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## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

### APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 526-8651  
SRP Section: 16 - Technical Specifications  
Application Section: 16  
Date of RAI Issue: 10/17/2016

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### **Question No. 16-223**

This is a followup to the responses dated 6/14/2016 to RAI Question 16-144, Items 1 and 3, and the response dated 2/19/2016 to RAI Question 16-24.

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. NUREG-1432, "Standard Technical Specifications-Combustion Engineering Plants," Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

In the 2/19/16 response to RAI Question 16-24, sub-question 9, KHNP proposed many changes to Subsection 3.7.11 which need to be modified. The response to sub-question 9 stated:

The CRHS requires two OPERABLE CREACS divisions and two OPERABLE AHUs to satisfy the design requirements of LCO 3.7.11. LCO 3.7.11 will be revised to clarify the relationship of the AHUs to the OPERABILITY of CRSRS and CRHS by stating that "The CRHS shall be OPERABLE with: a. Two CREACS divisions OPERABLE and b. Two AHUs OPERABLE." The Actions will be revised to separate Condition A into Condition A and Condition B to address Condition A for inoperability of a CREACS division and to address Condition B for inoperability of individual AHUs. Condition A will state that with one CREACS division inoperable for reasons other than Condition C, the CREACS division must be restored to operable status within 7 days. Condition B will

state that with three AHUs inoperable, at least one AHU should be restored to operable status within 7 days. KHNP will maintain the current combined LCO 3.7.11 for CREACS and CRSRS since they are closely related and can be more effectively addressed in a single LCO.

Staff noted that DCD Section 9.4.1.2, Control Room HVAC System Description, states in part: Emergency Mode

Upon receipt of an engineered safety feature actuation signal ... The emergency makeup ACU of the operating division starts automatically ... Upon failure of the designated ACU, the standby AHU and ACU of the redundant division start automatically.

For clarity and consistency with the design of the control room emergency air cleanup system (CREACS) and the control room supply and return system (CRSRS), and in conformance with the STS conventions on the use of notes, staff recommends the following changes to generic TS Subsection 3.7.11:

1. Revise the subsection title by replacing "Control Room HVAC System (CRHS)" with "Control Room Heating, Ventilation, and Air Conditioning (HVAC) System (CRHS)"; this change to the subsection title enables defining the HVAC acronym, as previously requested by the staff in RAI 481-8546, Question 16-144, which KHNP responded to on 6/14/16.
2. Remove the subsection title Note, which was expanded by KHNP's response to RAI 120-7977, Question 16-24, that states: "The CRHS consists of two divisions of control room emergency makeup air cleaning system (CREACS) and control room supply and return system (CRSRS). Each division of CREACS consists of one air cleaning unit (ACU) and each division of CRSRS consists of two air handling units (AHUs)."

The CRHS design clarification intended by the note, can be better achieved by revising the LCO statement, as follows; and explaining in the Bases LCO section that an operable CRSRS division requires just one of the two AHUs:

LCO 3.7.11 ~~Two CRHS divisions shall be OPERABLE~~ Two Control Room Emergency Makeup Air Cleaning System (CREACS) divisions and two Control Room Supply and Return System (CRSRS) divisions of the CRHS shall be OPERABLE.

Since a division of the CREACS cannot perform its control room envelope (CRE) occupant radiation protection function without the support of the associated CRSRS of the same division, staff considers that combining CREACS and CRSRS functions in the same generic TS subsection is an acceptable presentation. Because the CREACS and the CRSRS support different aspects of maintaining control room envelope (CRE) habitability, aspects that are all needed to satisfy GDC 19 requirements, staff considers that separating operability, action, and surveillance requirements for the CREACS and the CRSRS within the subsection is prudent, and is also an acceptable presentation.

By STS convention, the Bases is the preferred location to describe system design details including the equipment, components, and alignments needed to meet the operability requirements of the LCO. For example, the Bases for LCO 3.7.11 clarify that an operable

CRSRS division requires just one of the two air handling units (AHUs) in the division to be operable. Neither the revised LCO statement (which is quoted in sub-question 3 below) nor the expanded subsection title Note, both suggested by the applicant, provide this clarification, which the operator must understand to properly apply the action requirements. The applicant is requested to make the above requested change to the original LCO statement and, as noted in sub-question 8 below, the suggested changes to the LCO section of the Bases.

KHNP's responses to RAI 120-7977, Question 16-24 (red and blue colored markup) and RAI 481-8546 Question 16-144 (green and burnt orange colored markup) revised Actions A, B, and C as indicated:

A. One ~~CRHS~~ CREACS division inoperable for reasons other than Condition C ~~Condition B~~. | A.1 Restore ~~CRHS~~ CREACS division to OPERABLE status. | 7 days

CB. One or two CREACS divisions inoperable due to inoperable CRE boundary in MODE 1, 2, 3, or 4. | CB.1 Initiate action to implement mitigating actions. | Immediately AND CB.2 Verify mitigating actions to ensure CRE occupant exposures to radiological, ~~chemical,~~ [, toxic gas,] and smoke hazards will not exceed limits. | 24 hours AND CB.3 Restore CRE boundary to OPERABLE status. | 90 ~~92~~ days

DG. Required Action and associated Completion Time of Condition ~~A or B~~ A, B, or C not met in MODE 1, 2, 3 or 4. | DG.1 Be in MODE 3. | 6 hours AND DG.2 Be in MODE 5. | 36 hours

These indicated changes are acceptable.

3. In Attachment 6 to the response to RAI 120-7977, Question 16-24, the applicant proposed the following new Action B as indicated by blue or red colored markup; markup colored green or burnt orange are staff recommended additional changes:

B. One CRSRS division ~~Three AHUs inoperable~~. | B.1 Restore one inoperable AHU-CRSRS division to OPERABLE status. | 7 days

Staff recommends the above phrasing for proposed new Condition B in place of the applicant's proposed phrasing of "Three AHUs inoperable" because the staff's above recommended change to the LCO statement—"Two Control Room Emergency Makeup Air Cleaning System (CREACS) divisions and two Control Room Supply and Return System (CRSRS) divisions of the CRHS shall be OPERABLE."—does not use or define the term "AHU"; also, the applicant's proposed LCO statement only requires two AHUs to be operable without explicitly stipulating that they be in separate divisions.

In contrast, in the response KHNP had proposed to revise the LCO statement, as indicated below:

~~LCO 3.7.11 Two CRHS divisions shall be OPERABLE.~~ The CRHS shall be OPERABLE with:

- a. Two CREACS divisions OPERABLE, and
- b. Two AHUs OPERABLE.

The statement of Condition B should only address required AHUs (one operable AHU in each division), not all four AHUs, unless the applicant intends that the LCO require both AHUs in both divisions to be operable, which it does not. The Bases should explain that an operable CRSRS division requires just one AHU. Therefore, it is acceptable to state Condition B as “One CRSRS division inoperable” without explicitly referring to just one cause for the inoperability, namely an inoperable required AHU.

Staff noted an inaccuracy in the response to RAI 120-7977, Question 16-24. Because of the interlock feature to automatically start the standby AHU and ACU in the opposite CRHS division upon failure of the running AHU or ACU, when the CRHS is in the emergency mode of operation, and because each CRSRS division’s two AHUs are supported by the same essential chilled water division, each AHU is completely independent only from the two AHUs in the opposite division, but is not completely independent from the other AHU in the same division, as asserted by KHNP in the response to RAI 120-7977, Question 16-24.

