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MFN 06-460

Docket No. 52-010

December 1, 2006

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information
Letter No. 68 – Air Conditioning, Heating, Cooling and Ventilation
Systems – RAI Numbers 9.4-5 through 9.4-28 and 11.5-25**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the
Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

A handwritten signature in cursive script that reads "Kathy Sedney for".

David H. Hinds
Manager, ESBWR

Reference:

1. MFN 06-379, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 68 Related to ESBWR Design Certification Application*, October 10, 2006

Enclosure:

1. MFN 06-460 – Response to Portion of NRC Request for Additional Information Letter No. 68 – Air Conditioning, Heating, Cooling and Ventilation Systems – RAI Numbers 9.4-5 through 9.4-28 and 11.5-25

cc: AE Cabbage USNRC (with enclosures)
GB Stramback/GE/San Jose (with enclosures)
eDRFs 0061-6019 and 0061-6006

Enclosure 1

MFN 06-460

Response to Portion of NRC Request for

Additional Information Letter No. 68

Related to ESBWR Design Certification Application

Air Conditioning, Heating, Cooling, And Ventilation Systems

RAI Numbers 9.4-5 through 9.4-28 and 11.5-25

NRC RAI 9.4-5:

In DCD Tier 2, Rev. 1, Section 9.4, "Air Conditioning, Heating, Cooling, and Ventilation," the applicant did not provide a list of Codes and Standards used in the design of the ESBWR air conditioning, heating, cooling, and ventilation systems. The design of these systems will typically reference ASTM Standards, ASHRAE Standards, Regulatory Guides, the Code of Federal Regulations, and others. Provide (as references) a list of Codes and Standards used in the design of the ESBWR air conditioning, heating, cooling, and ventilation systems. The NRC staff expects the ESBWR design to commit to the latest revisions of the applicable Codes and Standards and include this commitment in the DCD.

GE Response:

A list of References, including codes and standards, were added to each subsection of Section 9.4 in DCD Tier 2, Revision 2. This Reference list will be expanded to include all the applicable codes and standards that apply to the HVAC systems and components in DCD Tier 2, Rev. 3. DCD Table 1.9-22 remains a complete and unified listing of applicable Codes and Standards for the ESBWR design.

DCD Impact:

DCD Tier 2, Subsections 9.4.1 – 9.4.8 will be revised as described above.

NRC RAI 9.4-6:

In DCD Tier 2 Section 9.4 provide a summary (table format preferred) with the plant areas served by the nuclear filtration systems including CRHAHVS, radwaste building HVAC (RWBHVAC), turbine building HVAC (TBHVS), controlled area ventilation subsystem of reactor building HVAC (CONAVS), refueling and pool area ventilation subsystem of fuel building HVAC (REPAVS), and technical support center (TSC) HVAC subsystems with their associated design/testing standards, filtration efficiency, design air flow rates and ambient pressure data, humidity control, charcoal adsorber thickness and maximum in-leakage flow. In addition, identify the minimum instrumentation and controls for the nuclear filtration systems (in accordance with regulatory guide (RG) 1.140 and ASME N509, Table 4-2).

GE Response:

A summary table for the filtration systems, including the CRHAVS filter units, TSCVS filter units, RBVS Purge filter unit (which also serves the FB), TBVS filter units, and the RWVS filter units will be provided in DCD Tier 2 Revision 3.

For the systems listed above, the ESBWR design for these nonsafety-related filter systems complies with RG 1.140. The design includes instrumentation and controls required by RG 1.140. Table 4-2 was not found in the ASME N509-2002 standard.

DCD Impact:

Revision 3 to DCD Tier 2, Section 9.4 will reflect the attached markup.

NRC RAI 9.4-7:

"Containment Inerting System" is described in two different places, i.e. DCD Tier 2, Rev. 1, Sections 6.2.5.2 and 9.4.9. However, the "Containment Inerting System" should be in DCD Tier 2, Section 6.2.5, "Combustible Gas Control in Containment," and not as part of "DCD Tier 2 Section 9.4. Therefore, the applicant should relocate the content of DCD Tier 2, Section 9.4.9 to DCD Tier 2, Section 6.2.5.2.

GE Response:

Subsection 9.4.9 will be relocated to Subsection 6.2.5.2 in DCD Tier 2, Revision 3

DCD Impact:

DCD Tier 2, Subsections 9.4.9 and 6.2.5.2 will be revised as noted above.

NRC RAI 9:4-8:

In general, the Codes and standards are identified in DCD Tier 2, Rev. 1, Table 1.9-22 that are applicable to ESBWR design. However, DCD Tier 2, Rev. 1, Sections 6.4 and 9.4, do not have component descriptions indicating the type of components and their capacities, and specific Codes and standards used for design, fabrication and testing of the system components for EBAS and various HVAC systems. In addition, the supplied engineering drawings do not contain sufficient details as would be included on piping and instrument diagrams (P&ID) that would include equipment Tag Numbers, flow and sizing data, notes, etc., that assist in determining how this system operates. Therefore, provide:

a. Component descriptions for each of the HVAC systems described in DCD Tier 2 Sections 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.4.6, 9.4.7, and 9.4.8 and control room habitability systems described in DCD Tier 2, Section 6.4, including Code and Standards information for the system equipment (e.g. fans, cooling and heating coils, filters, compressed breathing air tanks, two stage pressure regulators, isolation valves, sample ports, flow indicators, flow orifices, CRHA distribution piping, including flow orifices and flow and pressure indicators, relief valves and dampers, ductwork, and unique capacity/sizing information).

b. Updated system figures including sufficient details such as simplified instrumentation and control logics, piping criteria designation, equipment Tag Numbers, flow and sizing data, applicable P&ID notes, etc.

