Southern Company

B. H. Whitley
Director
Regulatory Affairs

Southern Nuclear
Operating Company, Inc.
42 Inverness Center Parkway
Birmingham, Alabama 35242

February 17, 2017

Docket Nos.: 52-025
52-026

ND-17-0271
10 CFR 50.90
10 CFR 52.63

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

Southern Nuclear Operating Company
Vogtle Electric Generating Plant Units 3 and 4
Request for License Amendment and Exemption:
Addition of In-containment Refueling Water Storage Tank (IRWST)
Lower Narrow Range Level Instrumentation (LAR-16-032)

Ladies and Gentlemen:

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, Southern Nuclear Operating Company (SNC), requests an amendment to Combined Licenses (COLs) for Vogtle Electric Generating Plant (VEGP) Units 3 and 4 (License Nos. NPF-91 and NPF-92, respectively). The requested amendment requires changes to the Updated Final Safety Analysis Report (UFSAR) in the form of departures from the Plant-Specific Design Control Document (DCD) Tier 2 information and involves changes to plant-specific Tier 1 information (and corresponding changes to COL Appendix C). Additionally, this request involves changes to the VEGP Units 3 and 4 COL Appendix A, Technical Specifications. Because the proposed changes impact Tier 1 of the Plant-Specific (DCD), Appendix C of the COL, and the Technical Specifications, this activity has been determined to require prior NRC approval. Pursuant to the provisions of 10 CFR 52.63(b)(1), an exemption from elements of the design as certified in the 10 CFR Part 52, Appendix D, design certification rule is also requested for the plant-specific Tier 1 material departures.

The proposed changes revise plant-specific Tier 1 (and corresponding COL Appendix C) and plant-specific Tier 2 information concerning changes to the Protection and Safety Monitoring System (PMS) including the reactor trip system (RTS) and the engineered safety feature actuation system (ESFAS), the passive core cooling system (PXS), the steam generator blowdown system (BDS), and the spent fuel pool cooling system (SFS). In addition, revisions are proposed to COL Appendix A, Technical Specifications.

Enclosure 1 provides the description, technical evaluation, regulatory evaluation (including the Significant Hazards Consideration Determination), and environmental considerations for the proposed changes in the License Amendment Request (LAR).

Enclosure 2 provides the background and supporting basis for the requested exemption.

Enclosure 3 provides the proposed changes to the licensing basis documents.

Enclosure 4 provides conforming Technical Specification Bases changes for information only.

This letter contains no regulatory commitments. This letter has been reviewed and confirmed to not contain security-related information.

In order to support the Vogtle Units 3 and 4 ITAAC schedule, SNC requests NRC staff review and approval of the license amendment and exemption no later than May 18, 2017. Approval by this date will allow sufficient time to implement licensing basis changes prior to performance of affected ITAAC activities. SNC expects to implement the proposed amendment within thirty days of approval. South Carolina Electric & Gas Company (SCE&G) has stated that the current requested approval date for the expected parallel LAR for Virgil C. Summer Nuclear Station (VCSNS) Unit 2 is July 28, 2017.

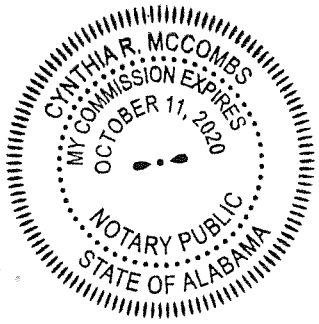
In accordance with 10 CFR 50.91, SNC is notifying the State of Georgia of this LAR by transmitting a copy of this letter and enclosures to the designated State Official.

Should you have any questions, please contact Mr. Christopher L. Whitfield at (205) 992-5071.

Mr. Brian H. Whitley states that: he is the Regulatory Affairs Director of Southern Nuclear Operating Company; he is authorized to execute this oath on behalf of Southern Nuclear Operating Company; and to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY



B. H. Whitley

BHW/CLW/ljs

Sworn to and subscribed before me this 17 *day of* February, *2017*

Notary Public: Cynthia R. McCombs

My commission expires: October 11, 2020

Enclosures: 1) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Request for License Amendment: Addition of IRWST Lower Narrow Range Level Instrumentation (LAR-16-032)
2) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Exemption Request: Addition of IRWST Lower Narrow Range Level Instrumentation (LAR-16-032)
3) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Proposed Changes to the Licensing Basis Documents (LAR-16-032)
4) Vogtle Electric Generating Plant (VEGP) Units 3 and 4 – Conforming Technical Specification Bases Changes (LAR-16-032) – (For Information Only)

cc:

Southern Nuclear Operating Company / Georgia Power Company
Mr. S. E. Kuczynski (w/o enclosures)
Mr. M. D. Rauckhorst
Mr. D. G. Bost (w/o enclosures)
Mr. M. D. Meier (w/o enclosures)
Mr. D. H. Jones (w/o enclosures)
Ms. K. D. Fili (w/o enclosures)
Mr. D. L. McKinney (w/o enclosures)
Mr. T.W. Yelverton (w/o enclosures)
Mr. B. H. Whitley
Mr. C. R. Pierce
Ms. A. G. Aughtman
Mr. D. L. Fulton
Mr. M. J. Yox
Mr. E. W. Rasmussen
Mr. T. R. Takats
Mr. W. A. Sparkman
Mr. J. P. Redd
Ms. A. C. Chamberlain
Document Services RTYPE: VND.LI.L00
File AR.01.02.06

Nuclear Regulatory Commission
Mr. W. Jones (w/o enclosures)
Mr. S. Lee (w/o enclosures)
Ms. J. Dixon-Herrity
Mr. C. Patel
Mr. W. C. Gleaves
Ms. R. Reyes
Ms. J. M. Heisserer
Mr. G. Khouri
Mr. J. D. Fuller
Ms. S. Temple
Ms. V. Ordaz
Mr. T.E. Chandler
Ms. P. Braxton
Mr. T. Brimfield
Mr. C. J. Even
Mr. A. Lerch

State of Georgia
Mr. R. Dunn

Oglethorpe Power Corporation
Mr. M. W. Price
Mr. K. T. Haynes
Ms. A. Whaley

Municipal Electric Authority of Georgia
Mr. J. E. Fuller
Mr. S. M. Jackson

Dalton Utilities
Mr. T. Bundros

Westinghouse Electric Company, LLC
Mr. R. Easterling (w/o enclosures)
Mr. G. Koucheravy (w/o enclosures)
Mr. C. D. Churchman (w/o enclosures)
Mr. P. A. Russ
Mr. A. F. Dohse
Mr. M. L. Clyde
Mr. C. A. Castell
Ms. K. Chesko
Mr. J. Hopkins
Mr. D. Hawkins

Other
Mr. J. E. Hesler, Bechtel Power Corporation
Ms. L. A. Matis, Tetra Tech NUS, Inc.
Dr. W. R. Jacobs, Jr., Ph.D., GDS Associates, Inc.
Mr. S. Roetger, Georgia Public Service Commission
Ms. S. W. Kernizan, Georgia Public Service Commission
Mr. K. C. Greene, Troutman Sanders
Mr. S. Blanton, Balch Bingham
Mr. R. Grumbir, APOG
Mr. N. R. Kellenberger, South Carolina Electric & Gas Company
Mr. D. Kersey, South Carolina Electric & Gas Company
NDDocumentinBox@duke-energy.com, Duke Energy
Mr. S. Franzone, Florida Power & Light

Southern Nuclear Operating Company

ND-17-0271

Enclosure 1

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Request for License Amendment:

Addition of IRWST Lower Narrow Range Level Instrumentation

(LAR-16-032)

(Enclosure 1 consists of 49 pages, including this cover page)

Table of Contents

1. SUMMARY DESCRIPTION

2. DETAILED DESCRIPTION

3. TECHNICAL EVALUATION (Incorporated into Section 2)

4. REGULATORY EVALUATION

    4.1 Applicable Regulatory Requirements/Criteria

    4.2 Precedent

    4.3 Significant Hazards Consideration Determination

    4.4 Conclusions

5. ENVIRONMENTAL CONSIDERATIONS

6. REFERENCES

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, Southern Nuclear Operating Company (SNC, or the "Licensee") hereby requests an amendment to Combined License (COL) Nos. NPF-91 and NPF-92 for Vogtle Electric Generating Plant (VEGP) Units 3 and 4, respectively.

