Response to

Request for Additional Information No. 505, Supplement 29

8/30/2011

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 07.01 - Instrumentation and Controls - Introduction
SRP Section: 07.03 - Engineered Safety Features Systems
SRP Section: 07.04 - Safe Shutdown Systems
SRP Section: 07.05 - Information Systems Important to Safety
SRP Section: 07.07 - Control Systems
SRP Section: 07.08 - Diverse Instrumentation and Control Systems
SRP Section: 07.09 - Data Communication Systems

Application Section: FSAR Chapter 7

QUESTIONS for Instrumentation, Controls and Electrical Engineering 1 (AP1000/EPR Projects) (ICE1)

Question 07.01-35:

OPEN ITEM

Provide failure modes and effects analysis (FMEA) and ITAAC to perform the FMEA for the Safety Automation System (SAS) to verify design commitments made in U.S. EPR FSAR, Tier 2, Section 7.1.

10 CFR 50.55a(h) incorporates by reference IEEE Std. 603-1991. As part of an alternative request, the applicant proposes to use IEEE Std. 603-1998. Clause 5.1 of IEEE Std. 603-1998 require, in part, that safety systems perform all safety functions in the presence of any single detectable failure, all failures caused by a single failure, and all failures or spurious actuations caused by a design basis event. In Tier 2, Section 7.1.2.6.12, the applicant states that an FMEA was performed for the PS and described in ANP-10309P, as a means of meeting the requirements of IEEE Std. 603-1998, Clause 5.1. An FMEA is a typical method of analysis used to demonstrate compliance with single failure criteria of IEEE Std. 603-1998, Clause 5.1. The staff review of the PS FMEA determined that the SAS functionality, as it pertains to ESF functionality, is not addressed in the analysis. The applicant did not state in Section 7.1.2.6.12 that an FMEA was performed for SAS. SAS provides safety-related functions relating to safe shutdown support as well as providing safety-related interlocks for numerous other safety systems. The staff review of Tier 1, Section 2.4.4, determined that there was no ITAAC item verifying the performance of a SAS FMEA, similar to that of the PS ITAAC item provided in Section 2.4.1.

Due to the safety significance of SAS, the staff requests the applicant provide an FMEA, or similar single failure analysis, for SAS that demonstrates SAS failure modes have been accounted for in the U.S. EPR design. The staff also requests the applicant provide an ITAAC item verifying the performance of the SAS FMEA.

Response to Question 07.01-35:

A system-level failure modes and effects analysis (FMEA) was performed on the safety automation system (SAS) to identify potential single-point failures and their consequences. The architecture of the SAS is redundant by the means of the use of redundant control units within divisions and divisional redundancy. The system is designed so that a single failure during corrective or periodic maintenance, or a single failure and the effects of an internal hazard, do not prevent performance of the safety functions. The FMEA for SAS has been incorporated into the U.S. EPR FSAR Tier 2, Section 7.1, Table 7.1-7, as described in the Response to RAI 505, Question 07.01-36.

The SAS logic diagrams and descriptions have been developed and will be incorporated into the U.S. EPR FSAR Tier 2, Section 7.3 (for SAS Control Functions) and Section 7.6 (for SAS Interlock Functions). An inspection, tests, analyses, and acceptance criteria (ITAAC) item for the SAS FMEA, similar to that of the protection system ITAAC provided in U.S. EPR FSAR Tier 1, Section 2.4.1, was included in U. S. EPR FSAR Tier 1, Section 2.4.4, Item 4.10, as part of the Response to RAI 452, Supplement 5, dated June 22, 2011. This U.S. EPR FSAR Tier 1 information has been updated to include conforming changes to match the addition of the SAS logic diagrams.

As part of the SAS logic diagrams and descriptions that have been developed, an SIS/RHRS automatic RHRS flow rate control function was added. This function is manually initiated by the operator as part of connecting RHR. The logic diagram and function is described in U.S. EPR FSAR Tier 2, Section 7.3.

A design change was implemented that modified the safety classification for the LHSI pump trips on Low dPsat and Low-Low RCS Loop level from safety-related to non-safety. These functions are equipment protection functions and don't have to be safety-related or implemented in SAS. They will be implemented in the PAS system.

Conforming changes to U.S. EPR FSAR Tier 2, Chapters 3, 6, 8, 9, and 14, due to this response, are also included in the response to this RAI. These changes include markups of the corresponding mechanical system design descriptions in U.S. EPR FSAR Tier 1 and Tier 2, Chapter 9, to reflect the additional design detail associated with each of the SAS I&C Logic Diagrams. Also included are conforming changes to U.S EPR FSAR Tier 2, Chapters 8 and 14, to reflect the corresponding mechanical changes. The inclusion of the additional design details also involved updating the U.S EPR FSAR Tier 2, Chapter 3 tables in Sections 3.2, 3.10, and 3.11 for Classification, Seismically Qualified Mechanical Equipment, and Environmentally Qualified Electrical/I&C Equipment.

Additional conforming changes were added to U.S. EPR FSAR Tier 2, Sections 7.1, 7.3, and 7.6; and corresponding figures; and Tables 7.1-5 and 7.1-7. Conforming changes to ANP-10309, "U.S. EPR Protection System Technical Report," have been included in the markups to this response. A complete revision to the technical report will be submitted by separate letter.

Conforming changes to ANP-10310, "Methodology for 100% Combinatorial Testing of the U.S. EPR™ Priority Module Technical Report," have been included in the markups to this response. A complete revision to the technical report will be submitted by separate letter.

U.S. EPR FSAR Tier 2, Section 7.1.1.2, was modified to provide details for the seventeen action items to be addressed for implementation of a TXS platform per the NRC Safety Evaluation Report (SER) for TELEPERM XS: A Digital Reactor Protection System Topical Report (EMF-2110(NP)(A).

Additional NRC follow-up questions concerning this issue are addressed as follows:

1. For Sections 7.3.1.3 and 7.3.1.4, what are the specific FSAR sections that are applicable to each newly added SAS function? Without a more detailed description of the individual mechanical system functionality, reviewing the content of the new related logic drawings is more difficult.

   For each SAS function described in U.S. EPR FSAR Tier 2, Sections 7.3.1.3 and 7.3.1.4, AREVA NP has added a brief description of the function and a pointer to other sections of the FSAR of the mechanical system for further detail.

2. For Sections 7.3.1.3 and 7.3.1.4, which of the newly added SAS functions are included in the Chapter 15 Safety Analyses similar in the way that EFWS Pump Flow control is mentioned?

   There are no other SAS functions that are considered in the Chapter 15 analyses similar to the EFWS Pump Flow Control. U.S. EPR FSAR Tier 2, Table 15.0-10, does show the plant systems that are used in the accident analyses. There are other ESF functions shown in this table in the column entitled: "ESF Functions," that are used as a part of responding to the accidents, but none of them are used for equipment protection similar to the EFWS pump flow control. All the functions listed in this table are for mitigating the accident.

3. Per Table 2.4.4.2 of FSAR markup, SAS performs automatic RHRS Flow Rate control. Is this function initiated as a part of the SI/RHR ESFAS actuation? If so, why is this not mentioned under the SI/RHR function in FSAR Section 7.3.1.2.1?

   RHRS Flow Rate Control is not a function that is initiated as a part of the SI/RHR ESFAS actuation. The RHRS Flow Rate Control is included in the logic of SAS, but is initiated manually once the transient reaches to point where the operator can put the RHRS on line. See U.S. EPR FSAR Tier 2, Section 15.0.0.3.7, "Operator Actions."

4. For all other SAS functions under the new Section 7.3.1.3, are these functions initiated as part of ESFAS actuations and Section 7.3.1.4 covers normally operating controls functions?

   U.S. EPR FSAR Tier 2, Table 7.1-5, "SAS Automatic Safety Function," has been changed in the attached U.S EPR FSAR Tier 2 markup to show which functions are initiated by a PS signal, those that are manually initiated, and which ones are in continuous operation.

5. For <u>all</u> SAS interlocks performed, which interlocks are included in the Chapter 15 Safety Analyses?

   All SAS interlocks, as well as all PS interlocks, are assumed to perform in accordance with their design in the U.S EPR FSAR Tier 2, Chapter 15 analysis unless the failure of the interlock is specified as the single failure in the analysis of the event. From U.S. EPR FSAR Tier 2, Section 15.0.0.3.1, "The limiting cases for each event are summarized in Table 15.0.62—Transient Analysis Limiting Cases, along with the acceptance criteria evaluated. The limiting cases were derived from a spectrum of cases that reflect the range of possible allowed operating conditions (including shutdown modes), availability of offsite power, variation of event-specific parameters (e.g., break size), and possible single failures." An

examination of U.S. EPR FSAR Tier 2, Table 15.0-62, shows the results of the analyses and no failures of the interlocks are mentioned.

6. Regarding the CCWS Interlocking function for RCP Thermal Barrier Cooling on Page 7.6-6 of the FSAR markup, clarify why a condition where two trains of CCWS feed a common header is an unacceptable condition? Is this because system piping cannot handle additional volume, etc. or is this an operational choice by the applicant? If it is a safety function, describe what hazard condition it is preventing.

   The RCP thermal barriers can be cooled from either Common 1b or Common 2b. During normal operation, one train of CCWS supplies Common 1b and one train of CCWS supplies Common 2b. In the event that both Common lines were to be connected to the RCP thermal barriers at the same time, it would be possible that a single failure in one of the CCWS trains could drain both of the operating CCWSs. Hence, the interlock that prevents this dual connection to the RCP thermal barriers; which protects the trains from being vulnerable to single failures and is a design requirement, not an operating choice. There is significant discussion of the CCWS in U.S. EPR FSAR Tier 2, Section 9.2.2.

7. Regarding the markup for the PS Technical Report, page A-36 of the PS FMEA, Item 37, comment section. The applicant states that for a loss of a division, the ability to detect RHR connections is lost.

   a. How does this failure specifically affect the ability of the PS to make up the logic for the P14 permissive, as shown on FSAR Figure 7.6-3?

      The logic for making up Permissive P14 is shown on U.S. EPR FSAR Tier 2, Figure 7.2-33. The loss of the detection of RHR connection function does not affect the logic of the Permissive P14. Failure of an ALU in one division does not impact the other three divisions, so that the P14 Permissive would still be able to be functional. Since the logic uses inputs from all four divisions to make up, and the logic is based on a two out of four voting on the inputs, the P14 Permissive would be able to be validated in three of the four divisions (or two of four divisions if one is out for maintenance).

   b. If this detection is lost, does this affect operator actions for aligning RHR?

      This does not affect operator actions because valve position indications to the operator are provided via the Priority and Actuator Control System (PACS) to Process Automation System (PAS) to Process Information and Control System (PICS), or PACS to Safety Information and Control System (SICS). The operator can provide manual actuation of RHR components via PICS to PAS to PACS, or SICS to PACS. Therefore, a failure in the PS and a failure of the RHR detection function, does not affect the indications or manual controls of the operator.

c. Per the comment, an inoperable APU could lead to activation of the RHR safety valves due to overpressure from the RCS due to inadvertent RHR connection because of the loss of RHR detection.

d. Clarify why this is an acceptable system effect considering the RHR safety valves would experience fluid discharge directly from the RCS as stated in U.S. EPR FSAR Tier 2, Section 5.4.7.2?

   The RHRS safety valves experiencing fluid discharge directly from the RCS is an acceptable system effect.

   A design-basis accident event during plant cooldown mode would result in actuation of the MHSI system for mitigation of the event (LHSI will not receive the SI signal as the system will be operating in RHR mode). Assuming an inoperable APU leads to a closed MHSI large mini-flow valve of one train (30JND10/20/30/40 AA005), the affected MHSI train will be injecting at a higher pressure. Overpressure protection of the RHRS will be provided by the RHRS safety valves, which are sized for such occurrence of MHSI injection with one large mini-flow valve closed. The fluid will be discharged to the IRWST via the RHRS safety valves; note that during an accident event, fluid from the RCS will eventually flow to the IRWST.

   Due to single failure consideration, spurious injection of the MHSI system along with an inoperable APU is not assumed.

e. Considering this failure could potentially lead to the overpressurization of a safety system connected to the RCS, has this failure been accounted for in Chapter 15?

   U.S. EPR FSAR Tier 2, Chapter 15 analysis evaluates events during Modes 1 and 2. The use of the MHSI large mini-flow valves are for low temperature over pressure conditions (LTOP), which are in Modes 4 and 5. Therefore, these valves are not addressed as part of the U.S EPR FSAR Tier 2, Chapter 15 analysis. The use of the MHSI large mini-flow valves is described in U.S. EPR FSAR Tier 2, Section 6.3.2.

8. As a clarification, regarding SAS FMEA, Table 7.1-7, page 33 of 36, item 87, when applicant refers to "train pairs", does this refer to the mechanical train pairs or one of two pairs of CUs within a SAS division to implement this function?

   Trains here refer to the mechanical system (CCWS). Understand that the common headers that can supply cooling can also be supplied by one or the other of two trains of CCWS. Under normal operation, only one train of CCWS supplies the common header, and the other matching train (1 and 2 or 3 and 4) is not in operation.

9. Regarding page 2.4-37, the applicant now includes P14 as a permissive (operating bypass) that affects the SAS. This question was specifically asked in RAI 505, Q07.01-49, supplement 21, for which the staff was informed that only permissive related to SAS functionality to address IEEE Std. 603-1991, Clause 6.6, was the P15 permissive. Q07.01-49 was sent closed by the applicant. What was the applicant's reasoning for this update?

   As a design change included in this response, the LHSI pump trip on low dPsat and low-low RCS loop level function's safety classification was changed from safety related to non-

safety. These functions are equipment protection functions and do not have to be safety-related or implemented in SAS. This design change moved these LHSI pump trips from SAS to PAS. These LHSI pump trips required the use of P14 and P15 permissives, and were the only functions in SAS to use permissives. Therefore, with these two functions removed from SAS, the SAS does not require any permissive signals.

Follow up Questions/Responses Regarding Applicant's Oct. 2012 Response to RAI 505, Q7.1-35:

Question 1

1. Regarding the applicant's response to Staff comment#3 on Supplement 25. Applicant stated that:

   "RHRS Flow Rate Control is not a function that is initiated as a part of the SI/RHR ESFAS actuation. The RHRS Flow Rate Control is included in the logic of SAS, but is initiated manually once the transient reaches to point where the operator can put the RHRS on line. See U.S. EPR FSAR Tier 2, Section 15.0.0.3.7, "Operator Actions.""

   a. Identify where specifically in U.S. EPR FSAR Tier 2, Section 15.0.0.3.7, revision 3, that expresses the manual initiation of RHRS automatic flow rate control as a credited operator action? It wasn't readily apparent after reviewing this section where this was captured.
   b. Is the flow rate control design function explained in another section of the FSAR? If so, where?
   c. Is the flow rate control function an automatic function if, in fact, it is initiated manually?

Response

a. The manual initiation is covered under the following statement in U.S. EPR FSAR Tier 2, Section 15.0.0.3.7: "Once the RCS reaches the conditions for RHR entry, the operator initiates RHR operation."
b. U.S. EPR FSAR Tier 2, Section 5.4.7.5 states:

   "No automatic features other than parametric range controls, such as temperature dependent HX bypass flow control, and equipment protection interlocks, such as the low suction pressure trip for the LHSI pumps, are incorporated for operation of the shutdown cooling function for the SIS/RHRS. The shutdown cooling function of the SIS/RHRS must be initiated and terminated by deliberate manual action. Operation of the SIS/RHRS is performed from the MCR for all operating conditions. Refer to U.S. EPR Tier 2, Section 6.3, for details of the automatic and manual actions associated with the LHSI function of the SIS/RHRS."
c. RHR flow rate control is done using an auto/manual control station. The operator's first choice would be to put the controller in the automatic mode, but he could also control the flow rate manually, if he chooses to do so. Nevertheless, initiating RHR flow by initiating the pump and setting up the controller is an operator action.