GE Response:

Detailed component descriptions will be reflected in DCD Tier 2, Revision 3, Subsections 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.4.6, 9.4.7, and 9.4.8. P&ID level detailed drawings are not planned to be included in the DCD; however, additional detail as available will be added to the existing DCD figures.

DCD Impact:

DCD Tier 2, Subsections 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.4.6, 9.4.7, and 9.4.8 will be revised as noted above in Revision 3.

NRC RAI 9.4-9:

The applicant referenced the applicability of various Regulatory Guides (RGs) for the ESBWR design in DCD Tier 2, Rev. 1, Table 1.9-21; provide details in DCD Tier 2 explaining how ESBWR complies with each position listed in the RGs 1.29, 1.78, 1.140,1.155, 1.194, 1.196, and 1.197, and Inspection and Enforcement Bulletin 80-03. Also, provide details in DCD Tier 2 discussing the applicability of Generic letters (GLs) 99-02 and 2003-01.

GE Response:

HVAC system compliance with RGs 1.29, 1.78, 1.140,1.155, 1.194, 1.196, and 1.197, Inspection and Enforcement Bulletin 80-03, and Generic letters (GLs) 99-02 and 2003-01 will be delineated in Subsections 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.4.6, 9.4.7, and 9.4.8 in DCD Tier 2 Rev. 3.

DCD Impact:

DCD Tier 2, Sections 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.4.6, 9.4.7, and 9.4.8 will be revised as noted above.

NRC RAI 9.4-10:

The applicant referenced the conformance of the Task Action Plan Items B-36 and B-66, Generic Issue 83, and TMI Task Action Plan (TAP) Item III.D.3.4, "Control Room Habitability," in DCD Tier 2, Rev. 1, Table 1.11-1. However, you have not addressed the detailed conformance in DCD Tier 2, Rev. 1, Sections 6.4 and 9.4. Therefore, revise DCD Tier 2, Sections 6.4 and 9.4 in detail to conform with the guidance and requirements of B-36, B-66, Issue 83, and TMI TAP Item III.D.3.4.

GE Response:

DCD Tier 2, Sections 6.4 and 9.4 will be revised to address conformance with the guidance and requirements of B-36, B-66, Issue 83, and TMI TAP Item III.D.3.4.

DCD Impact:

DCD Tier 2, Sections 6.4 and 9.4 will be revised as noted above in Revision 3.

NRC RAI 9.4-11:

In DCD Tier 2, Rev. 1, Sections 9.4.3, 9.4.4.2, 9.4.6.5 and 9.4.7.1, the expression of both slightly negative and slightly positive is used when referring to differential pressure. Quantify these expressions by providing values for slightly positive and slightly negative for these sections, and if these expressions are used other places in the DCD, provide values there also. In addition, provide intake and exhaust flows for all systems that are required to support differential pressure (table format preferred).

GE Response:

Slightly negative pressure typically ranges from less than zero inches water column to -0.75" water column (w.c.). Slightly positive pressure typically ranges from greater than zero inches water column to +0.75" w.c. These are industry standard terms applied to generically describe protection against infiltration or exfiltration of air into or out of a controlled building, room, or space boundary. This information will be added to DCD Tier 2 Section 9.4 in Revision 3 to define these terms. DCD Tier 2, Revision 2, Tables 9.4-1 through 9.4-16, list Design Parameter and Major Equipment for the various buildings including intake and exhaust flow for all systems required to support differential pressure with the exception of the Radwaste and TSC buildings. A table or addition to existing tables will be provided for the Radwaste and TSC buildings to include intake and exhaust flows that are required to support differential pressure in DCD Tier 2, Revision 3.

DCD Impact:

DCD Tier 2, Subsections 9.4.1, Control Building HVAC System; 9.4.3.1 Radwaste Building Heating, Ventilation and Air Conditioning System (Control Room), RWCRVS; 9.4.7 Electrical Building HVAC System (TSC HVAC Subsystem - TSCVS) will be revised to define slightly positive pressure as: "Slightly positive pressure is a range of pressure typically from greater than zero inches water column to +0.75 w.c." This information will be added in Revision 3 of the DCD Tier 2.

DCD Tier 2, Subsections 9.4.2, Fuel Building HVAC System; 9.4.3.1 Radwaste Building Heating, Ventilation and Air Conditioning System (General Area), RWGAVS; 9.4.4.2 Turbine Building Ventilation System; and 9.4.6.1 Reactor Building HVAC System; will be revised to define "Slightly Negative Pressure" as: "Slightly negative pressure is a range of pressure which typically ranges from less than zero inches water column to -0.75" w.c." This information will be added in DCD Tier 2 Revision 3.

A table or addition to existing tables will be provided for the Radwaste (9.4-7) and TSC (9.4-16) building ventilation systems to include intake and exhaust flows that are required to support differential pressure in DCD Tier 2 Revision 3.