4. In the response to RAI 120-7977, Question 16-24, the applicant proposed the following changes to original Action D (renumbered here as Action E) as indicated by blue or red colored markup; markup colored green or burnt orange are staff recommended additional changes:

~~E.D.~~ Required Action and associated Completion Time of Condition A or B ~~A~~-not met [in MODES 5 or ~~and~~ 6, or] during movement of irradiated fuel assemblies. | ~~E.D.1~~ [NOTE—Place CRHS in toxic gas isolation mode if automatic transfer to toxic gas isolation mode is inoperable.] Place CREACS and CRSRS of an OPERABLE CRHS division in emergency mode. | Immediately OR ~~E.D.2~~ Suspend movement of irradiated fuel assemblies. | Immediately

These changes reflect the design of a CRHS division, which consists of the portions of the CREACS and CRSRS in the same ventilation division that are supported by the same train of Class 1E electrical power. The Note to Required Action E.1 must be positioned inline, and accounts for the possibility that a COL applicant will need to address CRE occupant protection from toxic gas. By placing this contingency action in a required action Note, the operator will have to immediately initiate action to place the CRHS in isolation mode upon discovery that automatic transfer to toxic gas isolation mode is inoperable at any time subsequent to entering Condition E. Placing brackets around the Note and its Bases, and all other references to toxic gas in Subsection 3.7.11 and B 3.7.11, designates this provision as a COL action item, which according to the applicant’s response to sub-question 12 of RAI 120-7977, Question 16-24, “to provide flexibility to the COL Applicant to delete them if the COL Applicant concludes that these features of the CRHS are not needed based on the toxic gas analysis results.” The response also stated, “A reviewer’s note will also be added to the Bases for 3.7.11 that states the need for toxic gas isolation mode will be determined by the COL applicant.” Designating information and provisions involving toxic gas as a COL action item is acceptable. The applicant is reminded to include this COL action item in its pending response to RAI 154-8064, Question 16-44 (27307).

- a. The applicant is requested to indicate the flow path location of the toxic gas detectors in the CRHS system diagram in DCD Tier 1 Figure 2.7.3.1-1, and in DCD Tier 2 Figure 9.4.1-1. The applicant is also requested to include, in DCD Tier 2 Section 9.4.1, a discussion of CRHS automatic switchover—from both normal and

emergency modes—to the CRHS isolation mode of operation on detection of toxic gas.

- b. The applicant is requested to state whether all CRHS toxic gas mitigation features, such as toxic gas detectors and the capability to automatically place both divisions of the CRHS in the isolation mode of operation, must be operable to consider the CRHS to be operable to meet LCO 3.7.11.
  - c. The applicant is requested to state whether all CRHS smoke mitigation features, such as smoke detectors, automatic smoke isolation dampers, and the capability to manually place both divisions of the CRHS in the isolation mode of operation, must be operable to consider the CRHS to be operable to meet LCO 3.7.11.
  - d. The applicant is requested to include toxic gas detectors in DCD Tier 1 Table 2.7.3.1-2.
  - e. The applicant is requested to state whether the interlock feature—to automatically start the standby AHU and ACU in the opposite CRHS division upon failure of the running AHU or ACU, when the CRHS is in the emergency or isolation mode of operation—must be operable for both CRHS divisions to be considered operable. Also state whether this feature is tested by SR 3.7.11.3 (“Verify active CREACS and CRSRS components in each CRHS division actuates-actuate on an actual or simulated actuation signal. | 18 months”). See Subquestion 7 below.
5. In the response to RAI 120-7977, Question 16-24, the applicant proposed the following changes to original Action E (renumbered here as Action F) as indicated by blue or red colored markup; markup colored green or burnt orange are staff recommended additional changes:

~~FE~~. Two ~~CRHS~~ CREACS divisions inoperable [in ~~Mode~~ MODE 5 or 6, or] during movement of irradiated fuel assemblies. OR One or two CREACS divisions inoperable due to inoperable CRE boundary [in ~~Mode~~ MODE 5 or 6, or] during movement of irradiated fuel assemblies. | ~~FE~~.1 Suspend movement of irradiated fuel assemblies. | Immediately

- a. Staff understands that the operability of the ACU of a CREACS division requires an operable AHU in the same CRSRS division. Therefore, referring to CREACS in the first condition statement is equivalent to referring to the CRHS. The applicant is requested to make the indicated changes.
- b. The third paragraph of the LCO section of the Bases, which matches the content of the corresponding paragraph in STS Bases Subsection B 3.7.11 of NUREG-1432, needs clarification. Unlike the CREACS design assumed by the STS, an ACU includes two fans in parallel that supply two AHUs in parallel, each equipped with a control room air supply fan. An operable CREACS division requires being capable of automatic and manual actuation, from normal to emergency, from normal to isolation, and from emergency to isolation modes of operation, and being capable of automatic and manual actuation upon failure of the opposite CREACS division. Placing a CRHS division in the emergency mode of operation requires:

- An operable ACU with an ACU fan running;
- An operable AHU with an AHU fan running;
- An operable recirculation air damper to the ACU inlet open;
- An operable emergency makeup air damper to the ACU inlet open;
- An operable isolation damper in each of the two normal makeup air flow paths to the AHU inlet closed;
- An operable ACU outlet air flow control damper and an operable AHU outlet air flow control damper both open and ensuring correct flow through the ACU; and
- Two operable smoke removal fan isolation dampers closed.
- Four operable outside air supply isolation dampers capable of being closed.

In addition to the above, with the exception of an open emergency makeup air damper to the ACU inlet, placing the CRHS in the isolation mode of operation requires:

- Two operable emergency makeup air dampers to the ACU inlet, and two operable kitchen & toilet exhaust fan isolation dampers closed. These dampers must be capable of automatically closing on a control room ventilation isolation signal upon detection of smoke [or toxic gas].
- Four operable outside air supply isolation dampers closed.

Unless an ESFAS main control room air intake radiation high signal has initiated CREACS in the emergency mode of operation, upon a CRE isolation signal the recirculation flow path through the ACU remains isolated and the ACU fan remains off, while an AHU fan recirculates control room air. That is, the recirculation air damper to the ACU inlet remains closed.

The applicant is requested to revise the third paragraph of the LCO section of the Bases for Specification 3.7.11 to account for the above requirements regarding an operable CREACS division. See sub-questions 8 and 9 below for suggested clarifications of the first two paragraphs of the LCO section.

- c. The bracketed phrase in the first and second condition statements “[in MODE 5 or 6, or]” in Action F (as renumbered) must be adopted by a COL applicant if CREACS is determined to be necessary to protect against a radioactive gaseous release resulting from a failure of the Gaseous Radwaste System. However, the associated required action does not include remedial measures to address this hazard, such as “AND [F.2 Suspend operations with a potential for releasing radioactivity from the Gaseous Radwaste System. | Immediately]”.

The applicant is requested to consider including such a bracketed required action in Action F, including an appropriate bracketed Bases discussion.

6. For consistency with the staff's proposed changes to the LCO statement and the Actions table Conditions, the applicant is requested to revise Action F (renumbered as Action G) as indicated for applicant proposed changes with blue or red colored markup (response Attachment 6); and staff suggested additional changes with green or burnt orange colored markup:

~~FG~~. Two ~~CRHS~~ CREACS divisions inoperable in MODE 1, 2, 3, or 4 for reasons other than ~~Condition B~~ Condition C. OR Two CRSRS divisions inoperable in MODE 1, 2, 3, or 4. | ~~FG~~.1 Enter LCO 3.0.3. | Immediately

These suggested changes clarify that inability of both CRSRS divisions to provide adequate heating, cooling, or humidity control of air in the main control room would also warrant placing the unit in Mode 5 within 37 hours, per LCO 3.0.3. The applicant is requested to change Action G as indicated, and also to make conforming changes to the Bases for Required Action G.1, as suggested in sub-question 13 below.

7. For consistency with the staff's above proposed changes to the LCO statement and the Actions table Conditions, the applicant is requested to revise SR 3.7.11.3 as indicated:

Verify active CREACS and CRSRS components in each CRHS division ~~actuates~~ actuate on an actual or simulated actuation signal. | 18 months

Due to unique APR1400 design features for the CRHS, the suggested change is intended to ensure all applicable ESF actuations and fan-damper interlocks used for the automatic response of active CREACS and CRSRS components, such as fans and dampers, and the AHU cooling coil essential chilled water three-way flow control valve, are tested.