Question 2

2. In the current supplement of the RAI 505, Q7.1-35, the applicant appears to eliminate the SAS initiated automatic pump trip of LHSI pumps on Low delta Psat and Low-Low RCS Loop Level:

   a. These two trips still appear as items 85 and 86 on the SAS FMEA, table 7.1-6. Is this still appropriate for the recent design change? If so, would the non-safety related PAS be another failure mode?

   b. Does this design change from SAS to PAS affect the failure modes of the LHSI pumps individually?

Response

a. The two trips have been removed from the SAS FMEA table. These trips were determined to be for equipment protection of the RHR pumps; therefore, they were removed from the safety-related SAS and moved to the non-safety-related PAS. For the PAS failure mode, see the Response to RAI 555 Q 07.01-53.

b. No. Refer to the Response to RAI 555 Q 07.01-53 and U.S. EPR FSAR Tier 2, Section 5.4.7.

Question 3

3. Regarding the applicant's response to Staff comment#9:

   a. Are there other safety related components that have protective features performed by PAS besides the LHSI pumps? If so, what are they?

   b. Per IEEE Std. 603-1991(1998), Clause 4.11(4.k) it is required to document equipment protective features that prevent the safety system from accomplishing their safety functions. Has the applicant documented this design aspect in the FSAR?

   c. Has the applicant considered whether this new configuration meets the requirements of GDC 24, "Separation of protection and control systems" as well as Clause 5.6.3 of IEEE Std. 603? If so, what is the applicant's position on how this design change affects compliance with these requirements?

Response

Refer to the Response to RAI 555, Question 07.01-53, specifically the discussion of segmentation of PAS functions including safety-related equipment.

Question 4

4. Clarification: Regarding page 2.7-24 of the Tier 1 FSAR markup, ITAAC Item 4.13 acceptance criteria:

a. Is it correct that ALL of the CIVs of a closed header will open upon the detection of a single CIV on the open header going closed?

b. Does this information conform to what is depicted on the newly revised Figures 7.6-2 and 7.6-12 of the FSAR markup?

Response

a. Yes this is correct. If one CIV on the open header is closed, then all of the CIVs on the open header are closed, and all of the CIVs on the previously closed header are opened.

b. Yes, this logic is depicted in U.S. EPR FSAR Tier 2, Figure 7.6-12.

Question 5

5. Regarding Figure 7.6-2 of this supplement, one of the concerns stated by the applicant concerning the SAS/CCWS Interlock for the RCP Thermal Barriers supply headers (SAS FMEA Item #91 on table 7.1-7) is that if a failure occurred in the 'open' header, a switchover to the 'closed' header would not occur in enough time to prevent an eventual RT on low RCS flow due to the loss of RCP(s). Is the timing aspect no longer of concern given the new configuration of this interlock?

Response

U.S. EPR FSAR Tier 2, Figure 7.6-12, provides the logic that prevents both headers from being closed and causing an RT on low RCS flow.

Question 6

6. Referring to the "vote" definitions shown on Pages 7.1-4 and 7.1-126 of the FSAR markup: For the third voting definition bullet on page 7.1-126, it should say "....y is a value between 2 and x minus 1".

Response

This is correct, see attached markup of U.S. EPR FSAR Tier 2, Section 7.1 (Page 7.1-4) and Table 7.1-5.

Question 7

7. Figures 7.3-4 and 7.3-12 of this supplement no longer specifically reference SAS at the bottom of each logic as they did in the official, revision 3 versions of these logics. Why was the reference to SAS omitted in the supplement version of these logics?

Response:

This note was applicable when these two figures were the only SAS logics shown. Now that all of the SAS logic has been added to the U.S. EPR FSAR, the note is no longer applicable.

Question 8:

8. In Table 7.1-7, the SAS FMEA results, some of the compensating provisions for undetected spurious and undetected blocking failure modes are that there are two redundant train pairs. Clarify whether for these SAS automatic functions the CUs in the redundant train pairs are communicating with each other (e.g. divisions 1 and 2's CUs for the CCWS Switchover Valves Interlock function are communicating in any manner with the CUs in division 3 and 4 performing the same function)? If so, can a failure in the sending CU adversely impact the CUs in the other three divisions?

Response

ANP-10309, "U.S. EPR Protection System," Section 11.0, describes interdivisional communication for the Protection System. This description applies to all TXS systems (including SAS):

> *"Communication activities are performed sequentially and controlled by the central control unit of the runtime environment. The sending function processor initiates sending activities and the messages are addressed to the receiving function processor. The intermediate communication modules and OLMs transfer the messages without influencing the message data. The dual port random access memory (DPRAM) contained in the communication module serves as a buffering circuit and separates data flow between send and receive channels. The separation of data flow is continued within the function processor by the message input and message output buffers. The function processor accesses the DPRAM independently of access by the communication module's PROFIBUS controller, which sends and receives data to and from the network."*

TXS software consists of system software and application software. System software implements the TXS platform requirements. Application software implements the plant's functional requirements. See ANP-10304, "U.S. EPR Diversity and Defense-in-Depth Assessment," Section 4.11.2, for more information.

Based on the function, CUs in different divisions can be connected in different configurations. A function such as MSRCV control uses signals from all four divisions of SAS for voting. A function such as the SCWS switchover function is only connected across

two divisions (Divisions 1 & 2 or Divisions 3 & 4). These functions operate on the application layer of TXS software.

If a hardware failure occurs in a CU of Division 1 of SAS, the fault could be propagated to other CUs. Most of these faults would be detected by the TXS continuous self-test features, and ignored by the other divisions. A hardware failure could go undetected if it is sent to a connected division, such as between Divisions 1 and 2 in the SCWS switchover function. While this would cause a failure of Divisions 1 and 2 for this function, the failure is not propagated to Divisions 3 and 4. For the SCWS switchover function, the Division 1 CU and the Division 3 CU do not communicate with each other. If the hardware fault in Division 1 sends a signal to Division 3, the CU in Division 3 will detect that this is a faulty signal and ignore it.

A similar failure could occur on the application layer of the TXS software. A faulted sensor or an error within the software logic of the SCWS switchover function in Division 1 could adversely impact Division 2. However, because this function does not communicate with Divisions 3 and 4, any signals received by Divisions 3 and 4 from 1 and 2 will be detected as an error and ignored, and the error is not propagated beyond Division 2.

An error that occurs on the system software layer and is propagated to all four divisions is considered a software common cause failure. This can be described as a triggering event that exposes a latent defect in the system software. This type of failure is beyond the scope of the FMEA in Table 7.1-7. In the event of a software common cause failure of SAS, a plant shutdown is executed. See ANP-10304 for more information about the plant response to a software common cause failure.

ANP-10315, "U.S. EPR Surveillance testing and TELEPERM XS Self-Monitoring," Table 2-5, describes the TXS self-test features.

ANP-10304, Section 4.11.2, describes the TXS system software.

Technical Report Impact:

Technical Report ANP-10309 will be revised as described in the response and indicated on the enclosed markups.

Question 9

9. Page 7.6-5 states that "Two redundant ALUs within a division send the automatic opening signal through a "functional OR" to the isolation valve of the corresponding accumulator...this arrangement precludes a single actuator logic unit (ALU) failure from preventing the opening of a valve. Any other single failure which could prevent opening of a valve, such as failure of a PACS module or of the valve itself, is detected immediately by failure of the valve to open. Corrective actions can then be taken before continued increase in pressure." Please verify that the accumulators activated by other divisions provide sufficient redundancy to maintain the safety function.

Response

Yes, the accumulators activated by other divisions provide sufficient redundancy to maintain the safety function.

Question 10

10. AREVA design for the CCWS has a crosstie between Divisions 1 and 2, and Division 3 and 4, plus the crossties between thermal barrier headers, in addition to our recent discussion points, there are concerns related to other crosstie valves. The CCWS hydraulic valves of concern are: 10/20/30/40AA006, 10/20/30/40AA010, 10/20/30/40AA032, and 10/20/30/40AA033.

The FMEA describes these valves from a mechanical perspective (fails open – fails closed-fails mid position). A similar failure for clarification related to a possible I&C signal failing a 'normally close' crosstie to an 'open position'. If one of the crosstie valves fails open, could this cause the two CCWS to be interconnected? If so, one CCWS would then be supplying additional loads. Can AREVA verify if this is true? Because If so, the opposite CCWS surge tank could quickly overflow and result is two trains of CCWS being INOPERABLE.

Response

AREVA NP identified errors in the SAS logic concerning the control of the following valves: 10/20/30/40AA006, 10/20/30/40AA010, 10/20/30/40AA032, 10/20/30/40AA033, 50AA001, 50AA004, 50AA006, 80AA015, 80AA0016, and 80AA0019. The existing SAS logic shows control signals sent directly to these valves. With this control scheme, it would be possible for a spurious signal to inadvertently open a switchover valve and interconnect two trains of CCWS.

The existing SAS logic does not match the mechanical design for the system. See U.S. EPR FSAR Tier 2, Section 9.2.2.2.2, for a description of the switchover valves. Each of the valves listed above is controlled by a hydraulic circuit. The pilot valves in the circuit are powered and controlled from separate divisions. For example, switchover valve 10AA006 is controlled by four pilot valves (006A, 006B, 006C, and 006D). The pilot valves are located on two redundant flow paths in the hydraulic circuit. To open the switchover valve, pilot valves (006A OR 006B) and (006C OR 006D) must be closed to close the hydraulic flow path. Likewise, to close the switchover valve, pilot valves (006A AND 006B) or (006C and 006D) must be opened to open the hydraulic flow path.

With the new control scheme. a spurious signal sent from one division of SAS will actuate one pilot valve but will not change the position of the switchover valve (shown in the attached markups of U.S. EPR FSAR Tier 2, Figures 7.3-33, 7.3-35, 7.3-36, and 7.6-1).

Valves 10/20/30/40AA006, 10/20/30/40AA010, 10/20/30/40AA032, and 10/20/30/40AA033 are controlled by U.S. EPR FSAR Tier 2, Figure 7.3-33—CCWS Common 1.b Automatic Backup Switchover of Train 1 to Train 2 and Train 2 to 1, Figure 7.3-35—CCWS Emergency Leak Detection, Figure 7.3-36—CCWS Emergency Leak Detection - Switchover Valves Leakage or Fail, and Figure 7.6-1—CCWS Switchover Valves Interlock. Additionally, Figure

7.3-35—CCWS Emergency Leak Detection controls valves 50AA001, 50AA004, 50AA006, 80AA015, 80AA0016, and 80AA0019. The SAS logic has been corrected to show control of the pilot valves, rather than the switchover valve itself.

Question 11

11. In case a CIV fails to open on the final header, another transfer is automatically performed back to the initial configuration.

The staff needs to verify that this logic is in place. Can AREVA determine if a Chapter 7 logic drawing shows this?

Response

The function in question is a non-safety function and would not be included with the logic diagrams in U.S. ERP FSAR Tier 2, Chapter 7. Refer to U.S. EPR FSAR Tier 2, Section 9.2.2.6.1.3 for more information about the non-safety related CCWS functions.

Question 12

AREVA is to provide in response to RAI 505, 7.1-35, an analysis on how reliability of PACS has been accounted when developing the TS surveillance interval for the mechanical component. Specifically, that reliability of the PACS is significantly greater than the reliability of the mechanical component such that the contribution of PACS failure in determining the surveillance interval for the component is negligible.

Response

A Failure Modes and Effect Analysis (FMEA) for the SPLM1-PC11 module provides a theoretical breakdown of failures for the PACS module. At 104°F, 2,350 Failures in Time (FIT) are expected (A FIT is defined as 10-9 failures/hour). This number can be reduced to 1,350 at the expected operating conditions of 90°F. Of these 1,350 failures, 24 percent are not self-announcing and would only be detected by periodic testing. The theoretical failure rate of a PACS module is approximately 3.24e-7/hr. This failure rate is comparable to the failure rate of actuated equipment. However, a field report for TXS equipment shows that in 10.8 million operating hours, there has been 1 failure of a SPLM1-PC11 module. From this report, the field failure rate of the PACS module is 2.23e-8/hr and the upper confidence limit failure rate is 1.29e-7/hr. These failure rates are much smaller than the failure rate of actuated equipment; therefore, the frequency of the ADOT is sufficient.

This information will be placed into the ANP-10315, under the discussion of the ADOT.

Question 13

During the February 2013 I&C audit, the Staff had a question regarding the loss of checkback signals and if they are bounded by current FMEA?

Response

The loss of checkback signals is bounded by sensor failures, as described in the current FMEA. A statement has been added to the FMEA assumptions subsection of U.S. EPR FSAR Tier 2, Section in 7.1.1.4.2.

Question 14

1. FSAR Section 7.1 –

a. Tier 2* designation is inadequate for Sections 7.1.1.3.2(PICS) and 7.1.1.6.4(SU) as per previous discussions agreed upon between Staff and applicant.

i. AREVA has designated the above sections to have Tier 2* designation to expire at fuel load. The Tier 2* designations to both these sections are critical to the staff's evaluation. Secondly, due the nature of the subject matter covered in these two sections the Staff requests this information be designated Tier 2* and remain Tier 2* permanently as per guidance from RG 1.206.

ii. Per previous discussions with the applicant, in Section 7.1.1.6.2 the following lines should have been designated Tier 2* but were not :

1. "The SU shall not be continuously connected or used. It is only used as part of approved procedures that implement the functions listed above. When the SU is not in use as described, it is disconnected from the safety-related components by the hardwired SU isolation switch."

2. "Connections of the SU for the PS, SAS, and RPMS are controlled and limited by the operability requirements of the components being connected to the SU. The SUs for the various systems will only connect to one division in Modes 1 through 4 (e.g. PS, RPMS, and SAS SUs are connected only to Division 1). This design requirement will be enforced by the use of an administrative procedure during plant operations."

b. Section 7.1.1.4.2, "Safety Automation System" – The SAS description in this section does not mention the SAS ESF Control functions nor does it mention the SAS EAS function. This is important as this section is the only detailed description of SAS in the DC.

Response

i. Additional information in Sections 7.1.1.3.2 and 7.1.1.6.4 has been designated as Tier 2*. In addition, the Tier 2* designation for these sections has been made permanent, per the Staff's request.

ii. These sections have been designated as Tier 2* per the staff's request.

b. The SAS ESF Control functions and EAS Control functions are described in Table 7.1-5, as referenced in Section 7.1.1.4.2.

Question 15

1. FSAR Section 7.3 –

a. Section 7.3.1. "System Description", the applicant does not in this section that controls on the SICS and PICS can also available to perform all the functions in Section 7.3.1.3 and 7.3.1.4 manually. Only ESF functions are specifically mentioned in reference to manual controls.

b. Section 7.3.1.1 – The description of the SAS EAS on page 7.3-2 needs to be enhanced per previous discussion with the applicant to state that the EAS functions are in continuous operation, distinct from the other SAS functions.

c. Section 7.3.1.2.12 "Emergency Diesel Generator (EDG) Actuation" – This section states, in part, that, "In general, smaller loads that were energized before the loss of power automatically re-start when power from the EDG becomes available. This functionality is provided by the priority modules associated with each actuator."

i. The applicant stated that it would clarify what it means when it states 'In general…'. Are there cases where this is not true?

ii. Verify that the priority modules referenced are the PACS modules used for all other ESF actuations.