NRC RAI 9.4-12:

EBAS is a stand-alone system and is one of the safety-related control room habitability systems as described in DCD Tier 2, Rev. 1, Section 6.4 and is not a conventional HVAC and filtration system relied on during accident conditions for current operating reactors. Therefore, the applicant should relocate the entire contents of the text concerning the safety-related EBAS in DCD Tier 2, Rev. 1, Section 9.4.1 to DCD Tier 2, Section 6.4. Verify that DCD Tier 2, Section 6.4 contains EBAS information including its safety design basis and power generation design basis, safety-related areas being served with their temperature profile, post 72-hour design basis, Codes and Standards of the equipment involved (compressed breathing air tanks, isolation and relief valves, piping, instrumentation including flow orifices and flow and pressure indicators, etc.), system description, safety operation, safety evaluation, testing and inspection requirements, and instrumentation requirements. Also, revise the text of DCD Tier 2, Section 9.4.1, as needed to reflect these changes.

GE Response:

The EBAS description in Subsection 9.4.1 will be relocated to Section 6.4 in Revision 3 to DCD Tier 2. Subsection 9.4.1 will continue to contain a limited description of EBAS interaction with the CRHAVS for control room habitability.

DCD Impact:

DCD Tier 2, Section 6.4 and Subsection 9.4.1 will be revised as noted above in Revision 3.

NRC RAI 9.4-13:

DCD Tier 2, Rev. 1, Section 9.4.1 is titled "Control Room Area Ventilation System (CRAVS)," but the text of DCD Tier 2, Rev. 1, Section 9.4.1, Paragraph 1, refers to the system as "Control Building Heating, Ventilation and Air Conditioning System (CBHVS),"Please, clarify inconsistency.

GE Response:

The Subsection 9.4.1 title has been appropriately revised to "Control Building HVAC System" in DCD Tier 2 Revision 2.

DCD Impact:

No additional DCD Tier 2 changes will be made in response to this RAI.

NRC RAI 9.4-14:

The applicant stated in DCD Tier 2, Rev. 1, Section 9.4.1.4 that, "the CRHAHVS filtration components are periodically tested in accordance with ANSI/ASME N509, Nuclear Power Plant Air Cleaning Units and Components, and ANSI/ASME N510, Testing of Nuclear Power Plant Air Cleaning Systems. HEPA filters are tested periodically with dioctyl phthalate (DOP), and the charcoal filters are periodically tested for bypass." Please explain how these periodic tests meet the NRC staff's acceptance criteria for engineered safety feature (ESF) and normal atmospheric cleanup systems air filtration and adsorption units contained in RGs 1.52 and 1.140 respectively or provide an acceptable alternative approach. Include information in DCD Tier 2, Section 9.4.1.4.

GE Response:

The RAI statement noted in Subsection 9.4.1.4 was clarified in Revision 2 to the DCD Tier 2 to state: "The CRHAVS filtration components are periodically tested in accordance with ASME AG-1 Code On Nuclear Air And Gas Treatment and/or ASME N510, Testing of Nuclear Air Treatment Systems."

The statement was clarified to remove reference to N509, which is not a periodic testing standard, and to add reference to ASME AG-1, which is the latest code containing in-place testing information. The CRHAVS filter trains are non-safety related. As stated in Table 1.9-21, RG 1.52 is not applicable to the ESBWR. The CRHAVS filter units are defense-in-depth components and provide the function of filtration for the MCR during conditions of abnormal airborne radioactivity when power is available. Since RG 1.140 applies specifically to normal atmosphere cleanup, and since the filter units are not credited for ESF units per RG 1.52, the Codes and Standards that dictate the testing requirements of a filtration system designed for habitability have been identified. The specific tested and credited filtration efficiencies will meet or exceed the guidance in RG 1.140 and this will be specifically stated in Subsection 9.4.1.4, in DCD Tier 2 Rev. 3.

DCD Impact:

DCD Tier 2, Subsection 9.4.1.4 will be revised as noted above in Revision 3.

NRC RAI 9.4-15:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that ESBWR conforms with the guidance of SRP Section 9.4.1, Revision 2, for control room area ventilation system. SRP Section 9.4.1 lists the acceptance criteria as GDC 2, 4, 5, 19, and 60 and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the control room area ventilation system. However, DCD Tier 2, Rev. 1, Section 9.4.1 does not contain details on how these criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2, RG 1.78 provides some information (but not all) regarding compliance with GDC 19. Update section 9.4.1 to provide details demonstrating how the ESBWR design for the control room ventilation system meets the acceptance criteria of GDC 2, GDC 4, GDC 5, GDC 19, and GDC 60.

GE Response:

Subsection 9.4.1 will be updated to specify control room ventilation system design conformance to the acceptance criteria of GDC 2, GDC 4, GDC 5, GDC 19, and GDC 60.