8. In Attachment 6 of the response to RAI 120-7977, Question 16-24, the applicant proposed the following changes to the original first paragraph of the LCO section of the Bases for Subsection 3.7.11 as indicated by blue or red colored markup; markup colored green or burnt orange are staff recommended additional changes. Note that words added by the applicant but proposed for removal by the staff are indicated by burnt orange lined out and underlined font attributes. The applicant is requested to revise this paragraph of the LCO section of the Bases for Subsection 3.7.11, for clarity as indicated:

Two independent and redundant ~~CREACS divisions and any two of the four independent and redundant AHUs divisions of the CRHS~~ divisions of the CRHS are required to be OPERABLE to ensure that ~~at least one one division is one CREACS division and one AHU are is available during an event requiring the CRHS,~~ if a single failure disables the other ~~division CREACS division or AHU division.~~ An OPERABLE CRHS division requires the emergency makeup air cleaning unit (ACU) in the associated CREACS division and one of two air handling units (AHUs) in the associated CRSRS division to be OPERABLE. The ACU emergency makeup air and return air isolation dampers, and the ACU fan and discharge airflow control damper, which are

associated with the required AHU flow path, are also required to be OPERABLE for OPERABILITY of

a CRHS division.

Total ~~system-CRHS~~ failure, such as from a loss of both CRSRS ventilation divisions, ~~or both CREACS divisions, or one CRSRS division and the CREACS in the opposite division,~~ or from an inoperable CRE boundary, could result in exceeding a dose of 50 mSv to the control room operators in the event of an accident with a large radioactive release ~~and in the equipment operating temperature exceeding limits in the event of an accident.~~

Total CRSRS failure, such as from the loss of all AHUs, could result in exceeding the equipment operating temperature exceeding limits of equipment in the CRE, not just in the event of an accident when the CRSRS may be needed to operate in the recirculation or emergency mode, but also during normal operation.

9. In Attachment 6 of the response to RAI 120-7977, Question 16-24, the applicant proposed the following changes to the original second paragraph of the LCO section of Bases for Subsection 3.7.11, for clarity, as indicated by blue or red colored markup; markup colored green or burnt orange are staff recommended additional changes. The applicant is requested to revise this paragraph of the LCO section of the Bases for Subsection 3.7.11, as indicated:

~~The A~~ CRSRS division is considered OPERABLE when the necessary individual components associated with one AHU of the two AHUs that is are OPERABLE. The necessary components are those needed to maintain MGR-CRE temperatures and relative humidity within limits is ~~OPERABLE in both divisions~~ to meet equipment OPERABILITY requirements. These components include the AHU cooling coils and associated essential chilled water system three-way flow control valve, heating coils, and associated temperature control instrumentation; and the AHU supply fan, AHU inlet isolation dampers, ~~and the AHU discharge airflow control damper, and the humidifier in the AHU discharge duct.~~ In addition, the CRSRS division must be OPERABLE to the extent that the minimum necessary air circulation in the CRE can be maintained.

10. In response to RAI 120-7977 Question 16-24, in Attachment 6, the applicant proposed changes (shown in red strike out and blue underlined font attributes) to the Bases for Action A.1 of Subsection 3.7.11, which the applicant proposed to split into Action A.1 for CREACS and Action B.1 for CRSRS. The staff suggests additional edits (shown in burnt orange strike out and green underlined font attributes), as follows. Note that words added by the applicant but proposed for removal by the staff are indicated by burnt orange lined out and underlined font attributes. Action B for an inoperable CRE boundary is renumbered as Action C:

A.1

With one ~~CRHS~~ CREACS division inoperable for other than an inoperable CRE boundary, action must be taken to restore the division to OPERABLE status within 7 days. In this condition, the remaining OPERABLE ~~CRHS~~ CREACS division is adequate to perform the CRE ~~occupants~~ occupant protection function. However, the overall reliability is reduced because a single failure in the OPERABLE division could result in loss of the ~~CRHS~~ CREACS function. The 7-day Completion Time is based on the low probability of a DBA ~~occurring~~ occurring during this time period, and ~~the~~ the ability of the remaining division to provide ~~the required~~ capabilities ~~capability~~ capabilities.

B.1

With ~~one CRHS division~~ three AHUs ~~one CRSRS division~~ inoperable, ~~for reasons other than an inoperable CRE boundary,~~ action must be taken to restore the division to OPERABLE status within 7 days. In this condition, the remaining ~~OPERABLE CRHS division~~ OPERABLE CRSRS division is adequate to maintain the control room temperature and relative humidity within limits ~~and to perform the CRE occupants protection function~~ and to perform the CRE occupant protection function. However, the overall reliability is reduced because a single failure ~~in the OPERABLE division of the OPERABLE AHU in the OPERABLE CRSRS division~~ could result in ~~less the CRHS~~ loss of the CRSRS function. The 7-day Completion Time is based on the low probability of a DBA occurring during this time period and the ability of the remaining division AHU of the OPERABLE CRSRS division to provide the ~~required~~ capabilities ~~capability~~ capabilities.

BC.1, BC.2, and BC.3

11. In response to RAI 120-7977 Question 16-24, in Attachment 6, the applicant proposed changes (shown in ~~red~~ strike out and blue underlined font attributes) to the first paragraph of the Bases for Actions C.1 and C.2 of Subsection 3.7.11, which the applicant proposed to renumber as Actions D.1 and D.2. The staff suggests additional edits (shown in ~~burnt orange~~ strike out and green underlined font attributes), as follows:

CD.1 and CD.2

In MODE 1, 2, 3, or 4, if the inoperable ~~CRHS~~ CREACS or CRSRS division or the CRE boundary cannot be ~~restore~~ restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE that minimizes the accident risk. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and MODE 5 within 36 hours.

12. In response to RAI 120-7977 Question 16-24, in Attachment 7, the applicant proposed changes (shown in ~~red~~ strike out and blue underlined font attributes) to the first paragraph of the Bases for Action E.1 of Subsection 3.7.11, which the applicant proposed to renumber as Action F.1. The staff suggests additional edits (shown in ~~burnt orange~~ strike out and green underlined font attributes), as follows:

~~E~~F.1

~~In MODE 5, 6, or [In MODES 5 and 6, or] [In MODE 5 or 6, or]~~ during movement of irradiated fuel assemblies with two ~~CRHS-CREACS~~ divisions inoperable or two CRSRS divisions inoperable, or with one or two CREACS divisions inoperable due to an inoperable CRE boundary, action must be taken immediately to suspend activities that could result in a release of radioactivity that may require isolation of CRE. This places the unit in a condition that minimizes the accident risk. This does not preclude the movement of fuel to a safe position.

As suggested in Subquestion 5.c above, if CREACS is determined to be necessary to protect against a radioactive gaseous release resulting from a failure of the Gaseous Radwaste System, it may be appropriate to specify a required action to address this hazard, such as “AND [F.2 Suspend operations with a potential for releasing radioactivity from the Gaseous Radwaste System. | Immediately]”.

If the applicant includes such a bracketed required action in (as renumbered) Action E and Action F, an appropriate bracketed Bases discussion should also be included in the Bases for Actions E and F.

The applicant is also requested to consider stating in the Bases for Action E.1 and F.1 that placing the remaining OPERABLE CRHS division in emergency or isolation mode of operation also involves verification that in the opposite inoperable division all isolation dampers are closed, and the ACU and AHUs are not in standby for automatic initiation.

13. In response to RAI 120-7977 Question 16-24, in Attachment 6, the applicant proposed changes (shown in ~~red~~ strike out and blue underlined font attributes) to the Bases for Action F.1 of Subsection 3.7.11, which the applicant proposed to renumber as Action G.1. The staff suggests additional edits (shown in ~~burnt orange~~ strike out and green underlined font attributes), as follows:

~~F~~G.1

If both ~~CRHS-CREACS~~ divisions are inoperable in MODE 1, 2, 3, or 4 for ~~reason-reasons~~ other than an inoperable CRE boundary (i.e., Condition ~~B~~C) or both CRSRS divisions are inoperable in MODE 1, 2, 3, or 4, the CRHS may not be capable of performing the intended ~~function~~ functions and the unit is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

14. In the Surveillance Requirements section of Bases, the applicant is requested to revise the discussion of SR 3.7.11.3, in part, as indicated:

This SR verifies each respective component in the CRHS CREACS division and CRSRS division starts and operates on an actual or simulated actuation signal ...

15. In response to RAI 120-7977 Question 16-24, in Attachment 7, the applicant proposed changes (shown in ~~red~~ strike out and blue underlined font attributes) to the Bases for Actions D.1 and D.2 of Subsection 3.7.11, which the applicant proposed to renumber as Actions E.1 and E.2. The staff suggests additional edits (shown in ~~burnt orange~~ strike out and green underlined font attributes), as follows:

~~D~~E.1 and ~~D~~E.2

Required Action ~~D~~E.1 is ~~operated~~ performed manually.

