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MFN 07-042 Supplement 1

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U.S. Nuclear Regulatory Commission
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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 107 and Letter No. 96 Related to ESBWR Design Certification Application – Technical Specifications – RAI Numbers 16.0-5 S02 and 16.2-118**

Enclosures 1 and 2 contain the subject RAI responses resulting from NRC RAI Letter No. 107 and Letter No. 96. The GE Hitachi Nuclear Energy (GEH) responses to the original 16.0-5 and 16.0-5 S01 RAIs were provided in the Reference 1 letter.

Verified DCD changes associated with these RAI responses are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from these RAI responses. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

James C. Kinsey
James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 07-042, Letter from James C. Kinsey to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 80 Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 16.0-5 S01*, January 23, 2007

Enclosures:

1. MFN 07-042, Supplement 1 - Response to Portion of NRC Request for Additional Information Letter No. 107 and Letter No. 96 Related to ESBWR Design Certification Application - Technical Specifications - RAI Numbers 16.0-5 S02 and 16.2-118
2. MFN 07-042, Supplement 1 – DCD Markups for RAI Numbers 16.0-5 S02 and 16.2-118

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GEH (with enclosures)
	RE Brown	GEH (with enclosures)
	eDRFs	59-5596/2, 78-1134

Enclosure 1

MFN 07-042 Supplement 1

Response to Portion of NRC Request for

Additional Information Letter No. 107 and Letter No. 96

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Numbers 16.0-5 S02 and 16.2-118

NRC RAI 16.0-5 Supplement 1

Defense-in-Depth and the design basis require long term functional capability of the Containment, Control Room systems, and supporting systems. This is due to the long-term effects of radioactive decay and decay heat. The Containment, Control Room and supporting systems are required to mitigate the effects of design basis and severe accidents. Justify exclusion of the following STS from the ESBWR TS by demonstrating they do not satisfy the inclusion requirements of 10 CFR 50.36:

A. Section 3.7 (Service Water System and Ultimate Heat Sink (Cooling Towers), Control Room Fresh Air System, Control Room Heating Ventilation and Air Conditioning System)

B. Section 3.9 (Reactor Water Cleanup/Shutdown Cooling System);

C. Section 5.5 (Ventilation Filter Test Program, Diesel Generator Fuel Oil Testing Program).

GE Response

This supplemental question expands upon RAI 16.0-5 by including the first three sentences. By way of background, the response in MFN 06-431, November 13, 2006, to RAI 16.0-5 is restated for convenience as follows:

> **NRC RAI 16.0-5**
>
> *Justify exclusion of the following STS from the ESBWR TS by demonstrating they do not satisfy the inclusion requirements of 10 CFR 50.36:*
>
> *a. Section 3.7 (Service Water System and Ultimate Heat Sink (Cooling Towers), Control Room Fresh Air System, Control Room Heating Ventilation and Air Conditioning System);*
>
> *b. Section 3.9 (Reactor Water Cleanup/Shutdown Cooling System);*
>
> *c. Section 5.5 (Ventilation Filter Test Program, Diesel Generator Fuel Oil Testing Program).*
>
> **GE Response**
>
> In response to NRC RAI 16.0-1, GE completed a systematic and comprehensive evaluation of Revision 1 of the ESBWR DCD to determine the ESBWR process variables, design features, operating restrictions, and structures, systems, or components (SSCs) that meet one or more of the four criteria in 10 CFR 50.36(c)(2)(ii). This evaluation was used to verify that Revision 1 of DCD Chapter 16 includes the Limiting Conditions for Operations (LCOs) required to maintain the validity of the safety analysis and risk analysis described in Revision 1 of the ESBWR DCD. The evaluation determined that the ESBWR systems discussed below did not meet the criteria for inclusion in the Technical Specifications. The results of this evaluation were provided in GE letter MFN 06-263, dated August 8, 2006.
>
> a. In Section 3.7 of NUREG-1434 ["Standard Technical Specifications General Electric Plants, BWR/6"], Revision 3.1:
>
> - The system equivalent in intent to the Standby Service Water System and Ultimate Heat Sink (UHS) are the ESBWR Isolation Condenser/Passive

Containment Cooling (IC/PCC) pools, which reject all of the heat necessary to the atmosphere to meet the safety analyses acceptance criteria for the first 72 hours following a design basis event. The IC/PCC pools are included in ESBWR Technical Specification 3.7.5. The ESBWR non-safety Plant Service Water System and Main Cooling Tower do not provide required cooling to any safety-related system.

- Refer to the response to RAI 16.2-52 [actually, RAI 16.2-54] for a discussion of the Technical Specification requirements for the ESBWR systems equivalent in intent to the Control Room Fresh Air System and Control Room Air Conditioning System contained in Section 3.7 of NUREG-1434, Revision 3.1.

b. The results of the evaluation discussed in response to NRC RAI 16.0-1 determined that the cleanup function and the decay heat removal function of the non-safety related RWCU/SDC System do not meet any of the four criteria in 10 CFR 50.36(c)(2)(ii). Instead, refer to the response to RAI 16.2-74 for a discussion of the safety-related systems for decay heat removal included in the ESBWR Technical Specification requirements equivalent in intent to the Residual Heat Removal (RHR) System contained in Section 3.9 of NUREG-1434, Revision 3.1.

c. In Section 5.5 of NUREG-1434 ["Standard Technical Specifications General Electric Plants, BWR/6"], Revision 3.1:

- The Ventilation Filter Test Program is not needed in the ESBWR Technical Specifications because there are no ventilation filtration systems credited with meeting the safety analyses acceptance criteria for the first 72 hours following a design basis event. All ventilation filtration systems are non-safety in the ESBWR.

- The Diesel Generator Fuel Oil Testing Program is not needed in the ESBWR Technical Specifications because there are no diesel generators needed to operate in order to meet the safety analyses acceptance criteria for the first 72 hours following a design basis event. All diesel generators are non-safety in the ESBWR.