Subsection 9.4.1 will be revised to similarly state:

- The CRHAVS meets the acceptance criteria of GDC 2. The CRHA envelope is comprised of Seismic Category I structures and components that are protected from postulated tornados, hurricanes, tsunamis, seiches, and seismic events. The CRHAVS components are designated as Seismic Category II with the exception of the safety-related CRHA envelope, isolation dampers, EBAS and associated instrumentation and controls, which are Seismic Category I. The CB structure below grade is a Seismic Category I structure while above grade is Seismic Cat. II.
- The CRHAVS meets the acceptance criteria of GDC 4. Whenever electric power is available, a release of toxic gas causes the CRHAVS air inlet and exhaust dampers to close. The Main Control Room (MCR) air is re-circulated with no outside air makeup. The CRHAVS design complies with GDC 4 by ensuring that personnel in the MCR are protected from the effects of postulated accidents or release of toxic gas releases. The safety-related CRHA envelope, isolation dampers, EBAS and associated instrumentation and controls are designed to be protected from all postulated environmental and dynamic effects.
- The CRHAVS meets the acceptance criteria of GDC 5. The ESBWR CRHAVS supports a single unit, including one CRHA envelope. This meets the intent of GDC 5 with the following design considerations:
 - Each ESBWR unit at a multi-unit site has a separate control room.
 - An accident in one unit does not impair the ability to perform safety functions of the remaining units.
 - An orderly shutdown and cool down of remaining unit(s) would not be impaired.
- The CRHAVS meets the acceptance criteria of GDC 19. The CRHA is isolated during SBO or LOCA conditions, and the safety-related EBAS provides pressurization and

breathing quality air. Radiation detectors in the intake air supply to the Main Control Room provides warning and initiate actions to protect control room personnel under accident conditions. The CRHAVS design in conjunction with the EBAS, maintain a habitable control room under accident conditions by providing adequate radiation protection and breathing air. When power is available, the MCR Air Handling Units maintain the space temperature. Upon a loss of power, the MCR remaining heat loads are passively dissipated by the walls, floor, ceiling and interior walls for the 72 hr passive duration. The radiation detection range is selected to cover normal operation, with sufficient sensitivity to initiate isolation of the MCR prior to exceeding the 10CFR50 Appendix A GDC 19 guidelines.

- The CBVS, including the CRHAVS meets the acceptance criteria of GDC 60. The CRHAVS air intake filtration trains meet the guidance of Regulatory Guide 1.140 as related to design, testing and maintenance criteria for atmosphere cleanup system and normal ventilation system air filtration and adsorption units. The Control Building does not house any portion of the nuclear steam supply process or other equipment that can act as a source of radioactive material; and therefore has no postulated sources of radioactive materials in either particulate or gaseous form. Therefore, the CB exhaust systems have no provision for filtration or adsorption.

DCD Impact:

DCD Tier 2, Subsection 9.4.1 will be revised as noted above in Revision 3.

NRC RAI 9.4-16:

Explain what the phrase "[raw807]" means on Page 9.4-2, Line Number 7 of DCD Tier 2, Rev. 1, Section 9.4.1.1. Also define similar references to other phrases elsewhere in DCD Tier 1 and Tier 2 and revise these documents as needed.

GE Response:

The phrase "[raw807]" and similar phrases are annotation designators. These are essentially typographical errors, as the annotation designators are normally hidden, and were removed in DCD Revision 2.

DCD Impact:

DCD Tiers 1 and 2 have been revised as noted above in DCD Revision 2.

NRC RAI 9.4-17:

In order for the staff to understand how operators will be able to take appropriate actions, and to maintain appropriate equipment operability inside the CRHA during first 72-hours, and for the period of 72-hours to 30 days following the onset of an accident, provide a discussion demonstrating how the ESBWR design meets the requirement of GDC 19 to provide a control room from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions.... Also, provide data (table format preferred) on temperature and humidity profiles during the above periods in DCD Tier 2 Sections 9.4.1 and 6.4.

GE Response:

Subsection 9.4.1 and Section 6.4 will be revised to describe ESBWR design compliance to the acceptance criteria of GDC 19 (please refer to RAI 9.4-15 response for more detail). ESBWR is committed to the Utility Requirements Document (URD) based requirement of maintaining the MCR at a temperature no greater than 15°F above the initial MCR temperature for any loss of cooling event, including SBO or LOCA conditions. This temperature rise limit applies both during the 72 hr passive period, and the duration of any postulated accident. Since the MCR normal temperature range is stated in the DCD Tier 2 as 73-78°F. A temperature and humidity profile for the MCR under accident conditions will be provided in DCD Tier 2, Section 6.3 in Revision 3.

DCD Impact:

DCD Tier 2, Section 6.4 and Subsection 9.4.1 will be revised as noted above in Revision 3.

NRC RAI 9.4-18:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that ESBWR conforms with the guidance of SRP, Section 9.4.2, Revision 2, for spent fuel pool area ventilation system. SRP Section 9.4.2 lists the acceptance criteria as GDC 2, 5, 60, and 61 and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the spent fuel pool area ventilation system. However, DCD Tier 2, Rev. 1, Section 9.4.2 does not contain details on how these criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2. Provide details demonstrating how the ESBWR design for the spent fuel pool area ventilation system meets the acceptance criteria of GDC 2, GDC 5, GDC 60, and GDC 6. Update DCD Tier 2 Section 9.4.2 to include these details.