~~MODE 5, 6, or [In MODES 5 and 6, or] [In MODE 5 or 6, or during]~~  
[During] ~~during~~ movement of irradiated fuel assemblies, if Required Action A.1 or B.1 cannot be completed within the required Completion Time, the CREACS and CRSRS of the OPERABLE CRHS division must be immediately placed in the emergency MODE of operation. This action ensures that the remaining division is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action ~~D~~E.1 is Required Action[s] E.2[.1 and E.2.2] to immediately suspend activities that could result in a release of radioactivity that may require isolation of the control room. This places the unit in a condition that minimizes the accident risk.

This does not preclude the movement of fuel assemblies to a safe position.

As suggested in Subquestion 5.c above, if CREACS is determined to be necessary to protect against a radioactive gaseous release resulting from a failure of the Gaseous Radwaste System, it may be appropriate to specify a required action to address this hazard, such as “AND [E.2.2 Suspend operations with a potential for releasing radioactivity from the Gaseous Radwaste System. | Immediately]”.

If the applicant includes such a bracketed required action in (as renumbered) Action E and Action F, an appropriate bracketed Bases discussion, as indicated above, should also be included in the Bases for Actions E and F.

The applicant is also requested to consider stating in the Bases for Actions E.1 and F.1 that placing the remaining OPERABLE CRHS division in emergency or recirculation mode of operation also involves verification that in the opposite inoperable division all isolation dampers are closed, and the ACU and AHUs are not in standby for automatic initiation.

16. In Attachment 7 of the response to RAI 120-7977, Question 16-24, the applicant proposed the following changes to the Applicability section of the Bases for Subsection 3.7.11, as indicated by blue or red colored markup; markup colored green or burnt orange are staff recommended additional changes. The applicant is requested to revise the Applicability section of the Bases for Subsection 3.7.11, for clarity as indicated:

In MODES 1, 2, 3, 4, ~~5, and 6~~ [5, and 6] and during movement of irradiated fuel assemblies, the CRHS must be OPERABLE to ensure that the CRE will remain habitable during and following a DBA and ~~ensure that~~ the control room temperature will not exceed equipment operational requirements following isolation of the control room.

[In MODES ~~[5 and 6]~~ 5 and 6, the CRHS is also required to cope with a failure of the Gaseous Radwaste System.]

During movement of irradiated fuel assemblies, the CRHS must be OPERABLE to cope with the radioactivity release from a fuel handling accident.

17. The applicant is requested to clarify the following aspects of CRHS design:
- a. The applicant is requested to explain whether the following active components of an operable CRHS division must be powered by the same Class 1E electrical power division and train (Div. I, Train A or C) or (Div. II, Train B or D):
    - i. The CREACS division required ACU, required ACU fan, ACU makeup air inlet isolation damper, ACU recirculation inlet isolation damper, and ACU fan discharge air flow control damper;
    - ii. The CRSRS division required AHU, AHU fan, AHU outside air inlet isolation damper pair, and AHU fan discharge air flow control damper; and
    - iii. The CRSRS kitchen isolation damper pair and the smoke removal fan isolation damper pair.
    - iv. The two pairs of CRHS outside air dampers, one pair of which closes on a CREVAS main control room air intake high radiation signal.
  - A. The applicant is requested to state whether the instrumentation control logic to isolate the damper pair, which corresponds to the higher radiation signal, is required for operability of CREACS. Where is this logic implemented?
  - B. According to DCD Tier 2 Figure 7.3-11, ESFAS Functional Logic (CREVAS), just one of the four main control room air intake radiation monitors needs to reach its trip setpoint to initiate placing the CRHS division with the operating AHU in the emergency mode of operation, and the other CRHS division in standby. Explain how the CRSRS division with the operating AHU determines which CREACS train initiates ACU filtering of makeup air and MCR recirculated air.

- b. The applicant is requested to list the four ACU fans in DCD Tier 1 Table 2.7.3.1-1, and state the Class 1E electrical power source and distribution that powers each fan.
- c. The applicant is requested to describe how the ACU fan air flow control damper and the AHU fan air flow control damper maintain air flow within design limits during normal, emergency, and isolation modes of operation of the CRHS.
- d. The applicant is requested to state whether operability of the four CRHS tornado dampers is required for CRHS operability.

## **Response**

1. The subsection title will be revised to "Control Room Heating, Ventilation, and Air Conditioning (HVAC) System (CRHS)" as requested by NRC.
2. The subsection title Note, "The CRHS consists of two divisions of control room emergency makeup air cleaning system (CREACS) and control room supply and return system (CRSRS). Each division of CREACS consists of one air cleaning unit (ACU) and each division of CRSRS consists of two air handling units (AHUs)." will be deleted and the LCO 3.7.11 will be revised as requested by NRC as follows:

LCO 3.7.11 Two Control Room Emergency Makeup Air Cleaning System (CREACS) divisions and two Control Room Supply and Return System (CRSRS) divisions of the CRHS shall be OPERABLE.

And the Bases for LCO 3.7.11 will be revised to state that "An operable CRSRS division requires just one of the two air handling units (AHUs)." as explained in the response of sub-question 9.

3. The renumbered Action B will be revised as requested by NRC as follows:
  - B. One CRSRS division inoperable. | B.1 Restore CRSRS division to OPERABLE status. | 7 days

And the Bases for renumbered Action B will be also revised to state that "An operable CRSRS division requires just one AHU." as explained in the response of sub-question 9.

4. The renumbered Action E of TS subsection 3.7.11 will be revised as requested by NRC as follows:
  - E. Required Action and associated Completion Time of Condition A or B not met [in MODE 5 or 6, or] during movement of irradiated fuel assemblies. | E.1 [NOTE- Place CRHS in toxic gas isolation mode if automatic transfer to toxic gas isolation mode is inoperable.] Place CREACS and CRSRS of an OPERABLE CRHS division in emergency mode. | Immediately OR E.2 Suspend movement of irradiated fuel assemblies. | Immediately

The Note to renumbered Required Action E.1, "Place CRHS in toxic gas isolation mode if automatic transfer to toxic gas isolation mode is inoperable." will be positioned inline.

- a. As stated in DCD Tier 2 subsection 6.4.6, the COL applicant is to identify and develop toxic gas detection requirements to protect operators and assure the MCR habitability. And the number, locations, sensitivity, range, type, and design of toxic gas detectors are to be developed by the COL applicant (COL 6.4(3)). Therefore, toxic gas detectors will not be included in DCD Tier 1 Figure 2.7.3.1-1 and DCD Tier 2 Figure 9.4.1-1 and the CRHS automatic switchover-from both normal and emergency modes-to the CRHS isolation mode of operation on detection of toxic gas will not be discussed in DCD Tier 2 subsection 9.4.1. The number, location, and characteristics of toxic gas detectors will be discussed in the construction stage if the COL applicant is concluded that based on the toxic gas analysis results.
- b. As explained in the response of sub-question 4.a, the CRHS toxic gas mitigation features will be discussed in the construction stage if the COL applicant is concluded that based on the toxic gas analysis results.
- c. KHNP believes that all the CRHS smoke mitigation features such as smoke detectors, smoke isolation dampers, and the capability to manually place CRHS in the isolation mode do not need to be operable to consider CRHS to be operable to meet LCO 3.7.11 since they perform non-safety related functions. Even if the smoke detectors and smoke isolation dampers are inoperable, CRE occupants can be protected from smoke by using self-contained breathing apparatus inside the CRE as stated in DCD Tier 2 subsection 6.4.1.e and by manually isolating dampers in the path of smoke.
- d. As explained in the response of sub-question 4.a, toxic gas detectors will not be included in DCD Tier 1 Table 2.7.3.1-2.
- e. KHNP believes that “the interlock feature-to automatically start the standby AHU and ACU in the opposite CRHS division upon failure of the running AHU or ACU, when the CRHS is in the emergency of isolation mode of operation-must be operable” is not necessary for both CRHS divisions to be considered operable. Because KHNP believes that the condition of both CRHS divisions to be considered operable requires that all active components in both CRHS divisions must be operable and it is not extended to the interlock feature based on the reason that the standby AHU and ACU in the opposite CRHS division can be operated manually even if the interlock feature is inoperable when the running AHU or ACU fails.