Response

1.

a. A statement about the capability for component-level control of EAS system actuators on both PICS and SICS in the MCR will be added to this section of the U.S. EPR FSAR.

b. A statement will be added to U.S. EPR FSAR Tier 2, Section 7.3.1.1, about the continuous operation of EAS functions in SAS.

c.

i. The exception to the statement "In general…." is described later in the same paragraph. This is referring to the large electrical loads that are sequenced onto the EPSS according to the diesel load steps. This paragraph will be rewritten to clarify the design.

ii. A statement will be added to this paragraph that confirms that the priority modules are the PACS modules used for the ESF actuations.

Question 16

During the January 2013 Tech Specs audit, the Staff had a question regarding the operation and testing of the set/reset memory logic block that is used in various logic diagrams in Chapter 7.

Response

The functionality of the set/reset memory logic is described in the response to RAI 555 Question 07.01-54. The set/reset memory logic blocks that are used in PS and SAS are tested as a part of the continuous self-tests. The set/reset memory logic blocks that are used in DAS are tested as part of the Actuation Logic Test for each function. The set/reset memory logic blocks that are used in PACS for manual SICS commands are tested as part of the ADOT for manual controls. ANP-10315P will be revised as shown in the markups to show the testing of the set/reset memory logic blocks.

Question 17

During the January 2013 Tech Specs Audit, the Staff had a question regarding the operation and testing of a manual command on the APU level of the PS.

Response

The Anti-Dilution function uses a manual command to initiate the boron concentration calculation. It takes the calculation a few seconds to produce a result. The manual command is a temporary signal that switches the input to the ALU to the measured boron concentration in the CVCS charging line until the calculation is able to produce a result. This command is received on the APU level of logic in the PS. Testing of this manual command is performed in the ADOT by connecting an SU to the APU to observe the result. This is the only occurrence of a manual command that is input into the APU layer of logic.

Conforming changes to the U.S. EPR Generic Technical Specifications will be included in the Response to RAI 300.

Question 18

During the January 2013 Tech Specs audit, the Staff had a question regarding the prioritization of ESFAS actuations and DAS actuations.

Response

This question was discussed during the February 2013 I&C audit and details were provided in the Response to RAI 555, Question 07.01-54.

FSAR Impact:

U.S. EPR FSAR Tier 1, Sections 2.4.4, 2.4.24, 2.4.25, 2.6.1, 2.6.3, 2.6.6, 2.6.7, 2.6.8, 2.6.9, 2.6.13, and 2.7, were revised in Revision 4 as described in the Response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Sections 6.2.3, 6.2.4, 7.1, 7.3, 7.6, 8.3, 9.1.3, 9.2.2, 9.4.1, 9.4.2, 9.4.3, 9.4.5, 9.4.6, 9.4.9, 9.4.11, and 14.2, were revised as described in the response and indicated on the enclosed markup. U.S. EPR FSAR Tier 2, Tables 3.2.2-1, 3.10-1, 3.11-1, 3.11-2, and 7.1-5, were revised in Revision 4 as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 1, Sections 2.4.4, 2.4.25, 2.6.9, and 2.6.13, will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Sections 7.1, 7.3, and 7.6, will be revised as described in the Response and indicated on the enclosed markup. U.S. EPR FSAR Tier 2, Tables 7.1-5 and 7.1-7, will be revised as described in the response and indicated on the enclosed markup.

Technical Report Impact:

Technical Reports ANP-10309, ANP-10310, and ANP-10315 will be revised as described in the response and indicated on the enclosed markups.

Follow up Questions/Responses Regarding Applicant's Oct. 2012 Response to RAI 505, Q 7.1-44:

Question 1

NRC asked AREVA to clarify the match points in Figure 7.1-13 in the final response. AREVA did uniquely identify the match points (changed from all being S1 to unique numbering S1, S2, S3, S4), however, NRC would like this to be explained in a note added to the figure.

Response

A note has been added to U.S. EPR FSAR Tier 2, Figures 7.1-6 and 7.1-13, to explain the use of the match point.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 7.1, will be revised as described in the response and indicated on the enclosed markup.

Question 2

Add calibration method for devices not included in Section 2.2.1 of Tech Report ANP-10315.

Response

When sensors are accessible and suitable test equipment exists, a substitute input to the sensor of the same nature as the monitored variable is used. This includes variables such as pressure, level, speed, differential pressure, voltage, and flow.

Calibration of radiation monitors is performed based on a reference source of known radioactivity. The measurement value is viewed from the SICS and PICS to verify accuracy of the measurement channel.

For actuator position, the operator would place the actuator in the desired test position. The measurement value is viewed from the SICS and PICS to verify accuracy of the measurement channel.

Technical Report Impact:

Technical Report ANP-10315, Section 2.2.1, will be revised as described in the response and indicated on the enclosed markups.

Question 3

What is meant by the column 'Failures that are non-functional (failure does not prevent proper performance)' in Table 2.5 of Tech Report 10315.

Response

Non-functional failures do not prevent the equipment from providing the proper execution of the function (e.g., a failure of the LED on the front plate of a module or a failure of the reset push button on the module).

Technical Report Impact:

Technical Report ANP-10315 will be revised as described in the response and indicated on the enclosed markups.

U.S. EPR Final Safety Analysis Report Markups

Table I-1—Summary of Tier 2* Information (Sheet 4 of 5)

Location	Description of Tier 2* Information	Expiration at First Full Power
3.8.5.1.1	ASME 2004 III Div 2	Yes
3.8.5.2	ASME 2004 III Div 2	Yes
3.8.5.3	ASME 2004 III Div 2 with Clarifications	Yes
3.8.5.4.1	ASME 2004 III Div 2	Yes
3.9.3.3	Pump and Valve Operability in accordance with ASME QME-1-2007	Yes
3.9.3.5	Piping Design Acceptance Criteria	Yes
3.9.6.3.1.4	Acceptance Criteria for PST and IST MOVs	Yes
3.10.2	Qualifying Equipment per ASME QME-1-2007, Appendix QR-A Requirements	Yes
3.10.1.1	Equipment Seismic Qualification Methods and Standards	Yes
3.11.2.2	Environmental Qualification of Mechanical Equipment per ASME QME-1-2007, Appendix QR-B Requirements	Yes
Appendix 3B	Key Dimensions for NI Common Basemat Structure and Other Seismic Category I Structures	Yes
4.1.1	Nuclear Design Criteria of Fuel and Reactivity Control System, Except Burn-up Limit	Yes
4.3.1.1 4.3.5	Fuel Burn-up	No
4.3.1.2	Negative Reactivity Feedbacks (Reactivity Coefficient)	Yes
4.3.1.6	Control of Power Distribution	Yes
Table 4.3-1	Core Design Criteria	Yes
6.3.2.2.2	Latent Debris Inside Containment	No
7.1.1.3.2	Design Criteria for Process Information and Control System	~~Yes~~No
7.1.1.6.4	Service Unit Connection Design criteria	~~Yes~~No
7.1.4	Instrumentation and Control Technical and Topical Reports Design Criteria	Yes
7.2.3	Instrumentation and Control Technical and Topical Reports Design Criteria	Yes
7.3.3	Instrumentation and Control Technical and Topical Reports Design Criteria	Yes
7.6.3	Instrumentation and Control Technical and Topical Reports Design Criteria	Yes
7.8.3	Instrumentation and Control Technical and Topical Reports Design Criteria	Yes

Table 2.4.1-6—Protection System Interlocks

RHR Suction Valves Interlock
MHSI Large Miniflow Line Valves Interlocks
Safety Injection Accumulator Valves Interlock

- By introducing and varying, a substitute input of the same nature as the measured variable.
- By cross-checking between channels that bear a known relationship to each other.
- By specifying equipment that is stable and the period of time it retains its calibration during post-accident conditions.

4.16 Deleted.

4.17 Hardwired disconnects exist between the service unit (SU) and each divisional monitoring and service interface (MSI) of the SAS. The hardwired disconnects prevent the connection of the SU to more than a single division of the SAS.

4.18 The SAS generates automatic ESF and Essential Auxiliary Support (EAS) functions for the input variables listed in Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables. The ESF and EAS functions remain following removal of the input signal. The ESF and EAS functions are removed when input signals that represent the completion of the ESF and EAS functions are present. Deliberate operator action is required to return the safety systems to normal.

4.19 During data communication, the SAS function processors receive only the pre-defined messages for that specific function processor. Other messages are ignored.

4.20 SAS self-test features are capable of detecting and responding to faults.

4.21 SAS connections to the SICS are hardwired for manual grouped controls.

4.22 SAS manual grouped controls and indications are available on the SICS in the MCR.

4.23 Deleted. ~~Permissives P14 and P15 provide operating bypass capability for the following SAS functions:~~

- ~~Safety Injection and Heat Removal System—Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat.~~
- ~~Safety Injection and Heat Removal System—Automatic Trip of LHSI Pump (in RHR Mode) on Low-Low RCS Loop Level.~~

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.4.4-1 are powered from the Class 1E division as listed in Table 2.4.4-1 in a normal or alternate feed condition.

6.0 Environmental Qualification

6.1 Equipment listed as Class 1E in Table 2.4.4-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.

All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 1 of 11

System	Function Name	Input Variable
Annulus Ventilation System (AVS)	Accident Filtration Train Heater Control	Isolation Damper Position
		Heater Fan Signal~~Running~~
		Post Heater Temperature
	Accident Train Switchover	Pressure
		Differential Pressure
		Post Heater Temperature
		Filter Bank Isolation Inlet Damper Position
		Filter Bank Isolation Outlet Damper Position
		Exhaust Fan Signal

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables Sheet 2 of 11

System	Function Name	Input Variable
Component Cooling Water System (CCWS)	CCWS Common 1.b Automatic Backup Switchover of Train 1 to Train 2 and Train 2 to Train 1	Train 1 ESWS Pump Discharge PressureLoss of ESWS Signal
		Train 1 Pump Discharge Pressure
		Train 1 Flow Rate
		Train 2 ESWS Pump Discharge PressureLoss of ESWS Signal
		Train 2 Pump Discharge Pressure
		Train 2 Flow Rate
	CCWS Common 2.b Automatic Backup Switchover of Train 3 to Train 4 and Train 4 to Train 3	Train 3 ESWS Pump Discharge PressureLoss of ESWS Signal
		Train 3 Pump Discharge Pressure
		Train 3 Flow Rate
		Train 4 ESWS Pump Discharge PressureLoss of ESWS Signal
		Train 4 Pump Discharge Pressure
		Train 4 Flow Rate
	CCWS Emergency Temperature Control	Heat Exchanger Temp
		Heat Exchanger Bypass Valve Position
	CCWS Emergency Leak Detection	Surge Tank Level
		OCCWS Chiller Inlet Flow
		OCCWS Chiller Outlet Flow
		Common Supply Outlet Flow
		Common Supply Inlet Flow

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables Sheet 3 of 11

System	Function Name	Input Variable
	CCWS Emergency Leak Detection – Switchover Valves Leakage or Failure	Surge Tank 1 Level
		~~Surge Tank 2 Level~~
		~~Surge Tank 3 Level~~
		~~Surge Tank 4 Level~~
	CCWS Switchover Valves Interlock	~~Train 1~~ Common 1a Supply Valve Position
		~~Train 1~~ Common 1a Return Valve Position
		~~Train 1~~ Common 1b Supply Valve Position
		~~Train 1~~ Common 1b Return Valve Position
		~~Train 2 Common 1a Supply Valve Position~~
		~~Train 2 Common 1a Return Valve Position~~
		~~Train 2 Common 1b Supply Valve Position~~
		~~Train 2 Common 1b Return Valve Position~~
		~~Train 3 Common 1a Supply Valve Position~~
		~~Train 3 Common 1a Return Valve Position~~
		~~Train 3 Common 1b Supply Valve Position~~
		~~Train 3 Common 1b Return Valve Position~~
		~~Train 4 Common 1a Supply Valve Position~~
		~~Train 4 Common 1a Return Valve Position~~
		~~Train 4 Common 1b Supply Valve Position~~
		~~Train 4 Common 1b Return Valve Position~~

All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables Sheet 4 of 11

System	Function Name	Input Variable
	CCWS RCP Thermal Barrier Containment Isolation Valve Interlock	Common 1b Return Outer CIV Position
		Common 1b Supply Outer CIV Position
		Common 2b Return Outer CIV Position
		Common 2b Supply Outer CIV Position
		Common 1b Return Inner CIV Position
		Common 1b Supply Inner CIV Position
		Common 2b Return Inner CIV Position
		Common 2b Supply Inner CIV Position
	CCWS RCP Thermal Barrier Containment Isolation Valve Opening Interlock	Common 1b Return Outer CIV Position
		Common 1b Supply Outer CIV Position
		Common 2b Return Outer CIV Position
		Common 2b Supply Outer CIV Position
		Common 1b Return Inner CIV Position
		Common 1b Supply Inner CIV Position
		Common 2b Return Inner CIV Position
		Common 2b Supply Inner CIV Position
	SCWS Condenser Supply Water Flow Control	Condenser Refrigerant Pressure
Emergency Feedwater System (EFWS)	SG Level Control	SG Level
	Pump Flow Protection	Pump Discharge Flow ~~Signal~~

All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 5 of 11

System	Function Name	Input Variable
Essential Service Water Pump Building Ventilation System (ESWPBVS)	ESWPBVS ESWS Pump Rooms Temperature Control	Outside Air Temperature
Essential Service Water System (ESWS)	ESW Flood Prevention in the Safeguard Building	Non-Controlled Area of Safeguard Building Sump Level
Fuel Building Ventilation System (FBVS)	Safety-Related Room Heater Control	Room Temperature
	FBVS EBS / FPCS Pump Rooms Heat Removal	Pump Room ~~Recirculation~~ Temperature
	Isolation of FBVS on Containment Isolation	Containment Isolation Signal
	Isolation of the Fuel Pool Room	Fuel Pool Room Activity
		Fuel Pool Temperature
	Isolation of the Emergency Airlock and Equipment Hatch Fuel Building Areas	Reactor Building Activity
Fuel Pool Cooling and Purification System (FPCPS)	FPCPS Pump Trip on Low Spent Fuel Pool (SFP) Level	SFP Level (WR)
In-Containment Refueling Water Storage Tank System (IRWST)	IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock	IRWST Level
Main Control Room Air Conditioning System (CRACS)	Iodine Filtration Train Heater Control	Carbon Filter Isolation Damper Position
		Protective Switch Temperature
		ESF Filtration Booster Fan Status
	Heater Control for Outside Inlet Air	Downstream Temperature
		Inlet Damper Position
		Outlet Damper Position
	Pressure Control	MCR Differential Pressure
	Cooler Temperature Control	Supply Air Temperature

Deleted row.