GE Response:

The DCD Tier 2, Subsection 9.4.2 will be revised as follows to clearly delineate compliance to the General Design Criteria. The text will be revised to similarly state:

- Meets GDC 2 by compliance to Regulatory Guide (RG) 1.29 Position C.1 for safety-related portions and Position C.2 for nonsafety-related portions. The FB is a Seismic Category I structure except for the penthouse that houses HVAC equipment that is Seismic Category II. All FBHVS components are designed as Seismic Category II with the exception of the safety-related isolation dampers and associated controls. The FBVS maintains its structural integrity after a Safe Shutdown Earthquake (SSE).
- Meets GDC 5 for shared systems and components important to safety for the Fuel Building isolation dampers. There are no shared (multiple reactor units) structures, systems or components important to safety in the FBVS.
- Meets GDC 60 by suitably controlling the release of gaseous radioactive effluents to the environment. The system may direct its exhaust air to the Reactor Building HVAC Purge Exhaust Filter Unit during periods of high radioactivity. The Reactor Building HVAC Purge Exhaust Filter Unit is designed, tested and maintained in accordance with Regulatory Guide 1.140. DCD Tier 2, Section 11.5, Process Radiation Monitoring System, elaborates how the Radiation Monitoring and control system interfaces with the FBVS.
- Meets GDC 61 by providing containment, confinement, and filtration to limit releases of airborne radioactivity. The system may direct its exhaust air to the Reactor Building HVAC Purge Exhaust Filter Unit during periods of high radioactivity, which provides filtration prior to discharge to the plant stack. The Reactor Building HVAC Purge Exhaust Filter Unit is designed, tested and maintained in accordance with Regulatory Guide 1.140.

DCD Impact:

DCD Tier 2, Subsection 9.4.2 will be revised as noted above in Revision 3.

NRC RAI 9.4-19:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that ESBWR conforms with the guidance of SRP, Section 9.4.3, Revision 2, for auxiliary and radwaste area ventilation system. SRP Section 9.4.3 lists the acceptance criteria as GDC 2, 5, and 60 and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the radwaste building heating, ventilation and air conditioning system. However, DCD Tier 2, Rev. 1, Section 9.4.3 does not contain details on how these criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2. Provide details demonstrating how the ESBWR design for the radwaste building heating, ventilation and air conditioning system meets the acceptance criteria of GDC 2, GDC 5, and GDC 60. Update DCD Tier 2, Section 9.4.3 to include these details.

GE Response:

The information in DCD Tier 2 Subsection 9.4.3 will be revised to similarly state:

- Meets GDC 2 by compliance to Regulatory Guide (RG) 1.29 Position C.1 for safety-related portions, and Position C.2 for nonsafety-related portions. The Radioactive Waste (RW) Building structure meets RG 1.143 category RW-IIa.
- Meets GDC 5 compliance for shared systems and components important to safety. There are no shared (multiple reactor units) structures, systems or components important to safety in the RWVS.
- Meets GDC 60 by suitably controlling the release of gaseous radioactive effluents to the environment. The system directs exhaust air to the RWGA exhaust filtration units. The RWGA exhaust filtration unit is designed, tested and maintained in accordance with Regulatory Guide 1.140. The RW ventilation system contains 3 - 50% capacity exhaust filtration units. These units exhaust air from the building, which is maintained under negative pressure, to the vent stack.

DCD Impact:

DCD Tier 2, Subsection 9.4.3 will be revised as noted above in Revision 3.

NRC RAI 9.4-20:

The applicant stated in DCD Tier 2, Rev. 1, Section 9.4.3.4 that "Filtration units, including HEPA filters, are periodically tested in accordance with RG 1.140, Nuclear Air and Gas Treatment." However, the correct title of RG 1.140 is "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants." Correct RG 1.140 title and confirm commitment to RG 1.140, Revision 2.

GE Response:

The RG 1.140 title was corrected in DCD Revision 2. Compliance to R.G. 1.140 is delineated in Table 1.9-21 for the ESBWR design.

DCD Impact:

DCD Tier 2, Subsection 9.4.3.4 was revised to correct the RG 1.140 title in Revision 2.

NRC RAI 9.4-21:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that ESBWR conforms with the guidance of SRP Section 9.4.4, Revision 2, for turbine area ventilation system. SRP Section 9.4.4 lists the acceptance criteria as GDC 2, 5, and 60 and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the control room area ventilation system. However, DCD Tier 2, Rev. 1, Section 9.4.4 does not contain details on how these criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2. Provide details demonstrating how the ESBWR design for the turbine building HVAC system meets the acceptance criteria of GDC 2, GDC 5, and GDC 60. Update DCD Tier 2, Section 9.4.4 to include these details.

GE Response:

DCD Tier 2 in Subsection 9.4.4 will be revised to similarly state:

- Meets GDC 2 via compliance with Regulatory Guide 1.29 (Table 1.9-21), Position C.2 for non-safety related portions. The TB is a Seismic Category II nonsafety-related structure.
- Meets GDC 5 for shared systems and components. There are no shared (multiple reactor units) structures, systems or components important to safety in the TBVS.
- Meets GDC 60 by suitably controlling the release of gaseous radioactive effluents to the environment. The system can direct exhaust air to the TBHV system filtration units. The TBHV system filtration units are designed, tested and maintained in accordance with Regulatory Guide 1.140 (see DCD Subsection 9.4.4.1). The TB combined ventilation exhaust is monitored for halogens, particulates and noble gas releases. The TB Compartment area and normal ventilation HVAC RMS subsystems monitor air for gross radiation levels and alarm functions. The TB is under a slight negative pressure to minimize exfiltration. TB Equipment rooms are maintained at a negative pressure to minimize potential airborne radioactivity escaping adjacent areas or to the outside atmosphere during normal operation by exhausting air through filters from the areas in which a significant potential for contamination exists.

DCD Impact:

DCD Tier 2, Subsection 9.4.4 will be revised as noted above in Revision 3.