DCD Impact

No changes will be made to DCD Tier 2, Chapter 16 or Chapter 16B as a result of this RAI.

The above quoted response explains why selected non-safety systems are not included in the Technical Specifications as directly meeting one of the four criteria of 10 CFR 50.36(c)(2)(ii). These non-safety, active, defense-in-depth systems are not assumed to function during the first 72 hours of any analyzed accident or transient. It is GE's position that the intent of the application of the 10 CFR 50.36 Criterion is limited to the protective and mitigative features that are credited in the primary success path during the first 72 hours.

However, for these active, defense-in-depth non-safety systems, GE has not completed its evaluation of the appropriate regulatory treatment of non-safety systems (RTNSS).

The RTNSS evaluation and the relationship of the results of such an evaluation are explained in MFN 06-263, August 8, 2006, in response to NRC RAI 16.0-1. As stated in that response:

> Consistent with [NRC guidance on RTNSS in SECY 94-084 and SECY 95-132, and DCD Appendix 1D and Section 19.6], in a subsequent revision to the DCD, GE will provide appropriate "short-term availability controls" in the form of "simple Technical Specifications" for the RTNSS SSCs identified in DCD Appendix 1D.

Based on the NRC guidance and the ESBWR RTNSS evaluation, the systems that are the subject of RAI 16.0-5 and its supplement may, at a later time, be subject to short-term availability controls, which will be presented in DCD Chapter 19 as an appendix "in the form of simple Technical Specifications." At this time, for the reasons discussed herein, it would be inappropriate to address the RTNSS treatment in detail. GE met with the NRC Staff on November 28, 2006, to discuss RTNSS for the ESBWR. The discussions at that meeting were consistent with the positions discussed herein.

Recent NRC guidance further supports that the post-72 hours active systems should be evaluated as RTNSS. Specifically, NRC guidance in DG-1145, Section C.IV.10, "Regulatory Treatment of Non-Safety Systems," compares passive systems required during the first 72 hours following an initiating event, and active systems relied upon for defense-in-depth and necessary to meet passive ALWR plant safety and investment protection goals. The referenced section of the NRC guidance notes that the information contained therein is based on NUREG-1793, Volume 3, "Final Safety Evaluation report related to Certification of the AP1000 Standard Plant Design" (September 2004). The guidance states the following:

> Defense-in-depth systems provide long-term, post-accident plant capabilities. Passive systems should be able to perform their safety functions, independent of operator action or offsite support, for 72 hours after an initiating event. After 72 hours, non-safety or active systems may be required to replenish the passive systems or to perform core and containment heat removal duties directly. These active systems are the first line of defense in reducing challenges to the passive systems in the event of transients or plant upsets.

The DG-1145 guidance references NRC guidance first established in SECY 94-084 and SECY 95-132, which describe the scope, criteria, and process used to determine regulatory treatment of non-safety systems in passive plant designs. In SECY 94-084, "Policy and Technical Issues Associated with the Regulatory Treatment of Non- Safety Systems in Passive Plant Designs" (March 28, 1994), the NRC Staff discussed RTNSS. The Commission approved the staff's position regarding RTNSS as discussed in SECY 94-084 in a Staff Requirements Memorandum (SRM) dated June 30, 1994. The NRC Staff subsequently issued SECY 95-132, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs (SECY 94-084)" (May 22, 1995), which revised SECY 94-084, but retained the position on RTNSS with essentially no changes. The Commission approved the Staff recommendations contained in SECY 95-132 in a SRM dated June 28, 1995, with direction to the Staff to clarify a recommendation concerning inservice testing of pumps and valves (See NRC Memorandum, D. Crutchfield to Docket File, "Consolidation of SECY 94-084 and SECY 95-132," July 24, 1995).

In SECY 95-132, the NRC supported many of the EPRI Advanced Light Water Reactor (ALWR) Utilities Requirement Document design requirements. By way of example, the NRC explained:

> The passive ALWR designs also include active systems that provide defense-in-depth capabilities for reactor coolant makeup and decay heat removal. Active systems are the first line of defense to reduce challenges to the passive systems in the event of transients or plant upsets. As stated above, all active systems in passive plants are designated as non-safety systems. In addition, one of the principal design requirements of EPRI's ALWR utility requirements document (URD) is that passive systems should be able to perform their safety functions, independent of operator action or offsite support, for 72 hours after an initiating event. After 72 hours, non-safety, or active systems may be required to replenish the passive systems or perform core and containment heat removal duties directly . . .
>
> [A]ctive systems are not classified as safety-related in passive ALWR designs, and credit is not taken for these active systems in the Chapter 15 licensing design-basis accident (DBA) analyses. In SECY 90-406, "Quarterly Report on Emerging Technical Concerns," December 17, 1990, the staff listed the role of these active systems in the passive design as an emerging technical issue. In SECY 93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," April 2, 1993, the staff discussed the issue of regulatory treatment of active non-safety systems (the "RTNSS Issue") and stated that it would propose a resolution of this issue in a separate Commission paper.

The NRC Staff also acknowledged:

> The exclusive reliance on passive systems in meeting current licensing criteria is a departure from current design philosophy and licensing practice and must be evaluated. Therefore the staff will need new guidance for reviewing [passive design] submittals and in developing regulatory treatment of non-safety systems (RTNSS).

On July 19, 1995, the Commission issued an amendment to 10 CFR 50.36 to codify the criteria for determining the content of Technical Specifications (60FR36953, July 19, 1995). In the Statement of Considerations Supplementary Information, the Commission summarized the basis for Technical Specification content, explaining the four criteria:

> By applying the four criteria contained in this rule, a licensee should capture the conditions for operation of its facility that are required to meet the principal operative standard in Section 182a. of the Atomic Energy Act, that is, that adequate protection is provided to the health and safety of the public.
>
> The Commission recognizes that the four criteria carry a theme of focusing on the technical requirements for features of controlling importance to safety. Since many of the requirements are of significance to the health and safety of the public, this rule reflects the subjective statement of the purpose of technical specifications expressed by the Atomic Safety and Licensing Appeal Board in Portland General Electric Company (Trojan Nuclear Plant), ALAB–531, 9 NRC 263 (1979). There, the Appeal Board interpreted technical specifications as being reserved for those conditions or limitations upon reactor operation necessary to obviate the possibility of an abnormal situation or event giving rise to *an immediate threat* to the public health and safety.