According to the Bases for SR 3.7.11.3 in STS, the test for SR 3.7.11.3 is to verify that each CREACS division starts and operates on an actual or simulated ESFAS. Therefore, KHNP believes that the interlock feature —to automatically start the standby AHU and ACU in the opposite CRHS division upon failure of the running AHU or ACU, when the CRHS is in the emergency or isolation mode operation— is not included in the scope of the test for SR 3.7.11.3.

5. The renumbered Action F of TS subsection 3.7.11 will be revised as requested by NRC as follows:

F. Two CREACS divisions inoperable [in MODE 5 or 6, or] during movement of irradiated fuel assemblies. OR One or two CREACS divisions inoperable due to inoperable CRE boundary [in MODE 5 or 6, or] during movement of irradiated fuel assemblies. | Immediately

- a. The first condition statement in the new Action F of TS subsection 3.7.11 will be revised to refer two CREACS divisions inoperable as stated above.
- b. The third paragraph of the Bases for LCO 3.7.11 describes conditions that a CREACS division is considered operable. KHNP believes that the requested requirements of fans and isolation dampers regarding an operable CREACS division in this RAI are more close to a required status of fans and isolation dampers when the CREACS division is placed in the emergency mode or the isolation mode.

In the RAI 304-8361, Question 06.04-2, NRC requested to define the operability of CREACES related to the two fans in an ACU. And KHNP responded that each CREACS division is considered operable when one of two fans and one of two electric heating coils are operable.

There will be no change in the third paragraph of the Bases for LCO 3.7.11.

- c. The remedial action for the renumbered Condition F will be added as a bracketed required action F.2 as requested by NRC as follows :

[And F.2.Suspend operations with a potential for releasing radioactivity from the Gaseous Radwaste System. | Immediately]

6. The renumbered Action G of TS subsection 3.7.11 will be revised as requested by NRC as follows:

G. Two CREACS divisions inoperable in MODE 1, 2, 3, or 4 for reasons other than Condition C OR Two CRSRS divisions inoperable in MODE 1, 2, 3, or 4 | G.1 Enter LCO 3.0.3. | Immediately

7. KHNP considers that the test for SR 3.7.11.3 in STS is just to verify that each CREACS division starts and operates on an actual or simulated ESFAS which is supposed to start upon receipt of an ESFAS. Because CRSRS divisions are not started and operated by receiving an ESFAS and a CRSRS division which is running during the normal operation operates continuously whether an ESFAS is initiated or not. The SR 3.7.11.3 will be revised to meet the purpose of SR 3.7.11.3 in STS as follows:

Verify active components in each CREACS division actuate on actual or simulated actual signal. | 18 months

8. The first paragraph of the Bases for LCO 3.7.11 will be revised as requested by NRC except uses of different term regarding isolation dampers to make consistency of term used in DCD section 9.4 as follows:

Two independent and redundant divisions of the CRHS are required to be OPERABLE to ensure that one division is available during an event requiring the CRHS, if a single failure disables the other division. An OPERABLE CRHS division requires the emergency makeup air cleaning unit (ACU) in the associated CREACS division and one of two air handling units (AHUs) in the associated CRSRS division to be OPERABLE. The outside air intake isolation dampers, the ACU inlet isolation damper, the ACU return air isolation damper, the emergency makeup ACU fan, and the ACU discharge airflow control damper, which are associated with the required AHU flow path, are also required to be OPERABLE for OPERABILITY of a CRHS division.

Total CRHS failure, such as from a loss of both CRSRS divisions, both CREACS divisions, or one CRSRS division and the CREACS in the opposite division, or from an inoperable CRE boundary, could result in exceeding a dose of 50 mSv to the control room operators in the event of an accident with a large radioactive release.

Total CRSRS failure, such as from the loss of all AHUs, could result in exceeding operating temperature limits of equipment in the CRE, not just in the event of an accident when the CRSRS may be needed to operate in the recirculation or emergency mode, but also during normal operation.

9. The second paragraph of the Bases for LCO 3.7.11 will be revised as requested by NRC as follows:

A CRSRS division is considered OPERABLE when the necessary individual components associated with one of the two AHUs are OPERABLE. The necessary components are those needed to maintain CRE temperatures and relative humidity within limits to meet equipment OPERABILITY requirements. These components include the AHU cooling coil and associated essential chilled water system three-way flow control valve, the heating coil and associated temperature control instrumentation, and the AHU supply fan, AHU inlet isolation dampers, the AHU discharge airflow control damper, and the humidifier in the AHU discharge duct. In addition, the CRSRS division must be OPERABLE to the extent that the minimum necessary air circulation in the CRE can be maintained.

10. The Bases for renumbered Actions A.1 and B.1 of TS subsection 3.7.11 will be revised as requested by NRC except adding "and to perform the CRE occupant protection function" in the renumbered Action B.1 for the CRSRS by understanding that "the CRE occupant protection function" is a radiological protection function performed by the CREACS as follows:

#### A.1

With one CREACS division inoperable for other than an inoperable CRE boundary, action must be taken to restore the division to OPERABLE status within 7 days. In this condition, the remaining OPERABLE CREACS division is adequate to perform the CRE occupant protection function. However, the overall reliability is reduced because a single failure in the OPERABLE CREACS division could result in loss of the CREACS function. The 7-day Completion Time is based on the low probability of a DBA occurring

during this time period, and the ability of the remaining division to provide the required capabilities.

#### B.1

With one CRSRS division inoperable, action must be taken to restore the division to OPERABLE status within 7 days. In this condition, the remaining OPERABLE CRSRS division is adequate to maintain the control room temperature and relative humidity within limits. However, the overall reliability is reduced because a single failure in the OPERABLE CRSRS division could result in loss of the CRSRS function. The 7-day Completion Time is based on the low probability of a DBA occurring during this time period and the ability of the remaining AHU of the OPERABLE CRSRS division to provide the required capabilities.

11. The first paragraph of the Bases for renumbered Actions D.1 and D.2 of TS subsection 3.7.11 will be revised as requested by NRC as follows:

In MODE 1, 2, 3, or 4, if the inoperable CREACS or CRSRS division or the CRE boundary cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE that minimizes the accident risk. To achieve this status, the unit must be placed in at least MODE 3 within 5 hours, and MODE 5 within 36 hours.

12. The Bases for renumbered Action F.1 of TS subsection 3.7.11 will be revised to include bracketed Bases for Action F.2 as follows:

#### F.1 [and F.2]

[In MODE 5 or 6, or] during movement of irradiated fuel assemblies with two CREACS divisions inoperable or two CRSRS divisions inoperable, or with one or two CREACS divisions inoperable due to an inoperable CRE boundary, Required Action[s] F.1 [and F.2] must be taken immediately to suspend activities that could result in a release of radioactivity that may require isolation of CRE. This places the unit in a condition that minimizes the accident risk. This does not preclude the movement of fuel to a safe position.

And KHNP believes that including the verification that “in opposite inoperable division all isolation dampers are closed, and the ACU and AHU are not in standby for automatic initiation” in the Bases for renumbered Action F.2 of TS subsection 3.7.11 is not necessary. Because the isolation dampers are interlocked with their associated ACU or AHU to be opened only when the associated ACU or AHU is running and the isolation dampers are kept in close position if their associated ACU or AHU is not running as stated in the “paragraphs b and e” in DCD page 9.4-6 and “paragraphs c, d, and e” in DCD page 9.4-7. And the CRHS is interlocked to allow operation of only one AHU and one ACU in a same division and preclude operation of multiple AHUs and ACUs simultaneously.

13. The Bases for renumbered Action G.1 of TS subsection 3.7.11 will be revised as requested by NRC as follows:

G.1

If both CREACS divisions are inoperable in MODE 1, 2, 3, or 4 for reasons other than an inoperable CRE boundary (i.e., Condition C) or both CRSRS divisions are inoperable in MODE 1, 2, 3, or 4, the CRHS may not be capable of performing the intended functions and the unit is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

14. As responded in the response of sub-questions 4.e and 7, KHNP believes that the test for SR 3.7.11.3 is to verify that each CREACS division starts and operates on an actual or simulated ESFAS. Therefore, the part of Bases for SR 3.7.11.3 will be revised as follows:

This SR verifies active components in each CREACS division start and operate on an actual or simulated actuation signal...