NRC RAI 9.4-22:

The applicant stated in DCD Tier 2, Rev. 1, Section 9.4.4.4 that, "The TBHV system filtration components are periodically tested in accordance with ANSI/ASME N509, Nuclear Power Plant Air Cleaning Units and Components, and ANSI/ASME N510, Testing of Nuclear Power Plant Air Cleaning Systems. HEPA filters are tested periodically with a challenge aerosol, and the charcoal filters are periodically tested for bypass."

a. Please, explain how these periodic tests meet the NRC staff's acceptance criteria for ESF and normal atmospheric cleanup systems air filtration and adsorption units contained in RGs 1.52 and 1.140 respectively or provide an acceptable alternative approach. Include information in DCD.

b. In addition, DCD Tier 2, Rev. 1, does not include tables for "Major Equipment" and "Design Parameters" for the Turbine Building HVAC System as it does for other systems such as CBHVS, FBHVS, RWBHVACS etc. Tables for this system should also be included in the DCD.

c. Figure 9.4-8, "TBHV Simplified System Diagram," does not include charcoal filters as it should. Please correct this figure as necessary to include all applicable parts of the TBHV System.

GE Response:

Subsection 9.4.4.4 was revised in DCD Rev. 2 to state: "The TBVS filtration components are periodically tested in accordance with Regulatory Guide 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."

- A. The ESBWR design has no ESF ventilation filtration systems. As a result, RG 1.52 is not applicable (See DCD Tier 2 Table 1.9-21). The TBVS filtration units are designed, tested and maintained in accordance with Regulatory Guide 1.140. Reg. Guide 1.140 specifies the design, inspection and testing criteria for air filtration and adsorption units including applicable codes and standards.
- B. Table 9.4-15, Design Parameters for TBVS, which includes Major Equipment, was added to Section 9.4 in DCD Rev. 2.
- C. Carbon filters are not required for the design function of the TBVS exhaust filter units.

DCD Impact:

No DCD changes will be made in response to this RAI.

NRC RAI 9.4-23:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that ESBWR conforms with the guidance of SRP, Section 9.4.3, Revision 2, for auxiliary and radwaste area ventilation system. The NRC staff considers the criteria contained in SRP Section 9.4.3 applies to reactor building HVAC system. SRP Section 9.4.3 lists the acceptance criteria as GDC 2, 5, and 60 and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the reactor building HVAC system. However, DCD Tier2 Section 9.4.6 does not contain details on how these criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2. Provide details demonstrating how the ESBWR design for the reactor building HVAC system meets the acceptance criteria of GDC 2, GDC 5, GDC 60. Update DCD Tier 2 Section 9.4.6 to include these details.

GE Response:

DCD Tier 2 Subsection 9.4.6 will be revised to similarly state:

- Meets GDC 2 via compliance to the guidance of Regulatory Guide 1.29, Position C.2 for nonsafety-related portions. The RBVS is nonsafety related except for the building isolation dampers. The RBVS components are designed as Seismic Category II except for the safety related building isolation dampers and associated controls that are Seismic Category I. The RB is a Seismic Category I structure. The Fuel Building penthouse that houses the Reactor Building HVAC equipment is Seismic Category II.
- Meets GDC 5 for shared systems and components important to safety for the Reactor Building isolation dampers. Reactor Building HVAC Equipment is not shared among other operating units.
- Meets GDC 60 by suitably controlling the release of gaseous radioactive effluents to the environment. The system may direct its exhaust air to the Reactor Building HVAC Purge Exhaust Filter Unit during periods of high radioactivity (see DCD Tier 2 Subsection 9.4.4.1). The Reactor Building HVAC Purge Exhaust Filter Unit is designed, tested and maintained in accordance with Regulatory Guide 1.140. The Reactor Building HVAC exhaust system is equipped with a control system to automatically isolate the effluent on indication of a high radiation level. The RB boundary isolation dampers close on receipt of a high radiation signal, or on a loss of AC power.

DCD Impact:

DCD Tier 2, Subsection 9.4.6 will be revised as noted above in Revision 3.

NRC RAI 9.4-24:

The applicant stated in DCD Tier 2, Rev. 1, Section 9.4.6.4 that, "The Reactor Building HVAC purge exhaust filter components are periodically tested in accordance with ANSI/ASME N509, Nuclear Power Plant Air Cleaning Units and Components, and ANSI/ASME N510, Testing of Nuclear Air treatment Systems. HEPA filters are tested for penetration of a challenge aerosol periodically." Please, explain how these periodic tests meet the NRC staff's acceptance criteria for ESF and normal atmospheric cleanup systems air filtration and adsorption units contained in RGs 1.52 and 1.140 respectively or provide an acceptable alternative approach. Include information in DCD Tier 2, Sections 9.4 and 6.4.

GE Response:

The statement noted in the RAI and Subsection 9.4.6.4 was revised per DCD Rev. 2 to state: "The Reactor Building HVAC purge exhaust filter components are periodically tested in accordance with Regulatory Guide 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."

The statement was clarified to remove reference to N509, which is not a periodic testing standard. The Reactor Building HVAC purge exhaust filter trains are nonsafety-related. As stated in Table 1.9-21, RG 1.52 is not applicable to the ESBWR. The Reactor Building HVAC purge exhaust filter units components provide the function of contaminated area filtration for Reactor Building and Fuel Building exhaust ventilation during conditions of abnormal airborne radioactivity to meet General Design Criteria 60 and 61. RG 1.140 specifies the applicable design and testing requirements.