Emphasis added (60FR36954-5).

One primary purpose of SECY 95-132 was to address how non-safety, active, defense-in-depth systems would be evaluated for regulatory treatment appropriate to the function of these systems. This discussion of the regulatory treatment was new and separate from discussion of how credited protective systems were regulated by 10 CFR 50.36, which is intended to apply to "an immediate threat to public health and safety." Specifically, of the five RTNSS evaluation criteria described in SECY 95-132, Criterion B identifies the scope as including system functions relied upon for "long term safety (beyond 72 hours)."

Based on the above considerations, it is GE's position that the RTNSS evaluation is the appropriate regulatory treatment for non-safety, active, post-72 hour recovery/defense-in-depth systems, which do not fall within the scope of the criteria delineated in 10 CFR 50.36. Each of the systems, subsystems, and components listed in the subject of this RAI were addressed within the response to RAI 16.0-1 to determine if they fall under the scope of the criteria delineated in 10 CFR 50.36, consistent with the position and NRC guidance described above. To the extent that any of these systems are determined to require additional regulatory treatment per the RTNSS evaluation, the systems will be included in a future revision to Chapter 19 in a short-term availability controls appendix, as appropriate. Any additional information regarding the subject systems should be addressed through the NRC review of RTNSS.

DCD Impact

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

NRC RAI 16.0-5, Supplement 2

The ESBWR CRHAVS does not rely on air conditioning units for temperature control following isolation of the control room as does the STS BWR/6 control room fresh air (CRFA) system. The STS requires an operable control room air conditioning system.

The Bases for TS 3.7.2 states that following a DBA, the CRHAVS air handling units (AHUs) (the air conditioning units) are assumed to initially operate, with power from nonsafety-related uninterruptible AC sources, for up to 2 hours to remove heat from non-safety loads within the CRHA to maintain temperature ≤ 78°F; at time 2 hours, those non-safety loads are tripped and passive heat loss from the CRHA and the CRHAVS filtered air supply limit temperature increase to 15°F until ac power is restored no later than 72 hours after the event started.

Assuming a CRHA temperature of 93°F is acceptable, the NRC staff requests the applicant to establish an ITAAC to demonstrate the claimed post-accident temperature behavior of the CRHA and passive heat sink.

Alternatively, this issue over CRHA post accident cooling may be resolved by explicitly requiring the AHUs to be operable in LCO 3.7.2, and adding to the design electrical power support sufficient to run the AHUs for 72 hours without offsite or standby ac power.

TS 3.7.2 Action A allows 72 hours to restore temperature in the CRHA to ≤ 78 °F. Under normal unit power operating conditions, with CRHA air temperature and passive heat sink at 78°F, and assuming maximum expected ambient air temperature and no AHU cooling available, what temperature could the CRHA air reach in 72 hours? Consider adding a required action to verify CRHA air temperature and passive heat sink temperature at some maximum value, say on an hourly basis, as a condition for operating during the 72-hour window - to ensure the capacity of the heat sink remains available in case of a design basis event.

Add a SR to TS 3.7.2 (CRHAVS) for the AHUs, analogous to STS SR 3.7.4.1, or explain in the TS 3.7.2 Bases and reference the DCD discussion of how CRHA temperature remains acceptable during loss of CRHAVS air conditioning for 72 hours after event initiation.

GEH Response

Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) requirements in DCD, Tier 1, Revision 4, Section 2.16.2.2, Control Building HVAC System, Item (4), and Table 2.16.2-4, address requirements from DCD, Tier 2, Section 9.4.1, Control Building HVAC System and DCD, Tier 2, Section 6.4, Control Room Habitability Systems. Specifically, ITAAC ensure that the Control Room Habitability Area (CRHA) temperature increase will be ≤ 8.3°C (15°F) during the 72 hours following loss of normal cooling by passively dissipating heat to CRHA heat sinks. This ITAAC confirms that the nonsafety-related air conditioning units are not required to limit the increase in CRHA temperature consistent with design commitments in DCD, Tier 2, Section 9.4.1 and DCD, Tier 2, Section 6.4. Therefore, LCO 3.7.2, "Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS)," includes an SR that limits maximum CRHA heat sink temperature during normal operation but does not include a requirement for operability of air conditioning units or a requirement for periodic verification of air conditioning unit capacity.

DCD, Tier 1, ITAAC, is being evaluated as part of the response to RAI 9.4-33, Supplement 1, to ensure that assumptions related to the CRHA heat sink analysis are properly documented in the DCD and verified by ITAAC.

To ensure that the DCD fully describes the CRHA heat sink and that Technical Specification Surveillance Requirements verify that CRHA heat sink analysis initial conditions and assumptions are met, GEH will take the following action:

1. GEH will revise Tier 2, DCD Sections 6.4 and 9.4.1, to more completely describe the CRHA heat sinks and temperature limits assumed in the CRHA temperature analysis. Specifically, DCD 9.4.1 and DCD Section 6.4 will be revised to describe the CRHA heat sinks as including: the CRHA walls, floor, ceiling, and interior walls, and access corridors; adjacent Q-DCIS and N-DCIS equipment rooms and electrical chases; and, CRHA HVAC equipment rooms and HVAC chases. The initial temperature for the CRHA heat sinks used in the Technical Specifications is 27°C (78°F) for all areas except the HVAC equipment rooms and safety portions of the CRHAVS rooms, which use an initial temperature of 40°C (104°F). These temperatures were used in the CRHA heat sink temperature analysis and are based on DCD Table 9.4-1, "Design Parameters for the CBVS, " and DCD Table 3H-4, "Thermodynamic Environmental Conditions inside the Control Building for Normal Conditions, " and Table 3H-10, " Thermodynamic Environmental Conditions inside the Control Building for Accident Conditions. "
2. GEH will revise Tier 2, DCD Chapters 16 and 16B, LCO 3.7.2, " Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS), " to expand the requirements of Surveillance Requirement (SR) 3.7.2.1 to define the CRHA heat sinks and establish acceptance criteria consistent with the changes to DCD Sections 6.4 and 9.4.1 described above.
3. GEH will revise Tier 2, DCD Chapters 16 and 16 B, LCO 3.7.2, Actions and associated Bases, to limit the temperature excursion of the heat sink when air temperatures in the CRHA or adjacent spaces are not being maintained within SR 3.7.1.1 limits. Specifically, the Completion Time for restoration of CRHA heat sink temperature to within the SR 3.7.2.1 limit will be reduced from 72 hours to 24 hours. Additionally, a new Action will be established to limit the maximum temperature excursion of the CRHA heat sinks during the 24 hour Completion time. These Actions will ensure that CRHA heat sink temperatures are restored, or reactor shutdown initiated, before there is a substantial degradation of the CRHA heat sinks.

RAI 6.4-8, RAI 9.4-32, RAI 9.4-33, RAI 9.4-34, and RAI 16.2-118 address related issues.

DCD Impact

DCD, Tier 2, Sections 6.4 and 9.4.1, and DCD Chapters 16 and 16B, LCO 3.7.2, will be revised in Revision 5 as shown in Enclosure 2.

NRC RAI 16.2-118

Revise TS 3.7.2, "Control Room Habitability Area (CRHA) Heating, and Air Conditioning (HVAC) Subsystem (CRHAVS)." Please address the following topics in regard to TS 3.7.2, "Control Room Habitability Area (CRHA) Heating, and Air Conditioning (HVAC) Subsystem (CRHAVS)" in DCD Rev 3:

A. *Revise the 4th sentence of the Applicable Safety Analyses discussion in the Bases to state: "No single active or passive failure will cause the loss of outside air to the CRHA."*

B. *Required Action A.1 specifies 72 hours to recover from inadequate cooling in the CRHA as evidenced by temperatures above the limit of 78.0/F. Under the worst case conditions assumed in the design: 1) what temperature would be reached in the CRHA in 72 hours and afterwards during plant shutdown; and 2) could those temperatures interfere with the capability to safely shutdown the plant during both normal and Design Basis Accident operating conditions? That is, provide additional technical justification for the 72-hour completion time beyond that given in the Bases background discussion and the Bases for Required Action A.1.*

C. *Use "System" instead of "Subsystem" in the name of the CRHAVS TS. Also, please do not use both "subsystem" and "train" interchangeably; one or the other should be used throughout the TS.*

D. *Recommend requiring an Air Handling Unit (AHU) for each CRHAVS subsystem be operable, and revise Action A to address an inoperable subsystem due to inoperable AHUs, then allow appropriate restoration time for the CRHA cooling, contingent upon maintaining the temperature within limit (specify an action requirement to periodically check the temperature). Also, add a surveillance requirement to verify the heat removal capability of the AHUs similar to STS SR 3.7.4.1.*

GEH Response

A. GEH will revise the Applicable Safety Analyses discussion in the Bases of LCO 3.7.2, "Control Room Habitability Area Heating, Ventilation, and Air Conditioning Subsystem (CRHAVS)," to correct the typographical error in the fourth sentence.

B. GEH will revise LCO 3.7.2, Action A, to reduce the Completion Time for restoration of average CRHA heat sink temperature to within the specified limit. The revised Completion Time is justified in the response to RAI 16.0-5, Supplement 2.

C. Use of the term "subsystem" in the title of LCO 3.7.2, "Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS)," is consistent with DCD, Tier 2, Section 9.4.1, "Control Building HVAC System," which describes the CRHAVS as one of the subsystems of the control building ventilation system (CBVS). The CRHAVS subsystem consists of two trains of Emergency Filter Units (EFU). This terminology is used consistently throughout LCO 3.7.2 and the associated Bases.

D. As justified in the response to RAI 16.0-5, Supplement 2, LCO 3.7.2 does not include a requirement for the nonsafety-related heat removal capability of the AHUs to ensure that CRHA temperature is maintained during analyzed events. The heat removal capability of the nonsafety-related AHUs does not meet the criteria of 10 CFR 50.36(d)(2)(ii).

DCD Impact

DCD, Tier 2, Chapter 16, LCO 3.7.2, Action A and the fourth sentence in Chapter 16B, LCO 3.7.2, Applicable Safety Analyses will be revised in Revision 5 as shown in Enclosure 2.

Enclosure 2

MFN 07-042 Supplement 1

DCD Markups for

RAI Numbers 16.0-5 S02 and 16.2-118

Verified DCD changes associated with these RAI responses are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from these RAI responses. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

6.4.3 Control Room Habitability Area

The CRHA boundary is located on elevation –2000mm in the Control Building. The layout of the CRHA, which includes the MCR, is shown within Figure 1.2-3. The CRHA envelope includes the following areas:

- Main Control Room (Room 3275)
- Shift Supervisor Office (Room 3272)
- Shift Supervisor Conference Room (Room 3273)
- Operator's Area (Room 3270)
- Shift Technical Advisor Office (Room 3271)
- Main control Room Storage Room (Room 3204)
- Electrical Panel Board Room (Room 3205)
- Restroom A (Room 3201)
- Restroom B (Room 3202)

These areas constitute the operation control area, which can be isolated and remain habitable for 72 hours without AC powerthe duration of a DBA if high radiation conditions exist. Potential sources of danger such as steam lines, pressurized piping, pressure vessels, CO2 fire fighting containers, etc. are located outside of the CRHA.