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 6 of 11

System	Function Name	Input Variable
Main Steam System (MSS)	Steam Generator MSRCV Regulation during Pressure Control	MSRIV Position
		MSRIV Actuation Signal (from PS)
		MSRT Setpoint (from PS)
		SG Pressure
	Steam Generator MSRCV Regulation during Standby Position Control	MSRCV Position
		Nuclear Power Calculation (from PS)
Safeguard Building Controlled-Area Ventilation System (SBVS)	SIS/RHRS Pump Rooms Heat Removal	LHSI Pump Room Temperature
		MHSI Pump Room Temperature
		SIS Actuation (from PS)
		LHSI~~SIS~~/RHR Pump Running Signal
		LHSI~~SIS~~/RHR Pump Stopped Signal
		MHSI Pump Running Signal
		MHSI Pump Stopped Signal
	CCWS/EFWS Valve Rooms Heat Removal	Room Temperature
	Isolation of Mechanical Areas of Safeguard Building on Containment Isolation	Containment Isolation Signal
	Iodine Filtration Train Electric Heater Control	Post Heater Temperature
		Isolation Dampers Position
		Heater Fan Signal

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 7 of 11

System	Function Name	Input Variable
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply and Recirculation Exhaust Air Flow Control	Supply Air Temperature Downstream of Heaters
		Protective Switch Temperature
		Outside Air Temperature
		Outside Air Damper Open Position Signal
		Outside Air Damper Closed Position Signal
		Exhaust Damper Open Position Signal
		Exhaust Damper Closed Position Signal
		Recirculation Damper Open Position Signal
		Recirculation Damper Closed Position Signal
	Supply Fan Safe Shut-off	Recirc / Exhaust Fan Stopped Signal
		Outside Air Damper Closed Position Signal
		Recirculation Damper Closed Position Signal
	Recirculation Fan Safe Shut-off	CCW Pump Room Temperature
		EFW Pump Room Temperature
	Exhaust Fan Safe Shut-off	Exhaust Damper Closed Position

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 8 of 11

System	Function Name	Input Variable
	Supply Air Temperature Heater Control	Supply Air Downstream of Heaters Temperature
		Filter Bank Differential Pressure
	Freeze Protection	Outside Air Temperature
	Supply Air Temperature Control for Supply Air Cooling	Supply Air Downstream of Humidifier Temperature
	Battery Room Heater Control	Battery Room Temperature
		Supply Air Downstream of Heaters Flow
	Battery Room Supply Air Temperature Control	Battery Room Supply Air Temperature
	Emergency Feed Water System (EFWS) Pump Room Heat Removal	EFWS Pump Room Temperature
	Component Cooling Water System (CCWS) Pump Room Heat Removal	CCWS Pump Room Temperature
Safety Chilled Water System (SCWS)	SCWS Train 1 to Train 2 Switchover on Train 1 Low Evaporator Flow / Chiller Black Box Internal Fault / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start Failure Interlock	Train 1 Chiller Evaporator Outlet Temperature
		Train 1 Chiller Compressor Oil Pressure
		Train 1 Condenser Refrigerant Pressure
		Train 1 Chiller Evaporator Flow Signal
		Train 1 Cross-Tie Valves Position Signal
		Train 2 Cross-Tie Valves Position Signal
		Train 2 Circulating Pump 1 Running Signal
		Train 2 Circulating Pump 2 Running Signal
		Train 2 Evaporator ΔP Signal
		Train 2 Chiller Evaporator Flow Signal

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 9 of 11

System	Function Name	Input Variable
	SCWS Train 2 to Train 1 Switchover on Train 2 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start Failure Interlock	Train 1 Circulating Pump 1 Running Signal
		Train 1 Circulating Pump 2 Running Signal
		Train 1 Evaporator ΔP Signal
		Train 1 Chiller Evaporator Flow Signal
		Train 1 Cross-Tie Valves Position Signal
		Train 2 Cross-Tie Valves Position Signal
		Train 2 Chiller Evaporator Flow Signal
		Train 2 Condenser Refrigerant Pressure
		Train 2 Chiller Compressor Oil Pressure
		Train 2 Chiller Evaporator Outlet Temperature
		Train 2 Condenser Flow Rate Signal
	SCWS Train 3 to Train 4 Switchover on Train 3 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start Failure Interlock	Train 3 Condenser Flow Rate Signal
		Train 3 Chiller Evaporator Outlet Temperature
		Train 3 Chiller Compressor Oil Pressure
		Train 3 Condenser Refrigerant Pressure
		Train 3 Chiller Evaporator Flow Signal
		Train 3 Cross-Tie Valves Position Signal
		Train 4 Cross-Tie Valves Position Signal
		Train 4 Circulating Pump 1 Running Signal

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 10 of 11

System	Function Name	Input Variable
		Train 4 Circulating Pump 2 Running Signal
		Train 4 Evaporator ΔP Signal
		Train 4 Chiller Evaporator Flow Signal
	SCWS Train 4 to Train 3 Switchover on Train 4 Low Evaporator Flow / Chiller Black Box Internal Fault / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start Failure Interlock	Train 3 Circulating Pump 1 Running Signal
		Train 3 Circulating Pump 2 Running Signal
		Train 3 Evaporator ΔP Signal
		Train 3 Chiller Evaporator Flow Signal
		Train 3 Cross-Tie Valves Position Signal
		Train 4 Cross-Tie Valves Position Signal
		Train 4 Chiller Evaporator Flow Signal
		Train 4 Condenser Refrigerant Pressure
		Train 4 Chiller Compressor Oil Pressure
		Train 4 Chiller Evaporator Outlet Temperature
Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic RHRS Flow Rate Control	RHRS Flow Rate Signal
		RHRS Temperature
		RHRS~~LHSI~~ Pump Discharge Pressure
	~~Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat Interlock~~	~~Hot Leg Temperature (WR)~~
		~~Hot Leg Pressure (WR)~~
	~~Automatic Trip of LHSI Pump (in RHR Mode) on Low Low RCS Loop Level Interlock~~	~~Hot Leg Loop Level~~

Table 2.4.4-2—Safety Automation System Automatic Functions and Input Variables
Sheet 11 of 11

System	Function Name	Input Variable
	RHR Isolation Valves Interlock	LHSI Suction Isolation Valve Position
		RHR 1st RCPB Isolation Valve Position
		RHR 2nd RCPB Isolation Valve Position

Table 2.4.4-3—Safety Automation System Interlocks

CCWS Switchover Valves Interlock
CCWS RCP Thermal Barrier Containment Isolation Valve Interlock
CCWS RCP Thermal Barrier Containment Isolation Valves Opening Interlock
IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock
SCWS Train 1 to Train 2 Switchover on Train 1 Low Evaporator Flow / Chiller Black Box Internal Fault / SCWS Chiller Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
SCWS Train 2 to Train 1 Switchover on Train 2 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
SCWS Train 3 to Train 4 Switchover on Train 3 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
SCWS Train 4 to Train 3 Switchover on Train 4 Low Evaporator Flow / Chiller Black Box Internal Fault / SCWS Chiller Evaporator Water Flow Control / LOOP Re-Start Failure Interlock
~~Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat~~
~~Automatic Trip of LHSI Pump (in RHR Mode) on Low-Low RCS Loop Level~~
RHR Isolation Valves Interlock

Table 2.4.4-4—Safety Automation System ITAAC
Sheet 12 of 13

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.23	Deleted. ~~Permissives P14 and P15 provide operating bypass capability for the following SAS interlocks:~~ • ~~Safety Injection and Heat Removal System – Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat.~~ • ~~Safety Injection and Heat Removal System – Automatic Trip of LHSI Pump (in RHR Mode) on Low-Low RCS Loop Level.~~	Deleted.~~A test will be performed using test input signals to verify that the following interlocks are bypassed when test input signals representing the corresponding inhibited or validated Permissives P14 and P15 signals are present:~~ • ~~Safety Injection and Heat Removal System – Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat.~~ • ~~Safety Injection and Heat Removal System – Automatic Trip of LHSI Pump (in RHR Mode) on Low-Low RCS Loop Level.~~	Deleted.~~Permissives P14 and P15 provide operating bypass capability for the following SAS interlocks:~~ • ~~Safety Injection and Heat Removal System – Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat.~~ • ~~Safety Injection and Heat Removal System – Automatic Trip of LHSI Pump (in RHR Mode) on Low-Low RCS Loop Level.~~
5.1	Equipment designated as Class 1E in Table 2.4.4-1 are powered from the Class 1E division as listed in Table 2.4.4-1 in a normal or alternate feed condition.	a. Testing will be performed by providing a test input signal in each normally aligned division. b. Testing will be performed by providing a test input signal in each division with the alternate feed aligned to the divisional pair.	a. The test input signal provided in the normally aligned division is present at the respective Class 1E equipment identified in Table 2.4.4-1. b. The test input signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E equipment identified in Table 2.4.4-1.

2.4.24 Diverse Actuation System

Design Description

1.0 System Description

The diverse actuation system (DAS) is a non-safety-related I&C system.

The DAS is provided to mitigate anticipated operational occurrences (AOOs) or postulated accidents (PAs) concurrent with a software common-cause failure of the protection system (PS).

2.0 Arrangement

2.1 The location of the DAS equipment is as listed in Table 2.4.24-1—Diverse Actuation System Equipment.

2.2 Physical separation exists between the divisions of the DAS as listed in Table 2.4.24-1.

3.0 I&C Design Features, Displays, and Controls

3.1 The DAS design is accomplished through a phased approach which includes the following (or equivalent) phases:

1. System Requirements Phase.
2. System Design Phase.
3. Software/Hardware Requirements Phase.
4. Software/Hardware Design Phase.
5. Software/Hardware Implementation Phase.
6. Software/Hardware Validation Phase.
7. System Integration Phase.
8. System Validation Phase.

3.2 The technology used by the DAS is a technology that is not microprocessor based.

3.3 The DAS generates signals for automatic actuation of the functions listed in Table 2.4.24-2—Functions Automatically Actuated by the DAS.

3.4 The DAS allows manual, system-level actuation of the functions listed in Table 2.4.24-3—Functions Manually Actuated through the DAS.

3.5 The DAS response time from sensor output through equipment actuation for the functions listed in Table 2.4.24-2 is less than the value required to satisfy the diverse actuation function response time assumptions. ~~Deleted.~~

Table 2.4.24-4—Diverse Actuation System ITAAC
Sheet 3 of 3

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
3.5	The DAS response time from sensor output through equipment actuation for the functions listed in Table 2.4.24-2 is less than the value required to satisfy the diverse actuation function response time assumptions.~~Deleted.~~	Tests will be performed to verify DAS response times are less than the value required to satisfy the diverse actuation function response time assumptions~~Deleted.~~	A report concludes that DAS response times are less than the value required to support the diverse actuation function response time assumptions for the DAS functions listed in Table 2.4.24-2.~~Deleted.~~

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals
Sheet 1 of 7

Item #	Signal	Source	# Divisions
1	6.9 kV Bus Voltage	Emergency Power Supply System	4
2	Annulus Ventilation System Gamma Activity	Annulus Ventilation System	4
3	Chemical and Volume Control System (CVCS) Boron Concentration	Boron Concentration and Measurement System	4
4	Cold Leg Temperature (NR)	Reactor Coolant System	4
5	Cold Leg Temperature (WR)	Reactor Coolant System	4
6	Containment Equipment Compartment Pressure	Containment Ventilation System	4
7	Containment Equipment Compartment Containment Service Compartment Delta Pressure	Containment Ventilation System	4
8	Containment High Range Activity	Radiation Monitoring System	4
9	Containment Service Compartment Pressure (NR)	Containment Ventilation System	4
10	Containment Service Compartment Pressure (WR)	Containment Ventilation System	4
11	Core Outlet Thermocouples Wide Range Temperature	Incore Instrumentation System	4
12	CVCS Charging Flow	Chemical Volume and Control System	4
13	RCP Differential Pressure	Reactor Coolant System	4
14	Emergency Feedwater Pump Discharge Flow	Emergency Feedwater System	4
15	Hot Leg Pressure (NR)	Safety Injection & Residual Heat Removal System	4
16	Hot Leg Pressure (WR)	Safety Injection & Residual Heat Removal System	4
17	Hot Leg Temperature (NR)	Reactor Coolant System	4
18	Hot Leg Temperature (WR)	Reactor Coolant System	4
19	Low Head Safety Injection Flow (WR)	Safety Injection and Residual Heat Removal System	4
20	Main Control Room (MCR) Air Intake Activity	Sampling Activity Monitoring Systems	4
21	Main Steam Line Activity	Main Steam System	4

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals
Sheet 2 of 7

Item #	Signal	Source	# Divisions
22	Medium Head Safety Injection Flow (WR)	Safety Injection and Residual Heat Removal System	4
23	Neutron Flux from Intermediate Range Detector (IRD)	Excore Instrumentation System	4
24	Neutron Flux from Power Range Detector (PRD)	Excore Instrumentation System	4
25	Neutron Flux from Self Powered Neutron Detectors (SPND)	Incore Instrumentation System	4
26	Neutron Flux from Source Range (SRD)	Excore Instrumentation System	4
27	Pressurizer Level (NR)	Reactor Coolant System	4
28	Pressurizer Pressure (NR)	Reactor Coolant System	4
29	RCP Bus Breaker Position	Normal Power Supply System	4
30	RCP Breaker Position	Normal Power Supply System	4
31	RCS Loop Flow	Reactor Coolant System	4
32	RCS Loop Level	Reactor Coolant System	4
33	RCP Speed	Reactor Coolant System	4
34	SG Level (NR)	Reactor Coolant System	4
35	SG Level (WR)	Reactor Coolant System	4
36	SG Pressure	Main Steam System	4
37	Temperature compensated rod cluster control assembly (RCCA) positions	Rod Position Measurement System	4
38	Reactor Trip Contactor Position	Control Rod Drive Control System	4
39	Containment Hydrogen Concentration	Hydrogen Monitoring System	2
40	Core Outlet Temperature	Incore Instrumentation System	4
41	AVS Temperature	Annulus Ventilation System	2
42	AVS Isolation Damper Position	Annulus Ventilation System	2
43	AVS Heater Fan Signal	Annulus Ventilation System	2
44	AVS Pressure	Annulus Ventilation System	2
45	AVS Differential Pressure	Annulus Ventilation System	2
46	AVS Post Heater Temperature	Annulus Ventilation System	2
47	AVS Filter Bank Isolation Inlet Damper Position	Annulus Ventilation System	2
48	AVS Filter Bank Isolation Outlet Damper Position	Annulus Ventilation System	2

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals
Sheet 3 of 7

Item #	Signal	Source	# Divisions
49	AVS Exhaust Fan Signal	Annulus Ventilation System	2
50	ESWS Pump Discharge PressureCCWS Loss of ESWS Signal	Essential ServiceComponent Cooling Water System	4
51	CCWS Pump Discharge Pressure	Component Cooling Water System	4
52	CCWS Flow Rate	Component Cooling Water System	4
53	CCWS Heat Exchanger Temp	Component Cooling Water System	4
54	CCWS Heat Exchanger Bypass Valve Position	Component Cooling Water System	4
55	CCWS Surge Tank Level	Component Cooling Water System	4
56	OCCWS Chiller Inlet Flow	Component Cooling Water System	4
57	OCCWS Chiller Outlet Flow	Component Cooling Water System	4
58	CCWS Common Supply Outlet Flow	Component Cooling Water System	4
59	CCWS Common Supply Inlet Flow	Component Cooling Water System	4
60	CCWS Common 1a Supply Valve Position	Component Cooling Water System	2
61	CCWS Common 1a Return Valve Position	Component Cooling Water System	2
62	CCWS Common 1b Supply Valve Position	Component Cooling Water System	2
63	CCWS Common 1b Return Valve Position	Component Cooling Water System	2
64	CCWS Common 1b Return Outer CIV Position	Component Cooling Water System	2
65	CCWS Common 1b Supply Outer CIV Position	Component Cooling Water System	2
66	CCWS Common 2b Return Outer CIV Position	Component Cooling Water System	2
67	CCWS Common 2b Supply Outer CIV Position	Component Cooling Water System	2