DCD Impact:

No DCD changes will be made in response to this RAI.

NRC RAI 9.4-25:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that ESBWR conforms with the guidance of SRP, Section 9.4.1, Revision 2 for control room area ventilation system. The NRC staff considers the criteria contained in SRP Section 9.4.1 to also apply to TSC HVAC subsystem. SRP Section 9.4.1 lists the acceptance criteria as GDC 2, 4, 5, 19, and 60 and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the TSC HVAC subsystem. However, DCD Tier 2, Rev. 1, Section 9.4.7 does not contain details on how this criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2, RG 1.78 provides some information (but not all) regarding compliance with GDC 19. Provide details demonstrating how the ESBWR design for the TSC HVAC subsystem meets the acceptance criteria of GDC 2, GDC 4, GDC 5, GDC 19, and GDC 60. Update DCD Tier 2, Section 9.4.7 to include these details.

GE Response:

The TSC is an emergency response facility that is designed in accordance with the requirements delineated in NUREG-0696 "Functional Criteria For Emergency Response Facilities". The TSC and the TSC HVAC Subsystem (TSCVS) are nonsafety-related and are not credited to meet the requirements of GDC 2, 4, 5, 19, and 60. GDCs 2, 4, and 5 specifically apply to systems, structures, and components "important to safety", and are therefore not applicable to the TSC. The ESBWR design is committed to providing a TSC that meets the requirements of Utility Requirement Document (URD) Section 4.6.6, which states that a TSC shall be provided that complies with the requirements of NUREG-0696. NUREG-0696 requires the TSC to supply the same level of radiological protection as that supplied to the MCR under GDC 19; however, the TSC is not specifically committed to providing a safety-related environment in full compliance with GDC 19 that defines the Control Room habitability acceptance criteria. GDC 60 is not applicable to the TSC since no control functions are being made from the TSC for radioactive or toxic gas releases to the environment.

ESBWR compliance with NUREG-0696 for the TSC design will be described in DCD Tier 2 Subsection 9.4.7, Revision 3.

DCD Impact:

DCD Tier 2, Section 9.4.7 will be revised as noted above in Revision 3.

NRC RAI 9.4-26:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that ESBWR conforms with the guidance of SRP, Section 9.4.3, Revision 2, for auxiliary and radwaste area ventilation system. The NRC staff considers the criteria contained in SRP Section 9.4.3 to also apply to diesel generator (DG) HVAC subsystem. SRP Section 9.4.3 lists the acceptance criteria as GDC 2, 5, and 60 and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the DG HVAC subsystem. However, DCD Tier 2, Rev. 1, Section 9.4.3 does not contain details on how these criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2. Provide details demonstrating how the ESBWR design for the DG HVAC subsystem meets the acceptance criteria of GDC 2, GDC 5, and GDC 60. Update DCD Tier 2 Section 9.4.7 to include these details.

GE Response:

DCD Tier 2 Subsection 9.4.7 will be revised to similarly state:

- Meets GDC 2 via compliance with the guidance of Regulatory Guide 1.29, Position C.2 for nonsafety-related portions. The EBHV does not perform any safety-related function. The EBHV components are designated as Seismic Category NS. The Electrical Building is nonsafety-related and Seismic Category NS.
- Meets GDC 5 for shared systems and components important to safety. The ESBWR does not share any safety-related structure, system or component with any other unit.
- Meets GDC 60 because the Diesel Building HVAC has no source of radioactive materials in either particulate or gaseous form. The exhaust systems have no provision for filtration or adsorption because these areas are clean.

DCD Impact:

DCD Tier 2, Subsection 9.4.7 will be revised to incorporate the above in Revision 3.

NRC RAI 9.4-27:

The applicant stated in DCD Tier 2, Rev. 1, Section 9.4.7.4 that, "the EBHV filtration components are periodically tested in accordance with ANSI/ASME N509, Nuclear Power Plant Air Cleaning Units and Components, and ANSI/ASME N510, Testing of Nuclear Air Cleaning Systems. HEPA filters are tested periodically, and the charcoal filters are periodically tested for bypass."

a. Please, explain how these periodic tests meet the NRC staff's acceptance criteria for ESF and normal atmospheric cleanup systems air filtration and adsorption units contained in RGs 1.52 and 1.140, respectively, or provide an acceptable alternative approach. Include this information in the DCD.

b. In addition, DCD Tier 2, Rev. 1, does not include tables for "Major Equipment" and "Design Parameters" for the TSC HVAC subsystem as it does for other systems such as CBHVS, FBHVS, RWBHVACS, etc. Tables for this system should also be included in the DCD.

GE Response:

The statement noted in the RAI and Subsection 9.4.7.4 was revised per DCD Rev. 2 to state: "The EBVS filtration components are periodically tested in accordance with ASME AG-1 Code On Nuclear Air And Gas Treatment and/or ASME N510, Testing of Nuclear Air Treatment Systems."

