Society for Testing and Materials] Grade 2D fuel oil with a sulfur content as specified by the engine manufacturer.

A fuel sample is analyzed prior to addition of ASTM Grade 2D fuel oil to the storage tanks. The sample moisture content and particulate or color is verified per ASTM 4176. In addition, kinetic [sic] viscosity is tested to be within the limits specified in Table 1 of ASTM D975. The remaining critical parameters per Table 1 of ASTM D975 are verified compliant within 7 days.

Fuel oil quality is verified by sample every 92 days to meet ASTM Grade 2D fuel oil criteria. The addition of fuel stabilizers and other conditioners is based on sample results.

The fuel oil storage tanks are inspected on a monthly basis for the presence of water. Any accumulated water is to be removed.

The staff reviewed this revision and finds it acceptable because it addresses both the new and stored fuel oil and the requirements are the manufacturer's specifications and the same ASTM standards applied to safety-related diesel generators. The staff also confirmed that the revised fuel oil testing program was included as shown above in Revision 1 of the BLN COL FSAR.

Correction of Error in the Standard Content Evaluation Text

The NRC staff identified an error in the text reproduced above from Section 9.5.4.4 of the BLN SER that requires correction. The BLN SER includes the following statement: "In addition, kinetic [sic] viscosity is tested to be within the limits specified in Table 1 of the ASTM D975." The world "kinetic" should read as "kinematic." The staff thought this was a typographical error on the applicant's part because Table 1 of ASTM D975, "Standard Specification for Diesel Fuel Oils," which is the appropriate reference, specifies "kinematic viscosity." Therefore, the staff concludes that STD COL 9.5-13 has been resolved pending incorporation of the proposed revision in the VEGP COL FSAR, which is being tracked as **Confirmatory Item 9.5-3**.

Resolution of Standard Content Confirmatory Item 9.5-3

Confirmatory Item 9.5-3 is an applicant commitment to revise its FSAR Section 9.5.4.4 to correct a typographical error. The staff verified that the VEGP COL FSAR was appropriately revised. As a result, Confirmatory Item 9.5-3 is now closed.

9.5.4.5 *Post Combined License Activities*

There are no post-COL activities related to this section.

9.5.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to the standby diesel generator fuel oil system, and there is no outstanding information expected to be addressed in the VEGP COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the VEGP COL FSAR is acceptable and meets the guidelines given in Section 9.5.4 of NUREG-0800. The staff based its conclusion on the following:

- STD COL 9.5-13 has been adequately addressed by the applicant in that it ensures that the manufacturers' recommendations using industry standards are met and provides a fuel sampling and testing program to protect against fuel degradation.

9.5.5 Standby Diesel Generator Cooling Water System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.5, "Diesel Generator Cooling Water System")

Section 9.5.5 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.5.5, "Standby Diesel Generator Cooling Water System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.5.6 Standby Diesel Generator Starting Air System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.6, "Diesel Generator Starting System")

Section 9.5.6 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.5.6, "Standby Diesel Generator Starting Air System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.5.7 Standby Diesel Generator Lubrication System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.7, "Diesel Generator Lubrication System")

Section 9.5.7 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.5.7, "Standby Diesel Generator Lubrication System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

9.5.8 Standby Diesel Generator Combustion Air Intake and Exhaust System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.8, "Diesel Generator Combustion Air Intake and Exhaust System")

Section 9.5.8 of the VEGP COL FSAR, Revision 5, incorporates by reference, with no departures or supplements, Section 9.5.8, "Standby Diesel Generator Combustion Air Intake and Exhaust System," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue

related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the VEGP COL application are documented in NUREG-1793 and its supplements.

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11. ABSTRACT (200 words or less)

This final safety evaluation report (FSER) documents the U.S. Nuclear Regulatory Commission (NRC) staff's technical review of the combined license (COL) application submitted by Southern Nuclear Operating Company (SNC or the applicant), for the Vogtle Electric Generating Plant (VEGP) Units 3 and 4. The FSER also documents the NRC staff's technical review of the limited work authorization (LWA) activities for which SNC has requested approval.

By letter dated March 28, 2008, SNC submitted its application to the NRC for COLs for two AP1000 advanced passive pressurized water reactors (PWRs) pursuant to the requirements of Sections 103 and 185(b) fo the Atomic Energy Act of 1954, as amended; Title 10 of the Code of Federal Regulations (10 CFR) Part 52, "Licenses, certifications and approvals for nuclear power plants"; and the associated material licenses under 10 CFR Part 30, "Rules of general applicability to domestic licensing of byproduct material"; 10 CFR Part 40, "Domestic licensing of source material"; and 10 CFR Part 70, "Domestic licensing of special nuclear material." These reactors are identified as VEGP Units 3 and 4, and will be located on the existing VEGP site in Burke County, Georgia. In October 2009, SNC supplemented its COL application to include a request for an LWA.

This FSER presents the results of the staff's review of information submitted in conjunction with the COL and LWA application.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

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