Heat Sink

The function of providing a passive heat sink for the CRHA is part of the CRHA emergency habitability system. The heat sink for each room is designed to limit the temperature rise inside each room during the 72-hour period following a loss of CRHAVS operation. The heat sinks consists of the thermal mass of the concrete that makes up the ceilings and walls of these rooms. The CRHA heat sinks consist of the following: the CRHA walls, floor, ceiling, and interior walls, and access corridors; adjacent Q-DCIS and N-DCIS equipment rooms and electrical chases; and, CRHA HVAC equipment rooms and HVAC chases. After the 72-hour period the EFU maintains the habitability of the CRHA when B2 RTNSS power supplies are not available.

Radiation Protection

Description of control room instrumentation for monitoring of radioactivity is given in Sections 11.5 and 12.3.

Shielding Design

The design basis LOCA dictates the shielding requirements for the CRHA. Main control room shielding design bases are discussed in Section 12.3. Descriptions of the design basis LOCA source terms, main control room shielding parameters, and evaluation of doses to main control room personnel are presented in Section 15.4. The main control room location in the plant with respect to designated radiation zones is shown in Figure 12.3-3.

6.4.4 System Operation Procedures

The CRHA emergency habitability portion of the CRHAVS is not required to operate during normal conditions. The normal operation of the CRHAVS maintains the air temperature of the CRHA within a predetermined temperature range. This maintains the CRHA emergency habitability system passive heat sink at or below a predetermined temperature. The normal operation portion of the CRHAVS operates during all modes of normal power plant operation, including startup and shutdown. For a detailed description of the CRHAVS operation see Subsection 9.4.1.

The COL Applicant will verify procedures and training for control room habitability address the applicable aspects of NRC Generic Letter 2003-01 and are consistent with the intent of Generic Issue 83 (COL 6.4-1-A).

Emergency Mode

Operation of the emergency habitability portion of the CRHAVS is automatically initiated by either of the following conditions:

- High radioactivity in the main control room supply air duct, and
- Extended Loss of AC power.

Operation can also be initiated by manual actuation. Upon receipt of a high radiation level in the main control room supply air duct exceeding the setpoint, the normal outside air intake and restroom exhaust are isolated from the CRHA pressure boundary by automatic closure of the isolation dampers in the system ductwork. At the same time, one of the EFU automatically starts and begins to deliver filtered air from one of the two unique safety-related outside air intake locations. A constant air flow rate is maintained and this flow rate is sufficient to pressurize the CRHA boundary to at least 31 Pa (1/8-inch water gauge) positive differential pressure with respect to the adjacent areas. The EFU system air flow rate is also sufficient to supply the fresh air requirement of 9.5 l/s (20 cfm) per person for up to 21 occupants. (Ref~~. ASHRAE Standard 62~~erence 6.4-3).

With a source of AC power available, the EFU can operate and is controlled indefinitely through Q-DCIS. In the event that ~~AC~~ offsite or standby diesel power is not available, the safety-related battery power supply is sized to provide the required power to the operating EFU fan for 72 hours of operation. For longer-term operation, from ~~after~~ post 72 hrs ~~to 7 days~~ each EFU fan is powered via an electrical bus supplied by one (1) of two (2) ancillary diesel generators~~, a small portable AC power generator that is kept on the plant site can power the EFU fan system~~. The temperature and humidity in the CRHA pressure boundary following a loss of the normal portion of the CRHAVS remain within the limits for reliable human performance (References 6.4-1 and 6.4-2) over a 72-hour period. The CRHA isolation dampers fail as is on a loss of AC power or instrument air.

Backup power to the safety-related Control Room (CR) EFU fans (post 72 hours) if off site or standby diesel power is not available is provided by two (2) ancillary diesel~~a small portable dedicated electrical~~ generators. These~~is~~ generators ~~is~~ are required to support operation of the Control Room EFU beyond 72 hours ~~through 7 days~~ after an accident. This function is a nonsafety-related function that satisfies the significance criteria for Regulatory Treatment of NonSafety Systems. ~~This AC power generator is kept on the plant site to power the EFU fan~~

~~system.~~ For a period between 7 days out to 30 days, the EFU can be powered from either off-site power, onsite diesel generator powered PIP bus, or by continued use of the ancillary diesel~~small AC power~~ generators. The requirements for the ancillary~~CRHAVS portable~~ generators are described in Appendix 19A.

Upon a loss of preferred power or SBO, the initial ranges of temperature/relative humidity in the CRHA are 22.8 – 25.6°C (73 - 78°F) and 25% - 60% RH. During the first two hours of an SBO, most of the equipment in the MCR remains powered by the nonsafety-related battery supply. After two hours, the nonsafety-related batteries are exhausted, and only a small amount of safety-related equipment remains powered. During the first two hours the environmental conditions are maintained within the normal ranges listed above. This is accomplished via the continued operation of a CRHA recirculation AHU and chilled water pump powered from the same nonsafety-related battery supply that powers the non-safety MCR equipment. Chilled water from a chilled water thermal storage tank is utilized as the heat sink. The cooling function for this two hour period is not a safety function, if this cooling function is lost, the nonsafety-related equipment and their associated heat loads are automatically de-energized.

If power remains unavailable beyond two hours, the remaining CRHA safety-related equipment heat loads are dissipated passively to the CRHA heat sinks. The CRHA heat sinks limit~~s~~ the temperature rise to that listed in Table 6.4-1~~. The CRHA is passively cooled~~ by passively ~~conduction~~ conducting heat into the ~~walls and ceiling~~heat sinks. The CRHA heat sinks consist of the following: the CRHA walls, floor, ceiling, and interior walls, and access corridors; adjacent Q-DCIS and N-DCIS equipment rooms and electrical chases; and, CRHA HVAC equipment rooms and HVAC chases. Sufficient thermal mass is provided in the walls and ceiling of the main control room to absorb the heat generated by the equipment, lights, and occupants.

These actions discussed above protect the main control room occupants from a potential radiation release and maintain the CRHA as a safe and habitable environment for continued operator occupancy.