The statement was clarified to remove reference to N509, which is not a periodic testing standard, and to add reference to ASME AG-1, which is the latest code containing in-place testing information. The EBVS contains filter trains that are nonsafety-related as part of the Technical Support Center HVAC Subsystem (TSCVS). As stated in Table 1.9-21, RG 1.52 is not applicable to the ESBWR. The TSCVS filter units are defense-in-depth components and provide the function of filtration for the TSC during conditions of abnormal airborne radioactivity when power is available. Since RG 1.140 applies specifically to normal atmosphere cleanup, and since the filter units are not credited ESF units per RG 1.52, the Codes and Standards that dictate the testing requirements of a filtration system designed for habitability are described. The specific tested and credited filtration efficiencies will meet or exceed the guidance in RG 1.140 and this will be described in Subsection 9.4.7.4 in DCD Rev. 3.

DCD Impact:

DCD Tier 2, Subsection 9.4.7.4 will be revised as noted above in DCD Revision 3.

NRC RAI 9.4-28:

The applicant stated in DCD Tier 2, Rev. 1, Tables 1.9-9 and 1.9-20 that the ESBWR conforms with the guidance of SRP, Section 9.4.3, Revision 2, for auxiliary and radwaste area ventilation system. The NRC staff considers the criteria contained in SRP Section 9.4.3 to also apply to drywell cooling system. SRP Section 9.4.3 lists the acceptance criteria as GDC 2, 5, and 60, and provides guidance on how to meet these criteria, in a way that is acceptable to the NRC staff, for the drywell cooling system. However, DCD Tier 2, Rev. 1, Section 9.4.8 does not contain details on how these criteria will be met. For example, RG 1.29 provides an acceptable way to comply with GDC 2. Provide details demonstrating how the ESBWR design for the drywell cooling system meets the acceptance criteria of GDC 2, GDC 5, and GDC 60. Update DCD Tier 2, Section 9.4.7 to include these details.

GE Response:

DCD Tier 2 Subsection 9.4.8 will be revised to similarly state:

- Meets GDC 2 via compliance with the guidance of Regulatory Guide 1.29, Position C.2 for nonsafety-related portions. The DWVS is classified as nonsafety-related and Seismic Category II.
- Meets GDC 5 for shared systems and components important to safety. The ESBWR does not share any safety-related structure, system or component with any other unit.
- Meets GDC 60 by suitably controlling the release of gaseous radioactive effluents to the environment. During normal operation, the DWVS re-circulates air with no connection to any HVAC system outside primary containment. Only during DW purge operations, is the primary containment air connected with the CONAVS subsystem of RBV. During DW purge operations, the containment purge fan can be used to discharge primary containment air to the CONAVS subsystem. The CONAVS system has RB HVAC Purge Exhaust Filter Units that are designed, tested and maintained in accordance with Regulatory Guide 1.140.

DCD Impact:

DCD Tier 2, Subsection 9.4.8 will be revised as noted above in Revision 3.

NRC RAI 11.5-25:

DCD Tier 2, Revision 1, Sections 9.4.2, 9.4.3, 9.4.4, and 9.4.6, and Tables 9.4-7 and 9.4-11 inconsistently describe the types of filtration systems (as prefilters, high energy particulate air (HEPA), or charcoal) used for mitigating and controlling gaseous effluents described in DCD Tier 2, Sections 11.5 and 11.3. Please address the following:

(A) DCD Sections 9.4.2 and 9.4.6 and DCD Table 9.4-11 indicate that the exhaust flow out the reactor and fuel buildings may be diverted to the purge exhaust filter unit. The information does not describe the types of filters used in these subsystems. DCD Table 9.4-11 refers to "high efficiency and HEPA" and DCD Section 9.4.6 only refers to "filter units" or "filter unit." Update descriptions to clearly specify the exact make up of each "filter unit" (i.e., equipped with prefilters, HEPA filters, and/or charcoal filters, or combination of these) for each subsystem.

(B) DCD Section 9.4.4 states that HEPA filters are used for the turbine building exhaust subsystem, turbine building compartment exhaust subsystem, and turbine building decontamination room exhaust subsystem, but they are not listed in supporting DCD tables. Provide information and equipment descriptions in new tables for these subsystems - see details in DCD Table 9.4-7 as an example.

(C) DCD Table 9.4-7 describes the filters for the radwaste building general area exhaust as "medium efficiency and HEPA" filtration units, while DCD Section 9.4.3 describes the system as "medium efficiency prefilter and HEPA filter." The designation of "prefilter" should be used consistently throughout this and other sections when prefilters are specified by the design. Update DCD text and tables accordingly.

GE Response:

The following addresses the items listed in the RAI:

- A. The Reactor Building Purge Exhaust Filter units will be equipped with pre-filters, HEPA filters and Carbon filters for mitigating and controlling gaseous effluents for the Reactor and Fuel buildings. The filter descriptions will be consistently updated in Subsection 9.4.6, Table 9.4-11 and Figure 9.4-10.
- B. The Turbine Building exhaust subsystem design parameters were added to Table 9.4-15 in Revision 2 to the DCD Tier 2.
- C. The inconsistencies between DCD Tier 2 Table 9.4-7 and DCD Tier 2 Subsection 9.4.3, as well as the balance of Section 9.4, with respect to the use of pre-filter will be addressed in DCD Tier 2, Revision 3. Section 9.4 will universally define the filter efficiency requirements for "Medium Efficiency" and "High Efficiency" filters utilized as pre-filters or final filters.

DCD Impact:

DCD Tier 2, Section 9.4 will be revised as noted above in Revision 3.