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals
Sheet 4 of 7

Item #	Signal	Source	# Divisions
68	CCWS Common 1b Return Inner CIV Position	Component Cooling Water System	2
69	CCWS Common 1b Supply Inner CIV Position	Component Cooling Water System	2
70	CCWS Common 2b Return Inner CIV Position	Component Cooling Water System	2
71	CCWS Common 2b Supply Inner CIV Position	Component Cooling Water System	2
72	SCWS Condenser Refrigerant Pressure	Component Cooling Water System	2
73	~~EFW Pump Flow Signal~~	~~Emergency Feedwater System~~	~~4~~
74	ESW Outside Air Temperature	Essential Service Water Pump Building Ventilation System	4
75	FBVS Room Temperature	Fuel Building Ventilation Room Temperature System	2
76	EBS / FPCS Recirculation Temperature	Fuel Building Ventilation Room Temperature System	2
77	Spent Fuel Pool Level (WR)	Fuel Pool Cooling and Purification System	2
78	IRWST Level	In-Containment Refueling Water Storage Tank System	4
79	CRACS Carbon Filter Isolation Damper Position	Main Control Room Air Conditioning System	2
80	CRACS Protective Switch Temperature	Main Control Room Air Conditioning System	2
81	CRACS ESF Filtration Fan Status	Main Control Room Air Conditioning System	2
82	CRACS Downstream Temperature	Main Control Room Air Conditioning System	2
83	CRACS Inlet Damper Position	Main Control Room Air Conditioning System	2
84	CRACS Outlet Damper Position	Main Control Room Air Conditioning System	2
85	MCR Differential Pressure	Main Control Room Air Conditioning System	2
86	CRACS Supply Air Temperature	Main Control Room Air Conditioning System	4
87	MSRIV Position	Main Steam System	4

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals
Sheet 5 of 7

Item #	Signal	Source	# Divisions
88	MSRCV Position	Main Steam System	4
89	LHSI Pump Room Temperature	Safeguard Building Pump Room Temperature Controlled-Area Ventilation System	4
90	MHSI Pump Room Temperature	Safeguard Building Pump Room Temperature Controlled-Area Ventilation System	4
91	LHSISIS/RHR Pump Running Signal	Safeguard Building Pump Room Temperature Controlled-Area Ventilation System	4
92	LHSISIS/RHR Pump Stopped Signal	Safeguard Building Pump Room Temperature Controlled-Area Ventilation System	4
93	MHSI Pump Running Signal	Safeguard Building Pump Room Temperature Controlled-Area Ventilation System	4
94	MHSI Pump Stopped Signal	Safeguard Building Pump Room Temperature Controlled-Area Ventilation System	4
95	CCWS/EFWS Valve Room Temperature	Safeguard Building Pump Room Temperature Controlled-Area Ventilation System	4
96	SBVSE Supply Air Temperature Downstream of Heaters	Electrical Division of Safeguard Building Ventilation System	4
97	SBVSE Protective Switch Temperature	Electrical Division of Safeguard Building Ventilation System	4
98	SBVSE Outside Air Temperature	Electrical Division of Safeguard Building Ventilation System	4
99	SBVSE Outside Air Damper Open Position Signal	Electrical Division of Safeguard Building Ventilation System	4
100	SBVSE Outside Air Damper Closed Position Signal	Electrical Division of Safeguard Building Ventilation System	4
101	SBVSE Exhaust Damper Open Position Signal	Electrical Division of Safeguard Building Ventilation System	4
102	SBVSE Exhaust Damper Closed Position Signal	Electrical Division of Safeguard Building Ventilation System	4
103	SBVSE Recirculation Damper Open Position Signal	Electrical Division of Safeguard Building Ventilation System	4

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals
Sheet 6 of 7

Item #	Signal	Source	# Divisions
104	SBVSE Recirculation Damper Closed Position Signal	Electrical Division of Safeguard Building Ventilation System	4
105	SBVSE Recirculation / Exhaust Fan Stopped Signal	Electrical Division of Safeguard Building Ventilation System	4
106	SBVSE Outside Air Damper Closed Position Signal	Electrical Division of Safeguard Building Ventilation System	4
107	SBVSE Recirculation Damper Closed Position Signal	Electrical Division of Safeguard Building Ventilation System	4
108	SBVSE Exhaust Fan Exhaust Damper Closed Position	Electrical Division of Safeguard Building Ventilation System	4
109	Filter Bank Differential Pressure	Electrical Division of Safeguard Building Ventilation System	4
110	Supply Air Downstream of Humidifier Temperature	Electrical Division of Safeguard Building Ventilation System	4
111	Battery Room Supply Air Downstream of Heaters Flow	Electrical Division of Safeguard Building Ventilation System	4
112	Battery Room Temperature	Electrical Division of Safeguard Building Ventilation System	4
113	Battery Room Supply Air Temperature	Electrical Division of Safeguard Building Ventilation System	4
114	EFWS Pump Room Temperature	Electrical Division of Safeguard Building Ventilation System	4
115	CCWS Pump Room Temperature	Electrical Division of Safeguard Building Ventilation System	4
116	SCWS Chiller Evaporator Outlet Temperature	Safety Chilled Water System	4
117	SCWS Chiller Compressor Oil Pressure	Safety Chilled Water System	4
118	SCWS Condenser Refrigerant Pressure	Safety Chilled Water System	4
119	SCWS Chiller Evaporator Flow Signal	Safety Chilled Water System	4
120	SCWS Cross-Tie Valves Position Signal	Safety Chilled Water System	4
121	SCWS Circulating Pump 1 Running Signal	Safety Chilled Water System	4
122	SCWS Circulating Pump 2 Running Signal	Safety Chilled Water System	4
123	SCWS Evaporator ΔP Signal	Safety Chilled Water System	4
124	SCWS Chiller Evaporator Flow Signal	Safety Chilled Water System	4
125	RHRS Flow Rate Signal	Safety Injection and Residual Heat Removal System	4

Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals
Sheet 7 of 7

Item #	Signal	Source	# Divisions
126	RHRS Temperature	Safety Injection and Residual Heat Removal System	4
127	RHRS~~LHSI~~ Pump Discharge Pressure	Safety Injection and Residual Heat Removal System	4
128	Hot Leg Loop Level	Safety Injection and Residual Heat Removal System	4
129	Containment Isolation Signal	Fuel Building Ventilation System	4
130	LHSI Suction Isolation Valve Position	Safety Injection and Residual Heat Removal System	4
131	RHR 1st RCPB Isolation Valve Position	Safety Injection and Residual Heat Removal System	4
132	RHR 2nd RCPB Isolation Valve Position	Safety Injection and Residual Heat Removal System	4
133	RHR Outside Containment Isolation Valve Position	Safety Injection and Residual Heat Removal System	4
134	LHSI Hot Leg Injection Isolation Valve Position	Safety Injection and Residual Heat Removal System	4
135	CCWS Common 2a Supply Valve Position	Component Cooling Water System	2
136	CCWS Common 2a Return Valve Position	Component Cooling Water System	2
137	CCWS Common 2b Supply Valve Position	Component Cooling Water System	2
138	CCWS Common 2b Return Valve Position	Component Cooling Water System	2

Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals
Sheet 1 of 7

Item #	Signal	Recipient	# Divisions
1	6.9 kV Bus Voltage	Protection System	4
2	Annulus Ventilation System Gamma Activity	Safety Information and Control System	4
3	Chemical and Volume Control System (CVCS) Boron Concentration	Protection System	4
4	Cold Leg Temperature (NR)	Protection System	4
5	Cold Leg Temperature (WR)	Protection System Safety Information and Control System	4
6	Containment Equipment Compartment Pressure	Protection System	4
7	Containment Equipment Compartment Containment Service Compartment Delta Pressure	Protection System Diverse Actuation System	4
8	Containment High Range Activity	Protection System Diverse Actuation System Safety Information and Control System	4
9	Containment Service Compartment Pressure (NR)	Protection System Diverse Actuation System	4
10	Containment Service Compartment Pressure (WR)	Protection System Safety Information and Control System	4
11	Core Outlet Thermocouples Wide Range Temperature	Safety Information and Control System	4
12	CVCS Charging Flow	Protection System	4
13	RCP Differential Pressure	Protection System	4
14	Emergency Feedwater Pump Discharge Flow	Safety Automation System Safety Information and Control System	4
15	Hot Leg Pressure (NR)	Protection System	4
16	Hot Leg Pressure (WR)	Protection System Safety Information and Control System Diverse Actuation System	4
17	Hot Leg Temperature (NR)	Protection System	4
18	Hot Leg Temperature (WR)	Protection System, Safety Information and Control System	4
19	Low Head Safety Injection Flow (WR)	Safety Information and Control System	4

Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals
Sheet 2 of 7

Item #	Signal	Recipient	# Divisions
20	Main Control Room (MCR) Air Intake Activity	Protection System	4
21	Main Steam Line Activity	Protection System Safety Information and Control System	4
22	Medium Head Safety Injection Flow (WR)	Safety Information and Control System	4
23	Neutron Flux from Intermediate Range Detector (IRD)	Protection System Safety Information and Control System	4
24	Neutron Flux from Power Range Detector (PRD)	Protection System Diverse Actuation System	4
25	Neutron Flux from Self Powered Neutron Detectors (SPND)	Protection System	4
26	Neutron Flux from Source Range (SRD)	Safety Information and Control System	4
27	Pressurizer Level (NR)	Protection System	4
28	Pressurizer Pressure (NR)	Protection System Safety Information and Control System Diverse Actuation System	4
29	RCP Bus Breaker Position	Protection System	4
30	RCP Breaker Position	Protection System	4
31	RCS Loop Flow	Protection System Diverse Actuation System	4
32	RCS Loop Level	Protection System	4
33	RCP Speed	Protection System	4
34	SG Level (NR)	Protection System Diverse Actuation System	4
35	SG Level (WR)	Protection System Diverse Actuation System Safety Information and Control System, Safety Automation System	4
36	SG Pressure	Protection System Safety Information and Control System Safety Automation System Diverse Actuation System	4

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Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals
Sheet 3 of 7

Item #	Signal	Recipient	# Divisions
37	Temperature compensated rod cluster control assembly (RCCA) positions	Protection System	4
38	Reactor Trip Contactor Position	Protection System	4
39	Containment Hydrogen Concentration	Protection System	2
40	Core Outlet Temperature	Protection System	4
41	AVS Temperature	Safety Automation System	2
42	AVS Isolation Damper Position	Safety Automation System	2
43	AVS Heater Fan Signal	Safety Automation System	2
44	AVS Pressure	Safety Automation System	2
45	AVS Differential Pressure	Safety Automation System	2
46	AVS Post Heater Temperature	Safety Automation System	2
47	AVS Filter Bank Isolation Inlet Damper Position	Safety Automation System	2
48	AVS Filter Bank Isolation Outlet Damper Position	Safety Automation System	2
49	AVS Exhaust Fan Signal	Safety Automation System	2
50	ESWS Pump Discharge PressureCCWS Loss of ESWS Signal	Safety Automation System	4
51	CCWS Pump Discharge Pressure	Safety Automation System	4
52	CCWS Flow Rate	Safety Automation System	4
53	CCWS Heat Exchanger Temp	Safety Automation System	4
54	CCWS Heat Exchanger Bypass Valve Position	Safety Automation System	4
55	CCWS Surge Tank Level	Safety Automation System	4
56	OCCWS Chiller Inlet Flow	Safety Automation System	4
57	OCCWS Chiller Outlet Flow	Safety Automation System	4
58	CCWS Common Supply Outlet Flow	Safety Automation System	4
59	CCWS Common Supply Inlet Flow	Safety Automation System	4

**Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals
Sheet 4 of 7**

Item #	Signal	Recipient	# Divisions
60	CCWS Common 1a Supply Valve Position	Safety Automation System	4
61	CCWS Common 1a Return Valve Position	Safety Automation System	4
62	CCWS Common 1b Supply Valve Position	Safety Automation System	4
63	CCWS Common 1b Return Valve Position	Safety Automation System	4
64	CCWS Common 1b Return Outer CIV Position	Safety Automation System	2
65	CCWS Common 1b Supply Outer CIV Position	Safety Automation System	2
66	CCWS Common 2b Return Outer CIV Position	Safety Automation System	2
67	CCWS Common 2b Supply Outer CIV Position	Safety Automation System	2
68	CCWS Common 1b Return Inner CIV Position	Safety Automation System	2
69	CCWS Common 1b Supply Inner CIV Position	Safety Automation System	2
70	CCWS Common 2b Return Inner CIV Position	Safety Automation System	2
71	CCWS Common 2b Supply Inner CIV Position	Safety Automation System	2
72	SCWS Condenser Refrigerant Pressure	Safety Automation System	2
73	~~EFW Pump Flow Signal~~	~~Safety Automation System~~	~~4~~
74	ESW Outside Air Temperature	Safety Automation System	4
75	FBVS Room Temperature	Safety Automation System	2
76	EBS / FPCS Recirculation Temperature	Safety Automation System	2
77	Spent Fuel Pool Level (WR)	Safety Automation System	2
78	IRWST Level	Safety Automation System	4
79	CRACS Carbon Filter Isolation Damper Position	Safety Automation System	2
80	CRACS Protective Switch Temperature	Safety Automation System	2

All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals
Sheet 5 of 7

Item #	Signal	Recipient	# Divisions
81	CRACS ESF Filtration Fan Status	Safety Automation System	2
82	CRACS Downstream Temperature	Safety Automation System	2
83	CRACS Inlet Damper Position	Safety Automation System	2
84	CRACS Outlet Damper Position	Safety Automation System	2
85	MCR Differential Pressure	Safety Automation System	2
86	CRACS Supply Air Temperature	Safety Automation System	4
87	MSRIV Position	Safety Automation System	4
88	MSRCV Position	Safety Automation System	4
89	LHSI Pump Room Temperature	Safety Automation System	4
90	MHSI Pump Room Temperature	Safety Automation System	4
91	LHSI~~SIS~~/RHR Pump Running Signal	Safety Automation System	4
92	LHSI~~SIS~~/RHR Pump Stopped Signal	Safety Automation System	4
93	MHSI Pump Running Signal	Safety Automation System	4
94	MHSI Pump Stopped Signal	Safety Automation System	4
95	CCWS/EFWS Valve Room Temperature	Safety Automation System	4
96	SBVSE Supply Air Temperature Downstream of Heaters	Safety Automation System	4
97	SBVSE Protective Switch Temperature	Safety Automation System	4
98	SBVSE Outside Air Temperature	Safety Automation System	4
99	SBVSE Outside Air Damper Open Position Signal	Safety Automation System	4
100	SBVSE Outside Air Damper Closed Position Signal	Safety Automation System	4
101	SBVSE Exhaust Damper Open Position Signal	Safety Automation System	4

**Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals
Sheet 6 of 7**

Item #	Signal	Recipient	# Divisions
102	SBVSE Exhaust Damper Closed Position Signal	Safety Automation System	4
103	SBVSE Recirculation Damper Open Position Signal	Safety Automation System	4
104	SBVSE Recirculation Damper Closed Position Signal	Safety Automation System	4
105	SBVSE Recirculation / Exhaust Fan Stopped Signal	Safety Automation System	4
106	SBVSE Outside Air Damper Closed Position Signal	Safety Automation System	4
107	SBVSE Recirculation Damper Closed Position Signal	Safety Automation System	4
108	SBVSE Exhaust Fan Exhaust Damper Closed Position	Safety Automation System	4
109	Filter Bank Differential Pressure	Safety Automation System	4
110	Supply Air Downstream of Humidifier Temperature	Safety Automation System	4
111	Battery Room Supply Air Downstream of Heaters Flow	Safety Automation System	4
112	Battery Room Temperature	Safety Automation System	4
113	Battery Room Supply Air Temperature	Safety Automation System	4
114	EFWS Pump Room Temperature	Safety Automation System	4
115	CCWS Pump Room Temperature	Safety Automation System	4
116	SCWS Chiller Evaporator Outlet Temperature	Safety Automation System	4
117	SCWS Chiller Compressor Oil Pressure	Safety Automation System	4
118	SCWS Condenser Refrigerant Pressure	Safety Automation System	4
119	SCWS Chiller Evaporator Flow Signal	Safety Automation System	4
120	SCWS Cross-Tie Valves Position Signal	Safety Automation System	4

Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals
Sheet 7 of 7

Item #	Signal	Recipient	# Divisions
121	SCWS Circulating Pump 1 Running Signal	Safety Automation System	4
122	SCWS Circulating Pump 2 Running Signal	Safety Automation System	4
123	SCWS Evaporator ΔP Signal	Safety Automation System	4
124	SCWS Chiller Evaporator Flow Signal	Safety Automation System	4
125	RHRS Flow Rate Signal	Safety Automation System	4
126	RHRS Temperature	Safety Automation System	4
127	RHRS~~LHSI~~ Pump Discharge Pressure	Safety Automation System	4
128	Hot Leg Loop Level	Safety Automation System	4
129	Containment Isolation Signal	Safety Automation System	4
130	LHSI Suction Isolation Valve Position	Protection System Safety Automation System	4
131	RHR 1st RCPB Isolation Valve Position	Protection System Safety Automation System	4
132	RHR 2nd RCPB Isolation Valve Position	Protection System Safety Automation System	4
133	RHR Outside Containment Isolation Valve Position	Protection System	4
134	LHSI Hot Leg Injection Isolation Valve Position	Protection System	4

Table 2.6.1-2—CRACS Equipment I&C and Electrical Design
Sheet 5 of 5

Description	Tag Number[1]	Location	IEEE Class 1E [2]	PACS	MCR / RSS Displays	MCR / RSS Controls
Temperature Downstream of Electric Heaters	30SAB01CT003/004 30SAB04CT003/004	Safeguard Building 2 Safeguard Building 3	N/A	N/A	Temp / Temp	N/A
Main Control Room Temperature	30SAB32CT002 30SAB32CT003	Safeguard Building 2	N/A	N/A	Temp / Temp	N/A
Temperature Downstream of Iodine Train Heaters	30SAB11CT002 30SAB14CT002	Safeguard Building 2 Safeguard Building 3	N/A	N/A	Temp / Temp	N/A
Temperature Upstream of Iodine Train Heaters	30SAB11CT001 30SAB14CT001	Safeguard Building 2 Safeguard Building 3	N/A	N/A	Temp / Temp	N/A
Temperature Upstream of Electric Heaters	30SAB01CT001 30SAB04CT001	Safeguard Building 2 Safeguard Building 3	N/A	N/A	Temp / Temp	N/A
Temperature Downstream of Carbon Adsorber	30SAB11CT003 30SAB14CT003	Safeguard Building 2 Safeguard Building 3	N/A	N/A	Temp / Temp	N/A
Conditioning Trains Air Flow	30SAB01/02CF001 30SAB03/04CF001	Safeguard Building 2 Safeguard Building 3	N/A	N/A	Flow / Flow	N/A

1. Equipment tag numbers are provided for information only and are not part of the certified design.
2. ^{N} denotes division the equipment is normally powered from, while ^{A} denotes division the equipment is powered from when alternate feed is implemented.

Table 2.6.3-1—AVS Equipment Mechanical Design
Sheet 1 of 2

Description	Tag Number(1)	Location	ASME AG-1 Code	Function	Seismic Category
Normal Operation Train					
Motor Operated Supply Air Dampers	30KLB34AA002 30KLB34AA003	Fuel Building Fuel Building ~~30UFA21095~~ ~~30UFA21095~~	Yes	Close	I
Motor Operated Exhaust Air Dampers	30KLB44AA002 30KLB44AA003	Fuel Building Fuel Building ~~30UFA29054~~ ~~30UFA29054~~	Yes	Close	I
Accident Filtration Train					
Motor Operated Dampers	30KLB21AA003 30KLB24AA003	Fuel Building Fuel Building ~~30UFA17084~~ ~~30UFA17082~~	Yes	Open	I
Electric Heaters Two stage	30KLB21AH001A/B 30KLB24AH001A/B	Fuel Building Fuel Building ~~30UFA17084~~ ~~30UFA17082~~	Yes	On / Off	I
Prefilters	30KLB21AT001 30KLB24AT001	Fuel Building Fuel Building ~~30UFA17084~~ ~~30UFA17082~~	Yes	N/A	I
~~Upstream HEPA~~ Post Filters	30KLB21AT002 30KLB24AT002	Fuel Building Fuel Building ~~30UFA17084~~ ~~30UFA17082~~	Yes	N/A	I

Table 2.6.3-2—AVS Equipment I&C and Electrical Design
Sheet 2 of 3

Description	Tag Number[1]	Location	IEEE Class 1E [2]	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Exhaust Fan	30KLB21AN001	Fuel Building	Division 1[N] Division 2[A]	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Exhaust Fan	30KLB24AN001	Fuel Building	Division 4[N] Division 3[A]	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Electrical Heater Two stage	30KLB21AH001A/B	Fuel Building	Division 1[N] Division 2[A]	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Electrical Heater Two stage	30KLB24AH001A/B	Fuel Building	Division 4[N] Division 3[A]	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Instruments							
Annulus Pressure	30KLB21CP001 30KLB24CP001	Fuel Building	N/A	Yes	N/A	Press / Press	N/A
Temperature Upstream of Heaters	30KLB21CT001 30KLB24CT001	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Temperature Limit Switch for Heaters	30KLB21CT002 30KLB24CT002	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Temperature Regulation for Heaters	30KLB21CT003 30KLB24CT003	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Temperature downstream of carbon adsorbers	30KLB21CT004 30KLB24CT004	Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Pressure Limit Switch Exhaust Fans	30KLB21CP002 30KLB24CP002	Fuel Building	N/A	Yes	N/A	Press / Press	N/A

Table 2.6.6-1—SBVS Equipment Mechanical Design
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Description	Tag Number(1)	Location	ASME AG-1 Code	Function	Seismic Category
Motor Operated Dampers	30KLC45AA001 30KLC45AA002 30KLC45AA003 30KLC45AA004 30KLC45AA005 30KLC45AA006	Fuel Building ~~30UFA21095~~ Fuel Building ~~30UFA21095~~ Fuel Building ~~30UFA29045~~ Fuel Building ~~30UFA29045~~ Fuel Building ~~30UFA24045~~ Fuel Building ~~30UFA24045~~	Yes	Open	I
Personnel Air Lock Area					
Motor Operated Damper	30KLC12AA009 30KLC12AA010	Safeguard Building 2 ~~32UJH10006~~ Safeguard Building 2 ~~32UJH10006~~	Yes	Close	I
Motor Operated Damper	30KLC22AA010	Safeguard Building 2 ~~32UJH10006~~	Yes	Close	I
Iodine Filtration Trains 30KLC41/42					
Motor Operated Dampers	30KLC41AA001 30KLC42AA001	Fuel Building ~~30UFA21082~~ Fuel Building ~~30UFA21084~~	Yes	Open	I
Electric Heaters (Two stage)	30KLC41AH001A/B 30KLC42AH001A/B	Fuel Building ~~30UFA21082~~ Fuel Building ~~30UFA21084~~	Yes	On / Off ~~(based on ambient conditions)~~	I

Table 2.6.6-2—SBVS Equipment I&C and Electrical Design
Sheet 5 of 7

Description	Tag Number(1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Iodine Filtration Train 30KLC41							
Motor Operated Damper	30KLC41AA001	Fuel Building	Division 1N Division 2A	Yes	Yes	Position / Position	Open-Close / Open-Close
Electric Heater (two stage)	30KLC41AH001A/B	Fuel Building	Division 1N Division 2A	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Motor Operated Damper	30KLC41AA002	Fuel Building	Division 1N Division 2A	Yes	Yes	Position / Position	Open-Close / Open-Close
Exhaust Fan	30KLC41AN001	Fuel Building	Division 1N Division 2A	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Iodine Filtration Train 30KLC42							
Motor Operated Damper	30KLC42AA001	Fuel Building	Division 4N Division 3A	Yes	Yes	Position / Position	Open-Close / Open-Close
Electric Heater (two stage)	30KLC42AH001A/B	Fuel Building	Division 4N Division 3A	Yes	Yes	On-Off / On-Off	Start-Stop / Start-Stop
Motor Operated Damper	30KLC42AA002	Fuel Building	Division 4N Division 3A	Yes	Yes	Position / Position	Open-Close / Open-Close
Exhaust Fan	30KLC42AN001	Fuel Building	Division 4N Division 3A	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Recirculation Cooling Units							
Recirculation Fans	30KLC51AN001 30KLC51AN002 30KLC51AN003	Safeguard Building 1 Safeguard Building 1 Safeguard Building 1	Division 1N	Yes	Yes	On-Off / On-Off	Run-Stop / Run-Stop

Table 2.6.6-2—SBVS Equipment I&C and Electrical Design
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Description	Tag Number(1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
CCW & EFW Valve Room Temperature	30KLC51CT005 30KLC51CT006 30KLC52CT005 30KLC52CT006 30KLC53CT005 30KLC53CT006 30KLC54CT005 30KLC54CT006	Safeguard Building 1 Safeguard Building 1 Safeguard Building 2 Safeguard Building 2 Safeguard Building 3 Safeguard Building 3 Safeguard Building 4 Safeguard Building 4	N/A	Yes	N/A	Temp / Temp	N/A
Sampling System Room Temperature	30KLC51CT007 30KLC51CT008 30KLC54CT007 30KLC54CT008	Safeguard Building 1 Safeguard Building 1 Safeguard Building 4 Safeguard Building 4	N/A	Yes	N/A	Temp / Temp	N/A
Temperature Downstream of Iodine Filtration Heater	30KLC41CT001/002 30KLC42CT001/002	Fuel Building Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Temperature Downstream of Carbon Adsorbers	30KLC41CT003 30KLC42CT003	Fuel Building Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A
Differential Pressure across Iodine Filtration Trains	30KLC41CP001 30KLC42CP001	Fuel Building Fuel Building	N/A	Yes	N/A	Press / Press	N/A
Temperature Upstream of Iodine Filtration Trains	30KLC41CT004 30KLC42CT004	Fuel Building Fuel Building	N/A	Yes	N/A	Temp / Temp	N/A

Table 2.6.7-2—SBVSE Equipment I&C and Electrical Design
Sheet 9 of 11

Description	Tag Number(1)	Location	IEEE Class 1E(2)	PACS	MCR / RSS Displays	MCR / RSS Controls
Component Cooling Water System Pump Room Temperature	30SAC62CT004	Safeguard Building 2	Division 2	N/A	Temp/ Temp	N/A
Component Cooling Water System Pump Room Temperature	30SAC63CT003	Safeguard Building 3	Division 3	N/A	Temp/ Temp	N/A
Component Cooling Water System Pump Room Temperature	30SAC63CT004	Safeguard Building 3	Division 3	N/A	Temp/ Temp	N/A
Component Cooling Water System Pump Room Temperature	30SAC64CT003	Safeguard Building 4	Division 4	N/A	Temp/ Temp	N/A
Component Cooling Water System Pump Room Temperature	30SAC64CT004	Safeguard Building 4	Division 4	N/A	Temp/ Temp	N/A
Battery Room Exhaust Air Flow	30SAC41CF001	Safeguard Building 1	Division 1	N/A	Flow/ Flow	N/A
Battery Room Exhaust Air Flow	30SAC44CF001	Safeguard Building 4	Division 4	N/A	Flow/ Flow	N/A
Outside Air Temperature Sensors	30SAC01CT001/002 30SAC02CT001/002 30SAC03CT001/002 30SAC04CT001/002	Safeguard Building 1 Safeguard Building 2 Safeguard Building 3 Safeguard Building 4	N/A	N/A	Temp / Temp	N/A
Temperature Sensors Upstream of heaters	30SAC01CT501 30SAC02CT501 30SAC03CT501 30SAC04CT501	Safeguard Building 1 Safeguard Building 2 Safeguard Building 3 Safeguard Building 4	N/A	N/A	Temp / Temp	N/A

Table 2.6.7-2—SBVSE Equipment I&C and Electrical Design
Sheet 10 of 11

Description	Tag Number[(1)]	Location	IEEE Class 1E[(2)]	PACS	MCR / RSS Displays	MCR / RSS Controls
Protective Switch-off Temperature for heaters	30SAC01CT003 30SAC02CT003 30SAC03CT003 30SAC04CT003	Safeguard Building 1 Safeguard Building 2 Safeguard Building 3 Safeguard Building 4	N/A	N/A	Temp / Temp	N/A
Temperature Sensors Downstream of heaters	30SAC01CT004/005 30SAC02CT004/005 30SAC03CT004/005 30SAC04CT004/005	Safeguard Building 1 Safeguard Building 2 Safeguard Building 3 Safeguard Building 4	N/A	N/A	Temp / Temp	N/A
Temperature Sensors Downstream of Moisture Separators	30SAC01CT502 30SAC02CT502 30SAC03CT502 30SAC04CT502	Safeguard Building 1 Safeguard Building 2 Safeguard Building 3 Safeguard Building 4	N/A	N/A	Temp / Temp	N/A

Table 2.6.7-2—SBVSE Equipment I&C and Electrical Design
Sheet 11 of 11

Description	Tag Number(1)	Location	IEEE Class 1E(2)	PACS	MCR / RSS Displays	MCR / RSS Controls
Supply Air Temperature Sensors	30SAC01CT006 30SAC02CT006 30SAC03CT006 30SAC04CT006	Safeguard Building 1 Safeguard Building 2 Safeguard Building 3 Safeguard Building 4	N/A	N/A	Temp / Temp	N/A

1. Equipment tag numbers are provided for information only and are not part of the certified design.

2. ^{N} denotes division the equipment is normally powered from, while ^{A} denotes division the equipment is powered from when alternate feed is implemented.

Table 2.6.8-3—CBVS Equipment I&C and Electrical Design
Sheet 5 of 5

Description	Tag Number[1]	Location	IEEE Class 1E [2]	EQ – Harsh Env.	PACS	MCR / RSS Displays	MCR / RSS Controls
Temperature Upstream of Electric Heater	30KLA50CT002	Reactor Building	N/A	Yes	N/A	Temperature / Temperature	N/A
Temperature Downstream of Electric Heater	30KLA50CT001	Reactor Building	N/A	Yes	N/A	Temperature / Temperature	N/A
Duct Air Flow	30KLA50CF001	Reactor Building	N/A	Yes	N/A	Flow/Flow	N/A
Temperature Downstream of Carbon Adsorber	30KLA50CT003	Reactor Building	N/A	Yes	N/A	Temperature / Temperature	N/A

1. Equipment tag numbers are provided for information only and are not part of the certified design.

2. ^{N} denotes division the equipment is normally powered from, while ^{A} denotes division the equipment is powered from when alternate feed is implemented.

2.6.9 Emergency Power Generating Building Ventilation System

Design Description

1.0 System Description

The emergency power generating building ventilation system (EPGBVS) controls the temperature and air change rate in the Emergency Power Generating Buildings (EPGB) for personnel comfort, personnel safety, and equipment protection. The EPGBVS provides ventilation of the diesel hall, electrical room, and main tank room; and cooling of the electrical room for each of the four divisions of the EPGBs to remove equipment heat, and heat generated from other sources. The EPGBVS also provides heat to maintain a minimum temperature in the buildings.

Each division of the EPGBs has its own independent heating, ventilation and air conditioning system which is not connected to other divisions. Two divisions are located in each of the two EPGBs. EPGBVS Divisions 1 and 2 are located in EPGB 1/2 and Divisions 3 and 4 in EPGB 3/4. During normal plant operation, the emergency diesel generators (EDG) do not operate, however the EPGBVS maintains an acceptable ambient temperature for the startup of EDGs and for personnel comfort.