6.4.5 Design Evaluations

System Safety Evaluation

Doses to main control room personnel are calculated for the accident scenario where the EFU provides filtered air to pressurize the CRHA. Doses are calculated for the following accident:

Loss Of Coolant Accident Table 15.4-9

The dose analyses are performed in accordance with the requirements of Regulatory Guides 1.194 and 1.196. For all events, the dose is within the dose acceptance limit of 5.0 rem TEDE. The details of the analytical assumptions for modeling the doses to the main control room personnel are delineated in Chapter 15. No radioactive material storage areas are located adjacent to the main control room pressure boundary. As discussed and evaluated in Subsection 9.5.1, the use of noncombustible construction and heat and flame resistant materials throughout the plant reduces the likelihood of fire and consequential impact on the main control room atmosphere. Operation of the CRHAVS in the event of a fire is discussed in Subsection 9.4.1. The exhaust stacks of the onsite standby power diesel generators are located in excess of 48 m (157 ft) away from the fresh air intakes of the main control room. The onsite standby power system fuel oil storage tanks are located in excess of 55 m (180 ft) feet from the

The CBVS provides a safety-related means to passively maintain habitable conditions in the CRHA following a design basis accident (radiological event concurrent with SBO).

Radiation detected in the CRHA outside air inlet causes the following actions:

- A normally closed EFU outside air inlet to open;
- The normal outside air inlet and restroom exhaust dampers to close; and
- An EFU fan to automatically start.

The CRHA is isolated during SBO conditions and a safety-related EFU provides pressurization and breathing quality air. An EFU is powered from the safety-related battery supply for a 72 hour duration. For longer-term operation, post from after 72 hrs out to 7 days, a small portable AC power generator that is kept on the plant site either of two (2) ancillary diesel generators can power either the EFU fan system..

The CBVS provides the capability to maintain the integrity of the CRHA with redundant safety-related isolation dampers in all ductwork penetrating the CRHA envelope. The active safety-related components (CRHA isolation dampers and EFUs), that ensure habitability in the CRHA envelope, are redundant. Two trains of safety-related EFUs, including HEPA and Carbon filters, serve the CRHA envelop. Redundant fans are provided for each EFU to allow continued operability during maintenance of electrical power supplies. Therefore a single active failure cannot result in a loss of the system design function.

During normal modes of operation and emergency modes with electrical power available, the CRHA is maintained within the temperature and relative humidity ranges noted in Table 9.4-1 by the nonsafety-related CRHAVS Recirculation AHU. During emergency operation, with an SBO, a nonsafety-related CRHA recirculation air handling unit (AHU), powered from the nonsafety-related Uninterruptible AC Power Supply System, maintains the CRHA within the normal operating temperature range for two hours. This allows the continued operation of certain high heat producing nonsafety-related MCR DCIS electric loads. These nonsafety-related MCR DCIS electrical loads automatically de-energize after two hours or should the redundant CRHA recirculation AHUs become unavailable. In the event the SBO duration extends beyond two hours, the reduced CRHA heat load is passively cooled by the CRHA heat sink. The CRHA heats sinks, which consists of the following: the CRHA walls, floor, ceiling, and interior walls, and access corridors; adjacent Q-DCIS and N-DCIS equipment rooms and electrical chases; and, CRHA HVAC equipment rooms and HVAC chases. The CRHA heat sinks of the internal and external concrete walls, floor, and ceiling, such that limit the CRHA temperature rise is to no greater than 8.3°C (15°F) for 72 hours. After 72 hours the EFU maintains the habitability of the CRHA when RTNSS power supplies are available.

Power Generation Design Bases

The CBVS:

- Provides a controlled environment for personnel comfort and safety. Sufficient outside air is provided to meet the ventilation requirements for acceptable indoor air quality (Ref. ASHRAE 62-2001, Table 2). Table 9.4-1 depicts the area design temperature and humidity design parameters.

3.7 PLANT SYSTEMS

3.7.2 Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS)

LCO 3.7.2 Two CRHAVS trains associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems – Operating," and LCO 3.8.7, "Distribution Systems – Shutdown," shall be OPERABLE.

- NOTE -

The control room habitability area (CRHA) boundary may be opened intermittently under administrative control.

APPLICABILITY: MODES 1, 2, 3, and 4,
During operations with a potential for draining the reactor vessel (OPDRVs).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. CRHA ~~air~~ heat sink average temperature(s) not within limit.	A.1 Verify each CRHA heat sink average temperature is ≤ 4.4°C (8.0°F) above the specified limit.	Once per 8 hours
	AND	
	A.2 Restore each CRHA ~~air~~ heat sink average temperature to within limits.	~~72~~ 24 hours
B. One or more CRHAVS trains inoperable due to inoperable CRHA boundary in MODE 1, 2, 3, or 4.	B.1 Initiate action to implement mitigating actions.	Immediately
	AND	

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~G~~F. Two CRHAVS trains inoperable during OPDRVs. <u>OR</u> One or more CRHAVS trains inoperable due to inoperable CRHA boundary during OPDRVs.	F~~G~~.1 Initiate action to suspend OPDRVs.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.2.1	Verify average temperature of each CRHA ~~air~~ heat sink ~~temperature~~ is within ~~≤ 25.6°C (78.0°F)~~established design limits.	24 hours
SR 3.7.2.2	Operate each CRHAVS train for ≥ 15 minutes.	31 days
SR 3.7.2.3	Perform required CRHAVS filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.7.2.4	Verify CRHA isolation dampers and each CRHAVS train actuate on an actual or simulated initiation signal.	24 months
SR 3.7.2.5	Verify de-energization of the main control room Nonsafety-Related Distributed Control and Instrumentation System (N-DCIS) electrical loads on an actual or simulated initiation signal.	24 months

