

Enclosure 1

MFN 15-063, Supplement 1

GEH's Supplemental Response to Item #5 - Minimize Contamination

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(Please note that below is GEH's original response to Item #5 for convenience)

NRC- Suggested Design Changes Item #5 - Minimize Contamination

Include 10 CFR 20.1406 design features to minimize contamination and the generation of reactor waste.

GEH Response:

ABWR will meet the requirements of 10 CFR 20.1406, to the extent practicable, with respect to minimizing contamination, of the facility and the environment, facilitating eventual decommissioning, and minimizing, to the extent practicable, the generation of radioactive waste by following the guidance developed in Regulatory Guide 4.21.

ABWR DCD Tier 2 Subsection 12.3.1.5, "Minimization of Contamination and Radioactive Waste Generation," has been created to provide a general description of the design and operational objectives taken from the Regulatory Position of Regulatory Guide 4.21. DCD Tier 2, Table 12.3-8 has been added to provide a cross reference to design features for the ABWR systems/structures and associated DCD subsections that address contamination minimization.

DCD Tier 2, Table 12.3-8 identifies the DCD chapter and subsections that discuss implementation of the design objectives from Regulatory Guide 4.21. Both generic and specific design objective examples are also included in Subsection 12.3.1.5.1. The systems listed are of varied construction, purpose and function, and as such, not all of the design objectives or concepts are represented by a design feature in each identified system subsections.

Regulatory objectives that are operational or procedural in nature will be addressed by the COL Applicant. COL license information has been added in DCD Tier 2 Subsection 12.3.7.5.

The following systems and structures were reviewed for applicability of 10 CFR 20.1406 requirements:

- Chapter 3 - Design of Structures, Components, Equipment and Systems
 - 3.1 Conformance With NRC General Design Criteria (3.1.2)
 - 3.4 Water Level (Flood) Design (3.4.1)
 - 3.7 Seismic Design (3.7.3)
 - 3.8 Seismic Category 1 Structures (3.8.1, 3.8.4)
- Chapter 4 – Reactor
 - 4.1 Summary Description (4.1.2)
 - 4.5 Reactor Materials (4.5.1)
 - 4.6 Functional Design of Reactivity Control System (4.6.2)

- Chapter 5 - Reactor Coolant System and Connected Systems
 - 5.1 Summary Description
 - 5.2 Integrity of Reactor Coolant Pressure Boundary (5.2.1, 5.2.3, 5.2.5)
 - 5.3 Reactor Vessel (5.3.1, 5.3.3)
 - 5.4 Component and Subsystem Design (5.4.8)
- Chapter 6 – Engineered Safety Features
 - 6.1 Engineered Safety Feature Materials (6.1.2)
 - 6.2 Containment Systems (6.2.3, 6.2.4)
 - 6.5 Fission Products Removal and Control Systems (6.5.3)
- Chapter 9 – Auxiliary Systems
 - 9.1 Fuel Storage and Handling (9.1.1, 9.1.2, 9.1.3, 9.1.4)
 - 9.2 Water Systems (9.2.8, 9.2.9, 9.2.10, 9.2.11, 9.2.14, 9.2.15)
 - 9.3 Process Auxiliaries (9.3.2, 9.3.3)
 - 9.4 Air Conditioning, Heating, Cooling and Ventilation Systems (9.4.1, 9.4.4, 9.4.5, 9.4.6, 9.4.8)
- Chapter 10 – Steam and Power Conversion System
 - 10.3 Main Steam Supply System (10.3.2)
 - 10.4 Other Features of Steam and Power Conversion System (10.4.1, 10.4.2, 10.4.3, 10.4.6, 10.4.7)
- Chapter 11 – Radioactive Waste Management
 - 11.1 Source Terms (11.1.5)
 - 11.2 Liquid Waste Management System (11.2.1, 11.2.2, 11.2.3, 11.2.5)
 - 11.3 Gaseous Waste Management System (11.3.1, 11.3.3, 11.3.4)
 - 11.4 Solid Waste Management System (11.4.1, 11.4.2)
 - 11.5 Process and Effluent Radiological Monitoring and Sampling Systems (11.5.1, 11.5.2)
- Chapter 12 – Radiation Protection
 - 12.3 Radiation Protection Design Features (12.3.1, 12.3.3)

A review of these structures/systems in the DCD was performed using applicable contamination control design measures taken from Appendix A of Regulatory Guide 4.21. The reviews were targeted at either structural/architectural, HVAC, or mechanical process contamination control features based on the system or structure function. The design review examined individual Appendix A design related contamination control measures that may apply to a given system or structure.