The EPGBVS provides the following safety-related functions:

- Removes heat generated by the EDGs during operation of the EDGs to maintain acceptable operating conditions in the diesel hall.
- Maintains acceptable ambient conditions in the electrical room and main tank room.
- Maintains environmental conditions for startup of the EDGs.

The EPGBVS provides the following non-safety-related functions:

- Maintains the room ambient conditions to allow personnel access during normal operation.
- Provides ventilation to maintain required air renewal rates.

2.0 Arrangement

2.1 The functional arrangement of the EPGBVS is as described in the Design Description of Section 2.6.9, Tables 2.6.9-12.6.9-1—Emergency Power Generating Building Ventilation System Equipment Mechanical Design and 2.6.9-2, and as shown on Figures 2.6.9-1—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 1, 2.6.9-2—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 2, 2.6.9-3—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 3, and

2.6.9-4—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 4.

2.2 Deleted.

2.3 Physical separation exists between the divisions of the EPGBVS as listed in Table 2.6.9-1.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Class 1E dampers listed in Table 2.6.9-2 will function to change position as listed in 2.6.9-1 under normal operating conditions.

3.3 Equipment identified as Seismic Category I in Table 2.6.9-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.6.9-1.

3.4 Equipment listed in Table 2.6.9-1 as ASME AG-1 Code are designed in accordance with ASME AG-1 Code requirements.

3.5 Equipment listed in Table 2.6.9-1 as ASME AG-1 Code are fabricated in accordance with ASME AG-1 Code requirements, including welding requirements.

3.6 Equipment listed in Table 2.6.9-1 as ASME AG-1 Code are installed, inspected, and tested in accordance with ASME AG-1 Code requirements.

4.0 I&C Design Features, Displays, and Controls

4.1 Displays listed in Table 2.6.9-2 are indicated on the PICS operator workstations in the MCR and the RSS.

4.2 Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.6.9-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.9-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.6.9-2 are powered from the Class 1E division as listed in Table 2.6.9-2 in a normal feed condition.

5.2 Deleted.

6.0 Equipment and System Performance

6.1 The EPGBVS provides cooling to maintain design temperatures in the EPGB Buildings, while operating in a design basis accident alignment.

Table 2.6.9-1—EPGBVS Equipment Mechanical Design
Sheet 2 of 8

Description	Tag Number[1]	Location	ASME AG-1 Code	Function	Seismic Category
~~Backdraft Dampers~~	~~30SAD11AA003~~ ~~30SAD21AA003~~ ~~30SAD31AA003~~ ~~30SAD41AA003~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
~~Pre-filters~~	~~30SAD11AT003~~ ~~30SAD21AT003~~ ~~30SAD31AT003~~ ~~30SAD41AT003~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
~~Supply Air Fans~~	~~30SAD11AN003~~ ~~30SAD21AN003~~ ~~30SAD31AN003~~ ~~30SAD41AN003~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
Motor Operated Dampers	30SAD11AA004 30SAD21AA004 30SAD31AA004 30SAD41AA004	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4EPGB, Division 4	Yes	Open / Close~~N/A~~	I
Diesel Hall Air Supply and Exhaust					
~~Manual Dampers~~	~~30SAD12AA001~~ ~~30SAD22AA001~~ ~~30SAD32AA001~~ ~~30SAD42AA001~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4 EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~I~~
~~Manual Dampers~~	~~30SAD12AA002~~ ~~30SAD22AA002~~ ~~30SAD32AA002~~ ~~30SAD42AA002~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4 EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~I~~

All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.6.9-1—EPGBVS Equipment Mechanical Design
Sheet 4 of 8

Description	Tag Number(1)	Location	ASME AG-1 Code	Function	Seismic Category
Motor Operated Dampers	30SAD15AA004 30SAD25AA004 30SAD35AA004 30SAD45AA004	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4EPGB, Division 4	Yes	Open / Close ~~N/A~~	I
~~Exhaust Fans~~	~~30SAD15AN003~~ ~~30SAD25AN003~~ ~~30SAD35AN003~~ ~~30SAD45AN003~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
~~Backdraft Dampers~~	~~30SAD15AA003~~ ~~30SAD25AA003~~ ~~30SAD35AA003~~ ~~30SAD45AA003~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
Electrical Room Air Supply and Recirculation					
~~Manual dampers~~	~~30SAD13AA002~~ ~~30SAD23AA002~~ ~~30SAD33AA002~~ ~~30SAD43AA002~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4 EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~I~~
Prefilters	30SAD13AT001 30SAD23AT001 30SAD33AT001 30SAD43AT001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Yes	N/A	I
HEPA Filters	30SAD13AT002 30SAD23AT002 30SAD33AT002 30SAD43AT002	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Yes	N/A	I

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All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.6.9-1—EPGBVS Equipment Mechanical Design
Sheet 5 of 8

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Description	Tag Number[(1)]	Location	ASME AG-1 Code	Function	Seismic Category
Cooling Coils	30SAD13AC001 30SAD23AC001 30SAD33AC001 30SAD43AC001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Yes	N/A	I
Moisture Separators	30SAD13AT003 30SAD23AT003 30SAD33AT003 30SAD43AT003	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Yes	N/A	I
Supply Air Fans	30SAD13AN001 30SAD23AN001 30SAD33AN001 30SAD43AN001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Yes	Run	I
Motor Operated Dampers	30SAD13AA007 30SAD23AA007 30SAD33AA007 30SAD43AA007	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4EPGB, Division 4	Yes	Open / Close~~N/A~~	I
~~Manual Dampers~~	~~30SAD13AA008~~ ~~30SAD23AA008~~ ~~30SAD33AA008~~ ~~30SAD43AA008~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
~~Manual Dampers~~	~~30SAD13AA009~~ ~~30SAD23AA009~~ ~~30SAD33AA009~~ ~~30SAD43AA009~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
~~Pre-filters~~	~~30SAD13AT003~~ ~~30SAD23AT003~~ ~~30SAD33AT003~~ ~~30SAD43AT003~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~

All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.6.9-1—EPGBVS Equipment Mechanical Design
Sheet 6 of 8

Description	Tag Number(1)	Location	ASME AG-1 Code	Function	Seismic Category
~~Cooling Coils~~	~~30SAD13AC002~~ ~~30SAD23AC002~~ ~~30SAD33AC002~~ ~~30SAD43AC002~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
~~Cooling Coils~~	~~30SAD13AC102~~ ~~30SAD23AC102~~ ~~30SAD33AC102~~ ~~30SAD43AC102~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
~~Supply Air Fans~~	~~30SAD13AN002~~ ~~30SAD23AN002~~ ~~30SAD33AN002~~ ~~30SAD43AN002~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~II~~
Backdraft Dampers	30SAD13AA010 30SAD23AA010 30SAD33AA010 30SAD43AA010	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4EPGB, Division 4	Yes	Open / Close~~N/A~~	I
Main Tank Room Air Supply and Exhaust					
Backdraft Dampers	30SAD16AA001 30SAD26AA001 30SAD36AA001 30SAD46AA001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Yes	Open / Close~~N/A~~	I
~~Manual Dampers~~	~~30SAD16AA003~~ ~~30SAD26AA003~~ ~~30SAD36AA003~~ ~~30SAD46AA003~~	~~1/2 EPGB, Division 1~~ ~~1/2 EPGB, Division 2~~ ~~3/4 EPGB, Division 3~~ ~~3/4 EPGB, Division 4~~	~~Yes~~	~~N/A~~	~~I~~

Table 2.6.9-2—EPGBVS Equipment I&C and Electrical Design
Sheet 1 of 3

Description	Tag Number[(1)]	Location	IEEE Class 1E[(2)]		PACS	MCR / RSS Displays	MCR / RSS Controls
Supply Air Fans	30SAD11AN001 30SAD21AN001 30SAD31AN001 30SAD41AN001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4		Yes	On-Off / On-Off	Run-Stop / Run-Stop
Supply Air Fans	30SAD11AN002 30SAD21AN002 30SAD31AN002 30SAD41AN002	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4		Yes	On-Off / On-Off	Run-Stop / Run-Stop
Exhaust Fans	30SAD15AN001 30SAD25AN001 30SAD35AN001 30SAD45AN001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4		Yes	On-Off / On-Off	Run-Stop / Run-Stop
Exhaust Fans	30SAD15AN002 30SAD25AN002 30SAD35AN002 30SAD45AN002	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4		Yes	On-Off / On-Off	Run-Stop / Run-Stop
Supply Air Fans	30SAD13AN001 30SAD23AN001 30SAD33AN001 30SAD43AN001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4		Yes	On-Off / On-Off	Run-Stop / Run-Stop
Motor Operated Dampers	30SAD16AA007 30SAD26AA007 30SAD36AA007 30SAD46AA007	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4		Yes	Position / Position	Open-Close / Open-Close

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All indicated changes are in response to RAI 505, Question 07.01-35

Table 2.6.9-2—EPGBVS Equipment I&C and Electrical Design
Sheet 2 of 3

Description	Tag Number(1)	Location	IEEE Class 1E(2)	PACS	MCR / RSS Displays	MCR / RSS Controls
Motor Operated Dampers	30SAD16AA008 30SAD26AA008 30SAD36AA008 30SAD46AA008	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4	Yes	Position / Position	Open-Close / Open-Close
Exhaust Fans	30SAD16AN001 30SAD26AN001 30SAD36AN001 30SAD46AN001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4	Yes	On-Off / On-Off	Run-Stop / Run-Stop
Fan Heaters	30SAD16AH001 30SAD26AH001 30SAD36AH001 30SAD46AH001	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4 EPGB, Division 4	Division 1 Division 2 Division 3 Division 4	Yes	On-Off / On-Off	On-Off / On-Off
~~Fan Heaters~~	~~30SAD14AH001~~ ~~30SAD14AH002~~ ~~30SAD14AH003~~ ~~30SAD14AH004~~	~~1/2 EPGB, Division 1~~	~~Division 1~~	~~Yes~~	~~On-Off / On-Off~~	~~Start-Stop / Start-Stop~~
~~Fan Heaters~~	~~30SAD24AH001~~ ~~30SAD24AH002~~ ~~30SAD24AH003~~ ~~30SAD24AH004~~	~~1/2 EPGB, Division 2~~	~~Division 2~~	~~Yes~~	~~On-Off / On-Off~~	~~Start-Stop / Start-Stop~~
~~Fan Heaters~~	~~30SAD34AH001~~ ~~30SAD34AH002~~ ~~30SAD34AH003~~ ~~30SAD34AH004~~	~~3/4 EPGB, Division 3~~	~~Division 3~~	~~Yes~~	~~On-Off / On-Off~~	~~Start-Stop / Start-Stop~~
~~Fan Heaters~~	~~30SAD44AH001~~ ~~30SAD44AH002~~ ~~30SAD44AH003~~ ~~30SAD44AH004~~	~~3/4 EPGB, Division 4~~	~~Division 4~~	~~Yes~~	~~On-Off / On-Off~~	~~Start-Stop / Start-Stop~~

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All indicated changes are in response to RAI 505, Question 07.01-35

**Table 2.6.9-2—EPGBVS Equipment I&C and Electrical Design
Sheet 3 of 3**

Description	Tag Number(1)	Location	IEEE Class 1E(2)	PACS	MCR / RSS Displays	MCR / RSS Controls
Motor Operated Dampers	30SAD11AA004 30SAD21AA004 30SAD31AA004 30SAD41AA004	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4EPGB, Division 4	Division 1 Division 2 Division 3 Division 4	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Dampers	30SAD15AA004 30SAD25AA004 30SAD35AA004 30SAD45AA004	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4EPGB, Division 4	Division 1 Division 2 Division 3 Division 4	Yes	Position / Position	Open-Close / Open-Close
Motor Operated Dampers	30SAD13AA007 30SAD23AA007 30SAD33AA007 30SAD43AA007	1/2 EPGB, Division 1 1/2 EPGB, Division 2 3/4 EPGB, Division 3 3/4EPGB, Division 4	Division 1 Division 2 Division 3 Division 4	Yes	Position / Position	Open-Close / Open-Close

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1. Equipment tag numbers are provided for information only and are not part of the certified design.

2. ^{N} denotes division the equipment is normally powered from, while ^{A} denotes division the equipment is powered from when alternate feed is implemented.

Table 2.6.9-3—Emergency Power Generating Building Ventilation System ITAAC Sheet 3 of 4

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.2	Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.6.9-2.	a. Tests will be performed using controls on the PICS operator workstations in the MCR. b. Tests will be performed using controls on the PICS operator workstations in the RSS.	a. Controls on the PICS operator workstations in the MCR perform the function listed in Table 2.6.9-2. b. Controls on the PICS operator workstations in the RSS perform the function listed in Table 2.6.9-2.
4.3	Equipment listed as being controlled by a PACS module in Table 2.6.9-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.	A test will be performed using test input signals to verify equipment controlled by a PACS module responds to the state requested and provides drive monitoring signals back to the PACS module.	Equipment listed as being controlled by a PACS module in Table 2.6.9-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.
5.1	Equipment designated as Class 1E in Table 2.6.9-2 are powered from the Class 1E division as listed in Table 2.6.9-2 in a normal feed condition.	Testing will be performed by providing a test input signal in each normally aligned division.	The test input signal provided in the normally aligned division is present at the respective Class 1E equipment identified in Table 2.6.9-2.
5.2	Deleted.	Deleted.	Deleted.