15. The Bases for renumbered Actions E.1 and E.2 of TS subsection 3.7.11 will be revised as requested by NRC as follows:

E.1 and E.2

Required Action E.1 is performed manually.

[In MODE 5 or 6, or during] [During] movement of irradiated fuel assemblies, if Required Action A.1 or B.1 cannot be completed within the required Completion Time, the CREACS and CRSRS of the OPERABLE CRHS division must be immediately placed in the emergency MODE of operation. This action ensures that the remaining division is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action E.1 is Required Action[s] E.2[.1 and E.2.2] to immediately suspend activities that could result in a release of radioactivity that may require isolation of the control room. This places the unit in a condition that minimizes the accident risk.

This does not preclude the movement of fuel assemblies to a safe position.

16. The Bases for Applicability of TS subsection 3.7.11 will be revised as requested by NRC as follows:

In MODES 1, 2, 3, 4, [5, and 6] and during movement of irradiated fuel assemblies, the CRHS must be OPERABLE to ensure that the CRE will remain habitable during and following a DBA and the control room temperature will not exceed equipment operational requirements following isolation of the control room.

[In MODES 5 and 6, the CRHS is also required to cope with a failure of the Gaseous Radwaste System.]

During movement of irradiated fuel assemblies, the CRHS must be OPERABLE to cope with the radioactivity release from a fuel handling accident.

---

17. The CRHS is designed as follows:

- a. Electric power of active components
    - i. Each of the ACU inlet isolation dampers, the ACU return air isolation dampers, and the ACU discharge air flow control dampers is powered by same Class 1E electric power train of their associated ACU fan.
    - ii. Each of the AHU inlet isolation dampers and the AHU discharge air flow control dampers is powered by same Class 1E electric power train of their associated AHU fan.
    - iii. The individual isolation dampers in the CRSRS kitchen isolation damper pair or the smoke removal fan isolation damper pair are powered by different power divisions. One isolation damper of a pair is powered by Class 1E electric power Div. I and the other isolation damper of a pair is powered by Class 1E electrical power Div. II.
    - iv. The two pairs of CRHS outside air dampers are powered by different power divisions. One pair is powered by Div. I and the other pair is powered by Div. II.
  - A. The control logic to isolate the outside air intake isolation damper pair upon receipt of the higher radiation signal exists to isolate the outside air intake having higher radioactivity between dual outside air intakes and it is required for operability of CREACS. This control logic is implemented in safety-related component control system, which is called ESF-CCS. The ESF-CCS is discussed in DCD Tier 2 Section 7.3.
  - B. As stated in the "Emergency Mode" of DCD Tier 2 subsection 9.4.1.2, the CRHS is interlocked to start the ACU in the same division of the operating AHU.
  - b. DCD Tier 1 Table 2.7.3.1-1 is prepared on a HVAC equipment basis such as AHU and ACU and therefore individual fans of ACUs are not listed in the Table 2.7.3.1-1. And DCD Tier 1 has a standard format that does not state the Class 1E electric power source in the Tables. KHNP will revise DCD Tier 1 Table 2.7.3.1-1 to add a Note to the "Emergency Makeup ACU" that indicates each ACU has two fans and each fan is powered by different Class 1E electric power trains.
  - c. Flow controllers are located upstream of the ACU fan air flow control damper and the AHU fan air flow control damper. The flow controllers measure the discharge airflow rate and continuously modulate the opening of the air flow control dampers to maintain air flow within design limits.
  - d. As stated in DCD Tier 2 subsection 9.4.1.2, tornado dampers are provided to protect the CRHS against instantaneous pressure change caused by tornadoes and they are required for CRHS operability.
-

**Impact on DCD**

DCD Tier 1 Table 2.7.3.1-1, TS subsection 3.7.11, and Bases for TS subsection 3.7.11 will be revised as indicated in the attachment.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical Specifications**

TS subsection 3.7.11 and Bases for TS subsection 3.7.11 will be revised as indicated in the attachment.

**Impact on Technical/Topical/Environmental Reports**

There is no impact on any Technical, Topical, or Environmental Reports.

RAI 120-7977 - Question 16-24

RAI 526-8651 - Question 16-223

## 3.7.11 Control Room HVAC System (CRHS)

## NOTE

The CRHS consists of two divisions of control room emergency makeup air cleaning system (CREACS) and control room supply and return system (CRSRS).

## Control Room Heating, Ventilation, and Air Conditioning (HVAC) System (CRHS)

LCO 3.7.11

~~Two CRHS divisions shall be OPERABLE.~~

Delete

The CRHS shall be OPERABLE with:

a. ~~Two CREACS divisions OPERABLE and~~

b. ~~Two AHUs OPERABLE.~~

## NOTE

The control room envelope (CRE) boundary may be opened intermittently under administrative control.

Two Control Room Emergency Makeup Air Cleaning System (CREACS) divisions and two Control Room Supply and Return System (CRSRS) divisions of the CRHS shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4, ~~5, and 6,~~  
During movement of irradiated fuel assemblies.

[5, and 6,]

## ACTIONS

CREACS

CREACS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One <del>CRHS</del> division inoperable for reasons other than <del>Condition B.</del>	A.1 Restore <del>CRHS</del> division to OPERABLE status.	7 days
B. One or two CREACS divisions inoperable due to inoperable CRE boundary in MODE 1, 2, 3, or 4.	B.1 Initiate action to implement mitigating actions. AND B.2 Verify mitigating actions to ensure CRE occupant exposures to radiological, chemical, and smoke hazards will not exceed limits. AND B.3 Restore CRE boundary to OPERABLE status.	Immediately  24 hours  92 days

~~B. Three AHUs inoperable.~~

~~B.1 Restore one inoperable AHU to OPERABLE status.~~

7 days

3.7.11-1

B. One CRSRS division inoperable.

B.1 Restore CRSRS division to OPERABLE status.

ACTIONS (continued)	CONDITION	REQUIRED ACTION
<p><b>D.</b></p> <p><b>C.</b> Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3 or 4. <b>A, B, or C</b></p>	<p><b>D.1</b></p> <p><b>C.1</b> Be in MODE 3.</p> <p><b>AND</b> <b>D.2</b></p> <p><b>C.2</b> Be in MODE 5.</p>	<p><b>CRHS</b></p> <p><b>NOTE</b> Place in toxic gas isolation mode if automatic transfer to toxic gas isolation mode is inoperable.</p> <p>36 hours</p>
<p><b>E.</b></p> <p><b>D.</b> Required Action and associated Completion Time of Condition A not met in MODES 5 and 6, or during movement of irradiated fuel assemblies. <b>A or B</b></p>	<p><b>D.1</b> Place OPERABLE CRHS division in emergency mode. <b>E.1</b></p> <p><b>OR</b> <b>E.2</b> <b>E.2[.1]</b></p> <p><b>D.2</b> Suspend movement of irradiated fuel assemblies.</p>	<p>Immediately</p> <p><b>CREACS and CRSRS of an</b></p> <p>Immediately</p>
<p><b>F.</b></p> <p><b>E.</b> Two CRHS divisions inoperable in Mode 5 or 6, or during movement of irradiated fuel assemblies. <b>MODE 5 or 6</b></p> <p><b>CREACS</b></p> <p><b>OR</b></p> <p>One or two CREACS divisions inoperable due to inoperable CRE boundary in Mode 5 or 6, or during movement of irradiated fuel assemblies. <b>MODE 5 or 6</b></p>	<p><b>E.1</b> Suspend movement of irradiated fuel assemblies. <b>F.1</b></p>	<p>Immediately</p>
<p><b>G.</b></p> <p><b>F.</b> Two CRHS divisions inoperable in MODE 1, 2, 3, or 4 for reasons other than Condition B. <b>CREACS</b></p> <p><b>OR</b></p> <p>Two CRSRS divisions inoperable in MODE 1, 2, 3, or 4.</p>	<p><b>G.1</b></p> <p><b>F.1</b> Enter LCO 3.0.3. <b>Condition C.</b></p>	<p>Immediately</p> <p><b>E.2.2</b> Suspend operations with a potential for releasing radioactivity from the Gaseous Radwaste System. <b>Immediately]</b></p> <p><b>F.2</b> Suspend operations with a potential for releasing radioactivity from the Gaseous Radwaste System. <b>Immediately]</b></p>