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BACKGROUND (continued)

air supply fans and two redundant nonsafety-related internal floor mounted recirculation air handling units (AHUs). Upon receipt of the initiation signal(s) (indicative of conditions that could result in radiation exposure to CRHA occupants), the CRHAVS automatically switches to the isolation mode of operation to minimize infiltration of contaminated air into the CRHA. A system of dampers isolates the CRHA, the recirculation AHUs continue to operate to maintain the CRHA temperature, and CRHA makeup air flow is processed through either of the two EFU filter trains. If all onsite and offsite AC power is lost, one of the nonsafety-related recirculation AHUs and a nonsafety-related recirculating chilled water pump operate for a minimum of two hours using the nonsafety-related Uninterruptible AC Power Supply System to dissipate heat from operation of the main control room Nonsafety-Related Distributed Control and Instrumentation System (N-DCIS) electrical loads. These main control room N-DCIS electrical loads are automatically de-energized when the CRHA temperature rises above the normal maximum temperature, indicating that the redundant nonsafety-related recirculation AHUs are not in operation.

Following the loss of CRHA cooling, t~~T~~he ~~safety-related~~ CRHA heat loads are passively dissipated ~~by~~ to the heat sinks within the CRHA and adjacent spaces. The CRHA heat sinks consist of three groups: the CRHA (i.e., the CRHA walls, floor, ceiling, interior walls), adjacent corridors, and HVAC chases; adjacent Q-DCIS and N-DCIS equipment rooms and electrical chases; and, adjacent HVAC equipment rooms and safety portions of the CRHA rooms. When the temperature of each CRHA heat sink is maintained within the specified limit, the CRHA heat sinks are sufficient to limit the increase of CRHA temperature to less than 8.3°C (15°F).~~for 72 hours concurrent with a loss of all onsite and offsite AC power and, upon recovery of onsite or offsite AC power, for an additional 27 days continuous occupancy, without exceeding the initial main control room temperature by more than 8.3°C (15°F) for any loss of cooling event.~~

The CRHAVS is designed to maintain a habitable environment in the CRHA for 72 hours continuous occupancy after a design basis accident (DBA) concurrent with a loss of all onsite and offsite AC power and, upon recovery of onsite or offsite AC power, for an additional 27 days continuous occupancy, without exceeding 0.05 Sv (5 rem) total effective dose equivalent (TEDE). Controls to manually isolate the CRHA and to manually actuate CRHAVS following indication of a radiological event (indicative of conditions that could result in radiation exposure to CRHA occupants) are provided. CRHAVS operation in maintaining CRHA

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habitability is discussed in Section 6.4 and Section 9.4.1 (Refs. 1 and 2, respectively).

APPLICABLE SAFETY ANALYSES

The ability of the CRHAVS to maintain the habitability of the CRHA is an explicit assumption for the safety analyses presented in Chapter 6 and Chapter 15, (Refs. 1 and 3, respectively). The isolation mode of the CRHAVS is assumed to operate following a DBA. The radiological dose to CRHA occupants as a result of various DBAs is summarized in Reference 3. No single active or passive failure will cause the loss of outside air ~~from~~ to the CRHA. The CRHAVS provides protection from smoke [and hazardous chemicals] to the CRHA occupants. [The analysis of hazardous chemical releases demonstrates that the toxicity limits are not exceeded in the CRHA following a hazardous chemical release (Ref. 2).] The evaluation of a smoke challenge demonstrates that it will not result in the inability of the CRHA occupants to control the reactor either from the main control room or from the remote shutdown panels (Ref. 2).

COL 16.0-1-A 3.7.2-1

CRHA heat sinks in the CRHA and adjacent spaces must be maintained consistent with the assumptions in Reference 2 to ensure that the CRHA temperature can be maintained for 72 hours following an event that includes loss of CRHAVS cooling.

The CRHAVS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two redundant one hundred percent capacity trains of the CRHAVS~~, each associated with a different division of the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems – Operating," and LCO 3.8.7, "Distribution Systems – Shutdown,"~~ are required to be OPERABLE to ensure that at least one is available, assuming a single failure disables one train. ~~Total system failure could result in control room personnel receiving radiation exposures in excess of 0.05 Sv (5 rem) TEDE in the event of a DBA.~~ The CRHAVS is considered OPERABLE when the individual components necessary to limit CRHA occupant exposure are OPERABLE in each train. A CRHAVS train is ~~considered~~ OPERABLE when:

a. ~~The~~ One EFU fan is OPERABLE and associated with a DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems – Operating," and LCO 3.8.7, "Distribution Systems – Shutdown;"~~;~~ and

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b. The EFU HEPA filter and carbon adsorber are not excessively restricting flow and are capable of performing their filtration functions.

In order for the CRHAVS to be considered OPERABLE, the CRHA ductwork and CRHA ventilation dampers for isolation of the CRHA boundary must be OPERABLE, and the CRHA boundary must be maintained, including the integrity of the walls, floors, ceilings, ductwork, and access doors, such that the CRHA occupant dose from a large radioactive release does not exceed the calculated dose in the licensing

LCO (continued)

COL 16.0-1-A 3.7.2-1

basis consequence analyses for DBAs, and that CRHA occupants are protected from [hazardous chemicals and] smoke. In addition, the trip breakers for de-energization of the N-DCIS electrical loads inside the CRHA must be OPERABLE.

CRHA heat sinks in the CRHA and adjacent spaces must be maintained within the limits in SR 3.7.1.1 to ensure that the CRHA temperature can be maintained for 72 hours following an event that includes loss of CRHAVS cooling.

The LCO is modified by a Note allowing the CRHA boundary to be opened intermittently under administrative controls. This Note only applies to openings in the CRHA boundary that can be rapidly restored to the design condition, such as doors, hatches, floor plugs, and access panels. For entry and exit through doors, the administrative control of the opening is performed by the person(s) entering or exiting the area. For other openings, these controls consist of stationing a dedicated individual at the opening who is in continuous communication with the operators in the CRHA. This individual will have a method to rapidly close the opening and to restore the CRHA boundary to a condition equivalent to the design condition when a need for CRHA isolation is indicated.