Figure 2.6.9-1—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 1

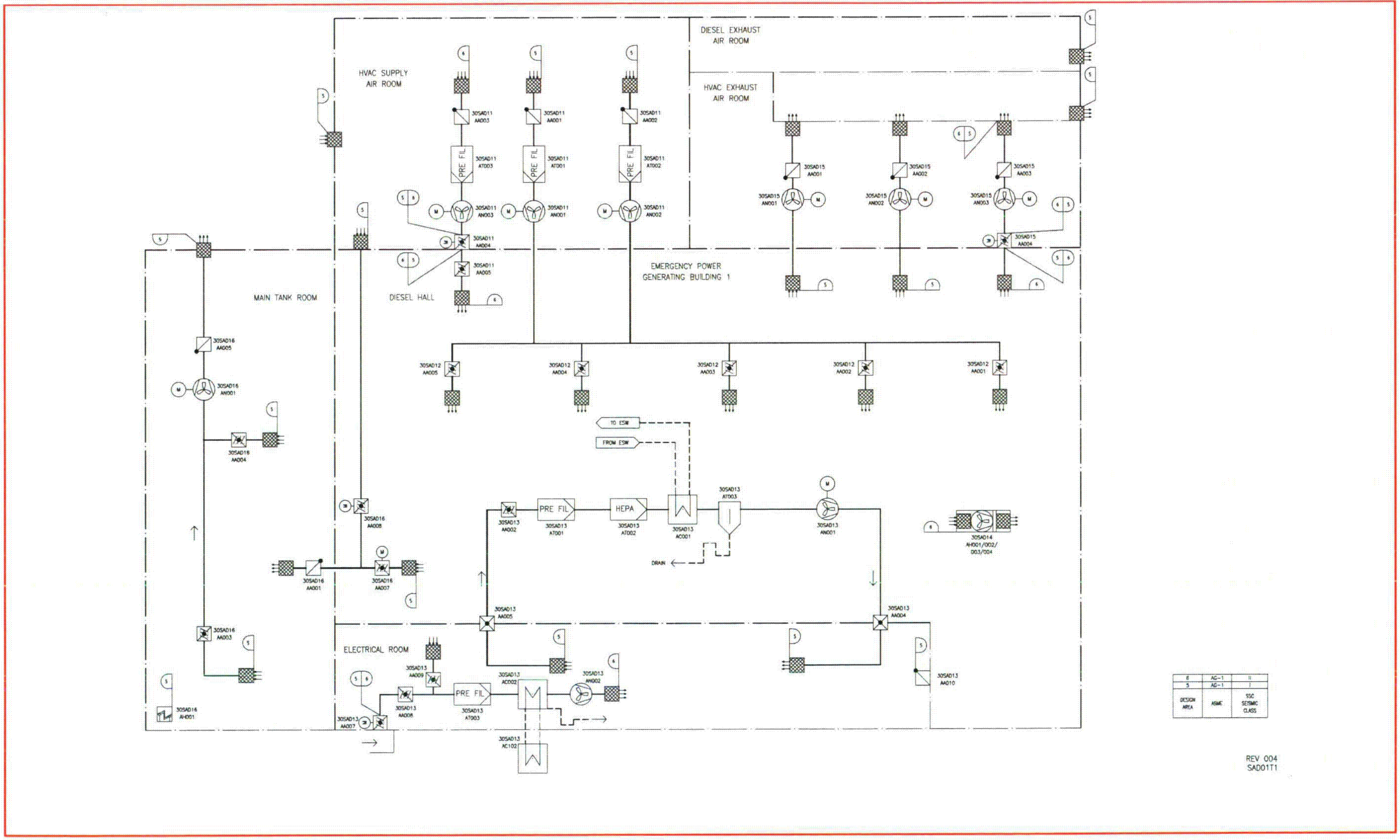


Figure 2.6.9-2—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 2

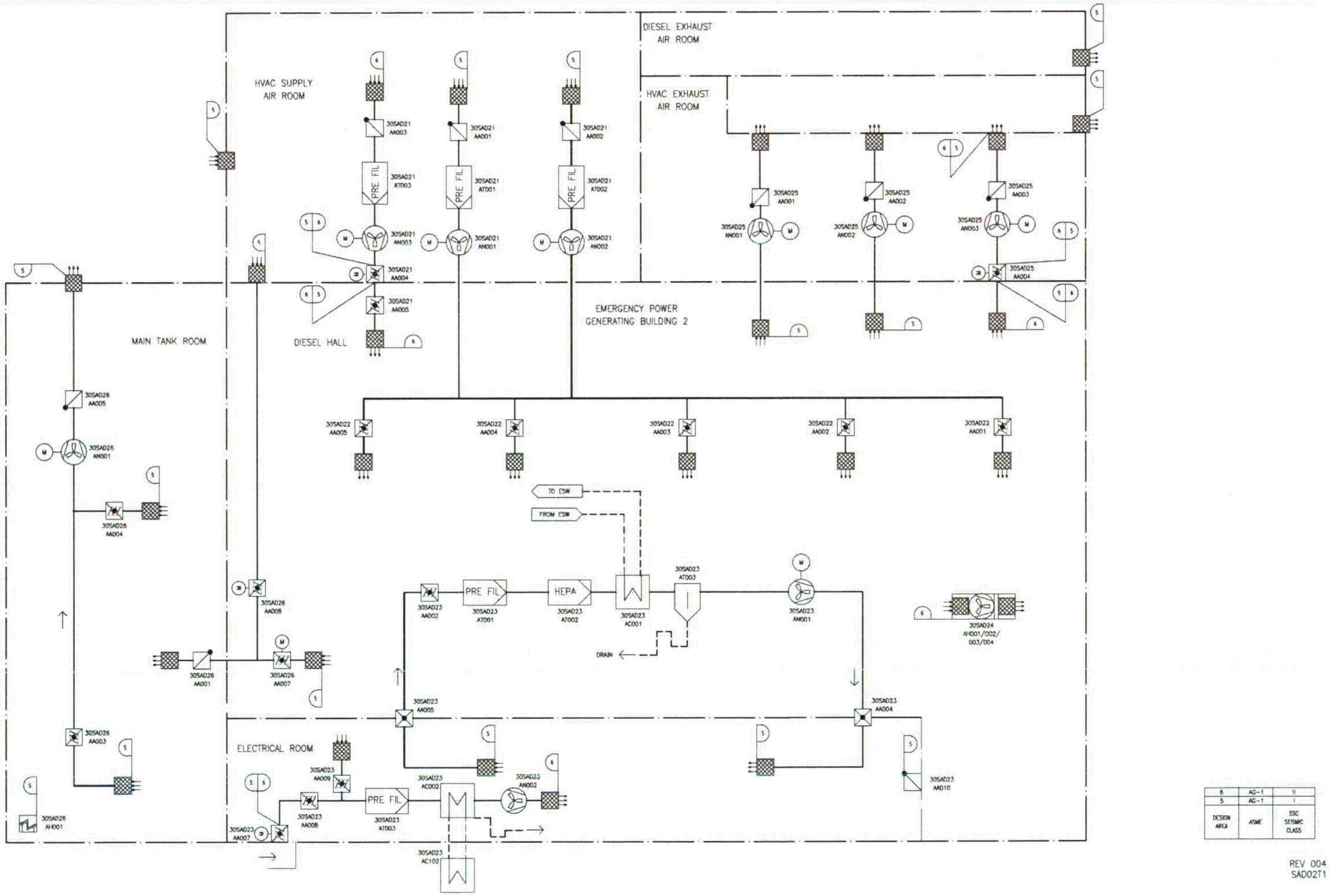


Figure 2.6.9-3—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 3

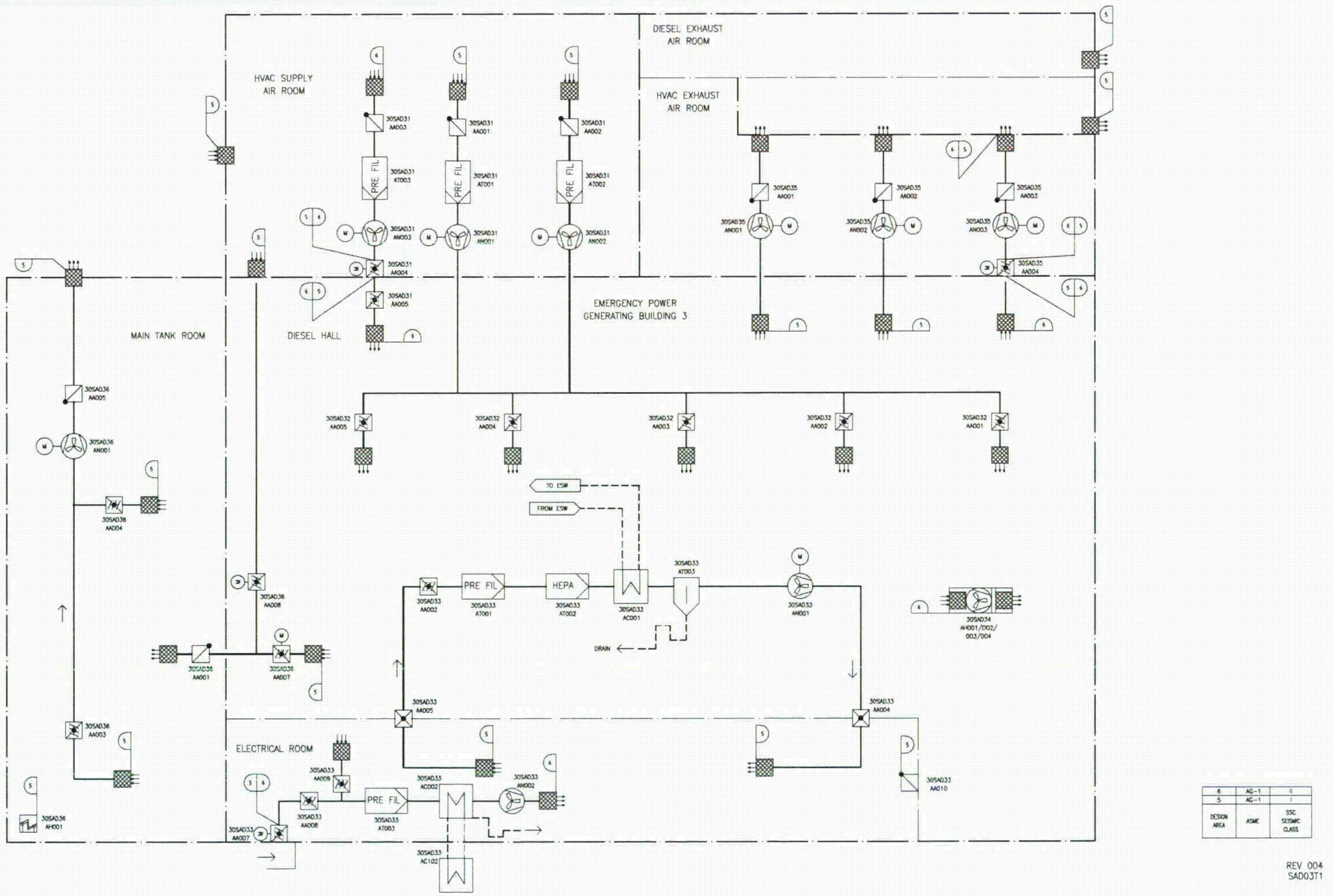
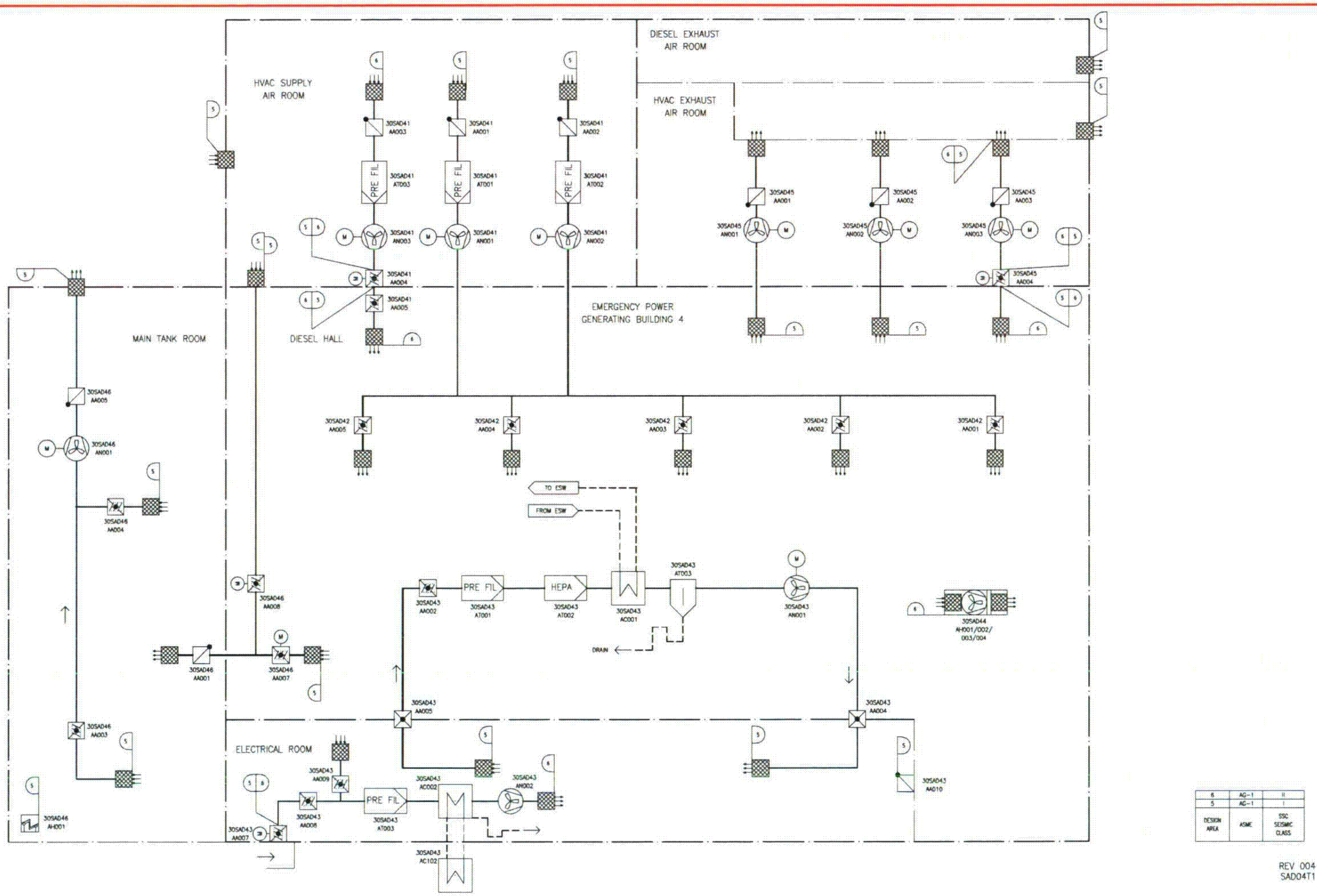


Figure 2.6.9-4—Emergency Power Generating Building Ventilation System Functional Arrangement, Division 4



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2.6.13 Essential Service Water Pump Building Ventilation System

Deleted text: "during operation of DSWS pumps."

Design Description

1.0 System Description

The essential service water pump building ventilation system (ESWPBVS) controls the temperature and air change rate in the essential service water system (ESWS) pump areas for personnel comfort, personnel safety, and equipment protection. The ESWPBVS provides cooling and heating for the ESWS pump area and associated electrical equipment in each of the four ESWS Pump Buildings (ESWPB) to remove equipment heat, and heat generated from other sources. Each building has its own independent ventilation system and is not connected to the other buildings.

The ESWPBVS provides the following safety-related functions:

- Removes heat generated by the ESWS pumps and associated electrical equipment.
- Maintains acceptable temperature limits to support operation of ESWS pumps.

The ESWPBVS provides the following non-safety-related functions:

- Maintains the room ambient conditions to allow personnel access during normal operation.
- Provides ventilation and cooling during plant operation when an ESW pump is not operating.

2.0 Arrangement

2.1 The functional arrangement of the ESWPBVS is as described in the Design Description of Section 2.6.13, Tables 2.6.13-1—Essential Service Water Pump Building Ventilation System Equipment Mechanical Design and 2.6.13-2—Essential Service Water Pump Building Ventilation System Equipment I&C and Electrical Design, and as shown on Figure 2.6.13-1—Essential Service Water Pump Building Ventilation System Functional Arrangement.

2.2 Deleted.

2.3 Physical separation exists between the divisions of the ESWPBVS located in separate ESWPBs as shown on Figure 2.6.13-1.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Class 1E dampers listed in Table 2.6.13-2 will function to change position as listed in Table 2.6.13-1 under normal operating conditions.

3.3 Equipment identified as Seismic Category I in Table 2.6.13-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.6.13-1.

3.4 Equipment listed in Table 2.6.13-1 as ASME AG-1 Code are designed in accordance with ASME AG-1 Code requirements.

3.5 Equipment listed in Table 2.6.13-1 as ASME AG-1 Code are fabricated in accordance with ASME AG-1 Code requirements, including welding requirements.

3.6 Equipment listed in Table 2.6.13-1 as ASME AG-1 Code are installed, inspected, and tested in accordance with ASME AG-1 Code requirements.

4.0 I&C Design Features, Displays, and Controls

4.1 Displays listed in Table 2.6.13-2 are indicated on the PICS operator workstations in the MCR and the RSS.

4.2 Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.6.13-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.13-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.6.13-2 are powered from the Class 1E division as listed in Table 2.6.13-2 in a normal feed condition.

6.0 Equipment and System Performance

6.1 The ESWPBVS provides cooling to maintain design temperatures in the ESWPBs, while operating in a design basis accident alignment.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.6.13-3 lists the ESWPBVS ITAAC.