## SURVEILLANCE REQUIREMENTS

RAI 526-8651 - Question 16-223

SURVEILLANCE		FREQUENCY
SR 3.7.11.1	Operate each CREACS division for $\geq 15$ minutes with heaters operating.	31 days
SR 3.7.11.2	Perform required CREACS filter testing in accordance with Ventilation Filter Testing Program (VFTP).	In accordance with VFTP
SR 3.7.11.3	Verify <del>each CRHS division actuates</del> on an actual or simulated actuation signal.	18 months
SR 3.7.11.4	Perform required CRE unfiltered air inleakage testing in accordance with Control Room Envelope Habitability Program.	In accordance with Control Room Envelope Habitability Program
SR 3.7.11.5	Verify each CRSRS division has the capacity to remove design heat load.	18 months

active components in each CREACS division actuate

## BASES

## BACKGROUND (continued)

The CRHS is designed to maintain a habitability environment in the CRE for 30 days of continuous occupancy after a design basis accident (DBA) without exceeding a 50 mSv whole body dose or its equivalent to any part of the body.

APPLICABLE  
SAFETY  
ANALYSES

The CRHS components are arranged in redundant safety-related ventilation divisions. The CRHS provides airborne radiological protection for the CRE occupants, as demonstrated by the CRE occupant dose analyses for the most limiting DBA fission product release presented in DCD Tier 2, Chapter 15 (Reference 4).

The location of components and ducting within the CRE ensures an adequate supply of filtered air to all areas requiring [and toxic gases]

The CRHS provides protection from smoke and hazardous chemicals to the CRE occupants. The analysis of hazardous chemicals releases demonstrates that the toxicity limits are not exceeded in the CRE following a hazardous chemical release (Reference 1). The evaluation of a smoke challenge demonstrates that it will not result in the inability of the CRE occupants to control the reactor either from the control room or from the remote shutdown room (Reference 3).

The worst case single active failure of a component of the CRHS, assuming a loss of offsite power, does not impair the ability of the system to perform its design function.

~~CREACS divisions and any two of the four independent and redundant AHUs~~ 36 (c)(2)(ii).

Replace to "A"

## LCO

Two independent and redundant divisions of the CRHS are required to be OPERABLE to ensure that at least one is available, if a single failure disables the other division. Total system failure, such as from a loss of both ventilation divisions or from an inoperable ~~one CREACS division and one AHU~~ result in exceeding a dose of 50 mSv to ~~are~~ event of a large radioactive release and in the equipment operating temperature exceeding ~~CREACS division or AHU~~.

The CRSRS is considered OPERABLE when one AHU that is necessary to maintain MCR temperature is OPERABLE in both divisions. These components include the cooling coils, heating coils, and associated temperature control instrumentation. In addition, the CRSRS must be OPERABLE to the extent that air circulation can be maintained. Deleted

Replace to "B"

**A**

RAI 526-8651 - Question 16-223

Two independent and redundant divisions of the CRHS are required to be OPERABLE to ensure that one division is available during an event requiring the CRHS, if a single failure disables the other division. An OPERABLE CRHS division requires the emergency makeup air cleaning unit (ACU) in the associated CRSRS division and one of two air handling units (AHUs) in the associated CRSRS division to be OPERABLE. The outside air intake isolation dampers, the ACU inlet isolation damper, the ACU return air isolation damper, the emergency makeup ACU fan, and the ACU discharge airflow control damper, which are associated with the required AHU flow path, are also required to be OPERABLE for OPERABILITY of a CRHS division.

Total CRHS failure, such as from a loss of both CRSRS divisions, both CREACS divisions, or one CRSRS division and the CREACS in the opposite division, or from an inoperable CRE boundary, could result in exceeding a dose of 50 mSv to the control room operators in the event of an accident with a large radioactive release.

Total CRSRS failure, such as from the loss of all AHUs, could result in exceeding operating temperature limits of equipment in the CRE, not just in the event of an accident when the CRSRS may be needed to operate in the recirculation or emergency mode, but also during normal operation.

**B**

A CRSRS division is considered OPERABLE when the necessary individual components associated with one of the two AHUs are OPERABLE. The necessary components are those needed to maintain CRE temperatures and relative humidity within limits to meet equipment OPERABILITY requirements. These components include the AHU cooling coil and associated essential chilled water system three-way flow control valve, the heating coil and associated temperature control instrumentation, and the AHU supply fan, AHU inlet isolation dampers, the AHU discharge airflow control damper, and the humidifier in the AHU discharge duct. In addition, the CRSRS division must be OPERABLE to the extent that the minimum necessary air circulation in the CRE can be maintained.

## BASES

## LCO (continued)

Each CREACS division is considered OPERABLE when the individual components necessary to limit CRE occupant exposure are OPERABLE. A CREACS division is considered OPERABLE when the associated:

- a. Fan is OPERABLE.
- b. HEPA filter and carbon absorber are not excessively restricting flow and are capable of performing their filtration functions.
- c. Heater, moisture separator, ductwork, and dampers are OPERABLE and air circulation can be maintained.

In order for the CREACS divisions to be considered OPERABLE, the CRE boundary must be maintained such that the CRE occupant dose from a large radioactive release does not exceed the calculated dose in the licensing basis consequence analyses for DBAs, and that CRE occupants are protected from hazardous chemicals and smoke.

 [toxic gases and]

The LCO is modified by a Note allowing the CRE boundary to be opened intermittently under administrative controls. This Note only applies to openings in the CRE 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 should be proceduralized and consist of stationing a dedicated individual at the opening who is in continuous communication with the operators in the CRE.

This individual will have to a method to rapidly close the opening and to restore the CRE boundary to a condition equivalent to the design condition when a need for CRE isolation indicated.

 [5, and 6]

## APPLICABILITY

In MODES 1, 2, 3, 4, 5, and 6 and during movement of irradiated fuel assemblies, the CRHS must be OPERABLE to ensure that the CRE will remain habitable during and following a DBA and ensure that the control room temperature will not exceed equipment operational requirements following isolation of the control room.

During movement of irradiated fuel, the CRHS must be OPERABLE to cope with the release from a fuel handling accident.

 In MODES [5 and 6], the CRHS is also required to cope with a failure of the Gaseous Radwaste System.

[In MODES 5 and 6]

[System.]

## BASES

## ACTIONS

A.1

B.1

one CRSRS division

RAI 120-7977 - Question 16-24

RAI 526-8651 - Question 16-223

OPERABLE CRSRS division

three AHUs

the division to

one AHU

Deleted

Deleted

With one CRHS division inoperable, for reasons other than an inoperable CRE boundary, action must be taken to restore OPERABLE status within 7 days. In this condition, the remaining OPERABLE CRHS division is adequate to maintain the control room temperature within limits and to perform the CRE occupants protection function. However, the overall reliability is reduced because a single failure in the OPERABLE division could result in less the CRHS function. The 7-day Completion Time is based on the low probability of a DBA occurring during this time period and the ability of the remaining division to provide the required capabilities.

loss of the  
CRSRS

AHU

and relative humidity

in the OPERABLE  
CRSRS division

B.1, B.2 and B.3

AHU of the OPERABLE CRSRS division

If the unfiltered leakage of potentially contaminated air past the CRE boundary C.1, C.2 and C.3 can result in CRE occupant radiological dose greater than the calculated dose of the licensing basis analyses of DBA consequences (allowed to be up to 50 mSv whole body or its equivalent to any part of the body), or inadequate protection of CRE occupants from hazardous chemicals or smoke, the CRE boundary is inoperable.

Actions must be taken to restore an OPERABLE CRE boundary within 92 days.