Not all of the above systems have significant features, which addressed 10 CFR 20.1406 requirements. The Standby Liquid Control, and Turbine Generator systems do not have significant contamination during operations and have little propensity for significant radioactive leakage leading to resultant contamination of the facility or environment. High-energy systems associated with the reactor coolant pressure boundary such as Nuclear Steam Supply, Reactor Water Cleanup, Shutdown Cooling, Main Steam, and Feedwater were determined to present a low probability of plant contamination as any system leakage would be quickly detected. Leakage in these systems is identified by flow, level, temperature, pressure and other parameters monitored by numerous plant systems and action would be immediately taken to correct system leakage. For example, the Leakage Detection and Isolation System would also serve to detect any leakage near the reactor coolant pressure boundary.

As a result of the design review process described above, DCD Tier 2, Table 12.3-8 provides a cross reference to design features in the specified DCD chapters and subsections that address the requirements of 10 CFR 20.1406.

Impact on DCD

DCD Tier 2, Chapter 12 Subsection 12.3.1.5, Subsection 12.3.7.5 and Table 12.3-8 were added as noted in the attached markups in MFN 15-063. In addition, Table 1.8-20, Table 1.9-1 and Subsection 12.3.8 are modified accordingly. The ABWR DCD Rev 5 marked up pages are provided in Enclosure 2 of MFN 15-063.

NRC Request for Supplemental Information:

In a public teleconference with the NRC on January 19th, 2016 the Staff raised several questions concerning GEH's response to NRC item #5 (MFN 15-063) and compliance with 10 CFR 20.1406. As a result of that teleconference the staff requested the following additional supplemental information:

- A) Provide additional information regarding the floor drain design features that minimizes the possibility of radioactive liquid spills penetrating the floor at embedment boundaries. Consider revising the 6th bullet under the generic ABWR design features of DCD Subsection 12.3.1.5.1 markup presented in MFN 15-063 response.*
- B) Provide additional information regarding the epoxy type coatings in the MFN 15-063 response, including tunnels containing radioactive liquid. Consider revising the 7th bullet under the generic ABWR design features of DCD Subsection 12.3.1.5.1 markup presented in MFN 15-063 response.*
- C) Describe what standards apply to the layout of embedded piping lines to minimize crud traps and facilitate access for cleaning and inspection (e.g. eliminate joints in embedded piping to minimize potential leakage, minimize the use of piping elbows to facilitate access for cleaning and inspection and minimize potential crud traps, minimize low spots which could become crud traps, and minimize high spots which could trap air).*
- D) Revise the last two sentence of ABWR DCD Subsection 12.3.1.1.1 Item (5) to wordings similar to ESBWR on embedded piping in ESBWR DCD 12.3.1.2.4:
"Some piping may be embedded in concrete (e.g., feed-throughs with short sections). Minimization of embedded piping to the extent practicable facilitates the dismantlement of the systems and the decommissioning of the facility, as required by 10 CFR 20.1406."*
- E) Revise the sentence of "Generic ABWR design features..." in DCD Subsection 12.3.1.5.1 markup presented in MFN 15-063 response to:
"Generic ABWR design features used to minimize contamination and generation of radioactive waste and facilitate decommissioning include the following:"*

GEH Response:

Response to Part A:

The 6th bullet under the generic ABWR design features of ABWR DCD Subsection 12.3.1.5.1 will be revised as follows:

"Appropriately sloped floors around floor drains in areas where the potential for a spill exists to limit the extent of contamination. The floor drains are monolithic in construction to minimize possibility of liquid penetrating at embedment boundaries. No grout is used in the installation of floor drains. Periodic visual inspections of the installation around the floor drains are performed to ensure no bypass exists in these floor drain areas;"

Response to Part B:

The 7th bullet under the generic ABWR design features of ABWR DCD Subsection 12.3.1.5.1 will be revised as follows:

“Provisions for decontaminable epoxy-type wall and floor coverings, which provide smooth surfaces to ease decontamination. Epoxy-type coatings are applied to both steel surfaces and concrete areas appropriate for contamination control. These areas consist of the walls and floors of the Reactor and Turbine Buildings, radwaste areas, rooms containing equipment with liquid radioactive sources, floor drain areas, washdown bays, and tunnels containing piping transporting potentially radioactive contaminated liquids;”

Response to Part C:

As a general rule, process piping is only embedded in concrete if no other reasonable configuration can be developed. Threaded and flanged joints are typically not embedded since embedding in concrete negates the usefulness of a joint that can be disassembled.

The ABWR will follow the guidance in NRC Regulatory Guides 1.143, 4.21 and 8.8 as well as ANSI/ANS Standards 55.1 and 55.6. The following is a summary of guidelines used for the layout of piping carrying radioactive liquids taken from the previously referenced documents. (Note that some of these guidelines appear in more than one document.)

- Minimize “dead spaces” or “traps” (i.e., zones of low fluid flow where contaminants settle out).
- Take advantage of gravity flow (i.e., slope lines where possible to reduce the potential for contamination buildup).
- Avoid stagnant legs and locate connections above the pipe centerline.
- Provide adequate drain and flush connections.
- Minimize the length of pipe runs and the number of fittings.
- Minimize flow restrictions; use full port valves without cavities.
- For solid waste piping, use 5 diameter bends where possible, or at a minimum, long radius elbows.
- Pressure retaining components shall utilize welded construction to the fullest extent practical.
- Use butt welds rather than socket welds.
- Do not use non-consumable backing rings for welds.
- Flanged joints or suitable rapid-disconnect fittings should be used only where maintenance or operational requirements so dictate.
- Screwed connections in which threads provide the only seal should not be used except for instrumentation and cast pump body drain and vent connections where welding is not suitable.

The guidelines for the layout of radioactive piping are the same whether the piping is embedded in concrete or not. These guidelines include all of the generally accepted methods for minimizing crud traps and simplifying cleaning as described above.

Typically, the only piping that will definitely be embedded in concrete is the drain piping in the floors and walls. This drain piping is low pressure piping, is of all welded construction and is hydrostatically tested in accordance with the applicable piping specification prior to placement of concrete. The floor drains are monolithic in construction to minimize possibility of liquid penetrating at embedment boundaries. No grout is used in the installation of floor drains.

Periodic visual inspections of the installation around the floor drains are performed to ensure no bypass exists in these floor drain areas.

The following sentence will be added in ABWR DCD Tier 2 Subsection 12.3.1.2 Item (4):

“In addition, the applicable regulatory and technical guidance documents are NRC Regulatory Guides 1.143 (Reference 12.3-13), 4.21 and 8.8 (Reference 12.3-14) as well as ANSI/ANS Standards 55.1 and 55.6 (References 12.3-15 and 12.3-16).”

Also, ABWR DCD Tier 2 Table 1.8-21 will be revised to include ANSI/ANS Standards 55.1 and 55.6 as industrial codes and standards applicable to ABWR. Subsection 12.3.8 will be revised to list Regulatory Guides 1.143 and 8.8 as well as ANSI/ANS Standards 55.1 and 55.6 as references.

Response to Part D:

Instead of revising ABWR DCD Subsection 12.3.1.1.1 Item (5), the following statements will be added in ABWR DCD Subsection 12.3.1.2 Item (4) making the ABWR DCD consistent with ESBWR DCD Subsection 12.3.1.2.4:

“Some process piping may be embedded in concrete (e.g., feed-throughs with short sections). Minimization of embedded piping to the extent practicable facilitates the dismantlement of the systems and the decommissioning of the facility, as required by 10 CFR 20.1406.”

Response to Part E:

The sentence of “Generic ABWR design features...” in ABWR DCD Subsection 12.3.1.5.1 will be revised as follows:

“Generic ABWR design features used to minimize contamination and generation of radioactive waste and facilitate decommissioning include the following:”

Impact on DCD

ABWR DCD R6, Tier 2, Table 1.8-21, Subsection 12.3.1.2, Subsection 12.3.1.5.1 and Subsection 12.3.8 are being revised as shown in Enclosure 2.