APPLICABILITY

In MODES 1, 2, 3, and 4, the CRHAVS must be OPERABLE to ensure that the CRHA will remain habitable during and following a DBA, since the DBA could lead to a fission product release.

In MODES 5 and 6, the probability and consequences of a DBA are reduced due to the pressure and temperature limitations in these MODES. Therefore, maintaining the CRHAVS OPERABLE is not required in MODES 5 or 6, except during operations with a potential for draining the reactor vessel (OPDRVs), which is a situation under which significant radioactive releases can be postulated.

BASES

ACTIONS	A.1 and A.2 When the average CRHA air temperature of any of the CRHA heat sinks is outside the acceptable rangegreater than the limit specified in SR 3.7.1.1, Required Action A.1 requires verification every 8 hours that the average temperature of each CRHA heat sink has not exceeded an interim limit. Additionally, Required Action A.2 requires that the average temperature of each heat sink be restored to within the specified limit within 24 hours.
ACTIONS (continued)	
	The combination of the interim limit for heat sink temperatures in Required Action A.1 and the 24 hour Completion Time for Required Action A.2 are based on engineering judgment and are intended to limit the temperature excursion of the heat sink when air temperatures in the CRHA or adjacent spaces are not being maintained within SR 3.7.1.1 limits. Required Action A.1 and A.2 and the associated Completion Times , ensure that air temperatures in the CRHA and adjacent spaces are restored or reactor shutdown initiated before there is a substantial degradation of the CRHA heat sinks. during normal operation of the nonsafety-related recirculation AHUs, action is required to restore it to an acceptable range. A Completion Time of 72 hours is permitted based upon the availability of temperature indication in the main control room. It is judged to be a sufficient amount of time allotted to correct the deficiency in the nonsafety-related ventilation system before shutting down.

B.1, B.2, and B.3

If the unfiltered inleakage of potentially contaminated air past the CRHA boundary can result in CRHA occupant radiological dose greater than the calculated dose of the licensing basis analyses of DBA consequences (allowed to be up to 5 rem TEDE), or inadequate protection of CRHA occupants from [hazardous chemicals or] smoke, the CRHA boundary is inoperable. Actions must be taken to restore an OPERABLE CRHA boundary within 90 days. **COL 16.0-1-A 3.7.2-1**

During the period that the CRHA boundary is considered inoperable, action must be initiated to implement mitigating actions to lessen the effect on CRHA occupants from the potential hazards of a radiological]or chemical] event or a challenge from smoke. Actions must be taken within 24 hours to verify that in the event of a DBA, the mitigating actions will ensure that CRHA occupant radiological exposures will not exceed the calculated dose of the licensing basis analyses of DBA consequences,

COL 16.0-1-A 3.7.2-1

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must be taken to immediately suspend activities that represent a potential for releasing radioactivity that might require isolation of the CRHA. This places the unit in a condition that minimizes risk.

Applicable actions must be initiated immediately to suspend OPDRVs to minimize the probability of a vessel draindown and subsequent potential for fission product release. Actions must continue until the OPDRVs are suspended.

SURVEILLANCE REQUIREMENTS

SR 3.7.2.1

This SR verifies every 24 hours that tThe average temperature for each CRHA air temperatureheat sinks is within established design limits. The CRHA heat sinks and associated initial temperature design limits are as shown in Table B 3.7.2-1. The CRHA heat sinks consist of three groups: the CRHA (i.e., the CRHA walls, floor, ceiling, interior walls), adjacent corridors, and HVAC chases; adjacent Q-DCIS and N-DCIS equipment rooms and electrical chases; and, adjacent HVAC equipment rooms and safety portions of the CRHA rooms. A CRHA heat sink temperature is assumed to be within the specified limit if the average of the air temperature in the heat sink is within the specified limit.

The surveillance limit for each of the CRHA heat sinkss- is the initial heat sink-temperature assumed in the CRHA thermal analysis. This SR ensures checked at a frequency of 24 hours to verify that the nonsafety-related recirculation AHUs are performing as required to maintain the initial condition CRHA heat sink temperatures consistent with the -assumedptions in the safety analysis, and towhich will ensure that the CRHA temperature will not exceed the required conditions after loss of CRHAVS cooling.

The 24 hour Frequency is acceptable based on the availability of temperature indication in the main control room and the slow change in the actual heat sink temperature following a change in the air temperature of the space being monitored.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.2.2

This SR verifies that a CRHAVS train in a standby mode starts on demand and continues to operate. Standby systems should be checked periodically to ensure that they start and function properly. As the environmental and normal operating conditions of this system are not

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Table B 3.7.2-1

Heat Sink Group	Established Design Temperature
CRHA Heat Sink Group 1	
Control Room Habitability Area: Main control room panel Rooms: No 3270, 3272, 3271, 3201, 3202, 3273, 3206, 3205, 3204, 3275, 3207, 3208.	25.6°C (78°F)
Corridors: [1] Rooms 3100, 3101 and Rooms 3200,3203, 3277, 3274	25.6°C (78°F)
HVAC chases: [1] Rooms 3251, 3260	25.6°C (78°F)
CRHA Heat Sink Group 2	
Q-DCIS equipment rooms: Rooms No 3110, 3120, 3130 and 3140	25.6°C (78°F)
N-DCIS equipment rooms: Rooms 3301, 3302, 3303, 3300	25.6°C (78°F)
Electrical chases: [1] Rooms 3250, 3261	25.6°C (78°F)
CRHA Heat Sink Group 3	
HVAC equipment rooms: Rooms 3401, 3402, 3403, 3404	40°C (104°F)
Safety Portions of CRHAVS: Rooms 3406, 3407	40 °C (104°F)

1. Access corridors, electrical chases, and HVAC chases, although part of the CRHA heat sink, are not monitored because these areas do not contain heat sources and their temperatures are assumed to match the average of the associated group.