[toxic gases or]

[or toxic gas]

During the period that the CRE boundary is considered inoperable, action must be initiated to implement mitigating actions to lessen the effect on CRE occupants from the potential hazards of a radiological or chemical event or challenge from the smoke. Actions must be taken within 24 hours to verify that in the event of a DBA, the mitigating actions will ensure that CRE occupant radiological exposures will not exceed calculated dose of the licensing basis analyses of DBA consequences, and that CRE occupants are protected from hazardous chemical and smoke. These mitigating actions (i.e., actions that are taken to offset the consequences of the inoperable CRE boundary) should be preplanned for implementation upon entry into the condition, regardless of whether entry is intentional or unintentional. The 24-hour Completion Time is reasonable based on the low probability of a DBA occurring during this time period and the use of mitigating actions. The 92-day Completion Time is reasonable based on the determination that the mitigating actions

[toxic gases and]

the  
division to

A.1 With one CREACS division inoperable for other than an inoperable CRE boundary, action must be taken to restore OPERABLE status within 7 days. In this condition, the remaining OPERABLE CREACS division is adequate to perform the CRE occupants protection function. However, the overall reliability is reduced because a single failure in the OPERABLE division could result in loss of the CREACS function. The 7-day Completion Time is based on the low probability of a DBA occurring during this time period, and ability of the remaining division to provide the required capability.

occurring

CREACS

B 3.7.11-5

capabilities

the

occupant

Rev. 0

## BASES

## ACTIONS (continued)

D.1, and D.2

CREACS or CRSRS  
division

C.1 and C.2

restored

CRHS division

In MODE 1, 2, 3, or 4, if the inoperable CRHS or the CRE boundary cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE that minimizes the accident risk. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and MODE 5 within 36 hours.

The allowed Completion Times are reasonable, based on operating experience to reach the required unit conditions from full power condition E.1, and E.2 by manner and without challenging unit systems.

MODE 5 or 6, or  
during

D.1 and D.2

E.1

performed

[In MODES 5 and 6, or]

Required Action D.1 is operated manually.

the CREACS and CRSRS of

A.1 or B.1

MODE 5, 6, or during movement of irradiated fuel assemblies, if Required Action A.1 cannot be completed within the required Completion Time, the OPERABLE CRHS division must be immediately placed in the emergency MODE of operation. This action ensures that the remaining division is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action D.1 is to immediately suspend activities that could result in a release of radioactivity that may require isolation of the control room. This places the unit in a condition that minimizes the accident risk.

Required Action[s] E.2[.1 and E.2.2]

CRE.

This does not preclude the movement of fuel assemblies to a safe position.

E.1

F.1 [and F.2]

MODE 5 or 6

E.1

[In MODES 5 and 6, or]

Required Action[s] F.1 [and F.2]

In MODE 5, 6, or during movement of irradiated fuel assemblies with two CRHS divisions inoperable, or with one or two CREACS divisions inoperable due to an inoperable CRE boundary, action must be taken immediately to suspend activities that could result in a release of radioactivity that may require isolation of CRE. This places the unit in a condition that minimizes the accident risk. This does not preclude the movement of fuel to a safe position.

CREACS divisions inoperable or two CRSRS

## -----REVIEWER'S NOTE-----

The need for toxic gas isolation mode will be determined by the COL applicant.

E.1

CRHS

[Required Action D.1 is modified by a Note indicating to place the system in the toxic gas isolation mode if the automatic toxic gas isolation mode is inoperable.]

## BASES

ACTIONS (continued)

G.1

F.1

CREACS

If both CRHS divisions are inoperable in MODE 1, 2, 3, or 4 for reason other than an inoperable CRE boundary (i.e. Condition B), the CRHS may not be capable of performing the intended function and the unit is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

- reasons

C

functions

<p>or both CRSRS divisions are inoperable in MODE 1, 2, 3, or 4</p>
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## SURVEILLANCE REQUIREMENTS

SR 3.7.11.1

Standby systems should be checked periodically to ensure that they function properly. Since the environment and normal operating conditions on this system are not severe, testing each ACU once every month provides an adequate check on this system.

Monthly heater operations dry out any moisture accumulated in the charcoal from humidity in the ambient air. Systems with heaters must be operated for greater than or equal to 15 minutes with the heaters energized. The 31-day Frequency is based on the known reliability of the equipment and the two train redundancy available.

SR 3.7.11.2

This SR verifies that the required CRHS testing is performed in accordance with the ventilation filter testing program (VFTP). The testing is performed in accordance with NRC RG 1.52 (Reference 5). The VFTP includes testing HEPA filter performance, carbon adsorber efficiency, minimum system flow rate, and the physical properties of the activated carbon (general use and following specific operations). Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.11.3

active components in each CREACS division start and operate


This SR verifies ~~each CRHS division starts and operates~~ on an actual or simulated actuation signal. The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. The 18-month Frequency is based on operating experience and design reliability of the equipment.

**APR1400 DCD TIER 1**

RAI 526-8651 - Question 16-223

Table 2.7.3.1-1 (1 of 2)

Control Room HVAC System Components List

Component Name <sup>(1)</sup>	Item No. <sup>(2)</sup>	ASME Section III Class	Seismic Category	Class 1E/Harsh Envir. Qual.	Control/Display at MCR	Control/Display at RSR	Control Signal	Active Safety Function	Loss of Motive Power Position
Supply AHU	VC-HV01A, HV01B, HV01C, HV01D	-	I	Yes/No	Yes/Yes	Yes/Yes	-	Start	-
Emergency Makeup ACU 	VC-AU01A, AU01B	-	I	Yes/No	Yes/Yes	Yes/Yes	SIAS or CREVAS	Start	-
Outside Air Intake Isolation Damper (ESR)	VC-Y0011A, Y0011B, Y0012A, Y0012B	-	I	Yes/No	Yes/Yes	Yes/Yes	SIAS or CREVAS	Open	Open
AHU Inlet Isolation Damper (PSR)	VC-Y0013A, Y0013C, Y0014B, Y0014D, Y0015A, Y0015C, Y0016B, Y0016D	-	I	Yes/No	Yes/Yes	Yes/Yes	SIAS or CREVAS	Closed	Closed
AHU Discharge Check Damper	VC-Y1002A Y1002B Y1002C Y1002D	-	I	-/-	-/-	-/-	-	Open	-
ACU Inlet Isolation Damper (ESR)	VC-Y0017A, Y0017C, Y0018B, Y0018D	-	I	Yes/No	Yes/Yes	Yes/Yes	ACU fan start	Open	Closed

## APR1400 DCD TIER 1

RAI 526-8651 - Question 16-223

Table 2.7.3.1-1 (2 of 2)

Component Name <sup>(1)</sup>	Item No. <sup>(2)</sup>	ASME Section III Class	Seismic Category	Class 1E/Harsh Envir. Qual.	Control/Display at MCR	Control/Display at RSR	Control Signal	Active Safety Function	Loss of Motive Power Position
ACU Return Air Isolation Damper (ESR)	VC-Y0019A, Y0019C, Y0020B, Y0020D	-	I	Yes/No	Yes/Yes	Yes/Yes	ACU fan start	Open	Closed
AHU Discharge Flow Control Damper (ESR)	VC-Y0021A, Y0021C, Y0022B, Y0022D	-	I	Yes/No	Yes/Yes	Yes/Yes	AHU fan start	Modulate	Closed
ACU Discharge Flow Control Damper (ESR)	VC-Y0023A, Y0023C, Y0024B, Y0024D	-	I	Yes/No	Yes/Yes	Yes/Yes	ACU fan start	Modulate	Closed
Kitchen and Toilet Exhaust Isolation Damper (PSR)	VC-Y0027, Y0028	-	I	Yes/No	Yes/Yes	Yes/Yes	SIAS or CREVAS	Closed	Closed
Smoke Removal Isolation Damper (PSR)	VC-Y0029, Y0030	-	I	Yes/No	Yes/Yes	Yes/Yes	SIAS or CREVAS	Closed	Closed
Tornado Dampers	VC-Y1101A, Y1101B, Y1102, Y1103	-	I	-/No	-/-	-/-	-	Closed (Tornado Condition) Open (After Tornado Condition)	-

(1) Damper actuator types are as follows:

- ESR : Electro hydraulic spring return
- PSR : Pneumatic spring return

(2) The column "Item No." is information only (not part of certified design).

(3) Dash(-) indicates not applicable.

(4) Each ACU has two fans. Two fans in AU01A are powered by Class 1E train A and C, respectively, and two fans in AU01B are powered by Class 1E train B and D, respectively.