1. SUMMARY DESCRIPTION

The proposed changes revise the Combined Licenses (COLs) concerning the design details of the protection and safety monitoring system (PMS) including the reactor trip system (RTS) and the engineered safety feature actuation system (ESFAS), the passive core cooling system (PXS), the steam generator blowdown system (BDS), and the spent fuel pool cooling system (SFS). These proposed changes include the following:

1. Four divisions A, B, C, and D in-containment refueling water storage tank (IRWST) lower narrow range level instruments are proposed to be added for ESFAS actuations on IRWST Level Low-2 and Low-3.
2. Division A IRWST level instrumentation is deleted, and divisions B, C, and D IRWST level instrumentation are renamed as IRWST wide range level instrumentation.
3. The existing Low steam generator narrow range water level reactor trip setpoint actuation name is proposed to be changed to Low-2 steam generator narrow range water level in the COL Appendix C, Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) (and Plant specific DCD Tier 1), COL Appendix A Technical Specifications, and UFSAR.
4. A reactor coolant average temperature (T_{avg}) P-9 permissive and interlock is proposed to be added for Low-2 steam generator narrow range water level reactor trip functions.
5. The existing Low steam generator wide range water level and Low steam generator narrow range water level setpoint ESFAS automatic actuation names are proposed to be changed to Low-2 steam generator wide range water level and Low-2 steam generator narrow range water level, respectively, in the COL Appendix A Technical Specifications, and UFSAR where necessary to reflect a standardized nomenclature scheme. Conforming changes to the Technical Specifications Bases are provided in Enclosure 4 for information only.
6. A P-9 permissive and interlock is proposed to be added for core makeup tank (CMT) actuation (including reactor coolant pump trip), passive residual heat removal (PRHR) heat exchanger actuation, and steam generator blowdown isolation on Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS functions.
7. A defense-in-depth Low IRWST wide range level ESFAS automatic actuation function is proposed to be added for refueling cavity and SFS isolation, including a P-9 permissive and interlock.

The requested amendment proposes changes to the UFSAR in the form of departures from the plant-specific Design Control Document (DCD) Tier 2 information (as detailed in Section 2), and involves changes to related plant-specific DCD Tier 1 information, with corresponding changes to the associated COL Appendix C information. In addition, revisions are proposed to COL Appendix A Technical Specifications. This enclosure requests approval of the license amendment necessary to implement the Tier 2, COL Appendix A, and COL Appendix C changes. Conforming changes to the Technical Specifications Bases are provided in Enclosure 4 for information only. Enclosure 2 requests the exemption necessary to implement the involved changes to the plant-specific DCD Tier 1 information.

2. DETAILED DESCRIPTION

2.1 Addition of IRWST Lower Narrow Range Level Instrumentation Channels

The existing IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048) cannot provide the ESFAS IRWST level Low-3 actuation signal within the accuracy assumed in the safety analysis. As described in UFSAR Subsection 15.6.5.4C.1, the safety-related systems are designed to provide adequate cooling of the reactor. Initially, this is achieved by discharging water from the IRWST into the reactor vessel. When the Low-3 IRWST level setpoint is reached in the IRWST, the containment recirculation subsystem isolation valves open and water from the containment RCS compartment flows into the reactor vessel through the passive core cooling system (PXS) piping. The purpose of the long-term cooling safety analysis is to demonstrate that the passive systems provide adequate emergency core cooling system performance during the IRWST injection/containment recirculation time scale. This IRWST injection/containment recirculation time scale is dependent upon the accuracy of the Low-3 IRWST level setpoint in order to remain within the bounds assumed in the long-term cooling safety analysis.

Therefore, the design is proposed to be changed to add four IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069) to provide the Low-2 IRWST level alarm function, and to provide the Low-3 IRWST level ESFAS automatic actuation function to open the containment recirculation squib valves. This lower narrow range instrumentation improves the instrument span accuracy for the Low-2 IRWST level alarm function and Low-3 IRWST level ESFAS function, without any changes required to the existing setpoints for these functions.

The four new IRWST lower narrow range level instrumentation channels are specified and required to be qualified as Regulatory Guide 1.97, Revision 3, Type D2 post accident monitoring system (PAMS) IRWST level instrumentation, required to function as post-accident monitoring instrumentation for the first 24 hours following a design basis accident.

This proposed change results in the addition of IRWST lower narrow range level transmitter isolation valves (PXS-PL-V161A, PXS-PL-V161B, PXS-PL-V161C, and PXS-PL-V161D) on the lower instrument lines from the IRWST. In addition, the upper instrument reference lines for the four new IRWST lower narrow range level transmitters are left open to the containment atmosphere, and are routed above the containment flood-up level and turned downward to prevent water or steam from entering. IRWST lower narrow range level transmitter reference leg isolation valves (PXS-PL-V162A, PXS-PL-V162B, PXS-PL-V162C, and PXS-PL-V162D) are added to a branch test/drain line for each of the upper instrument reference lines.

Technical Evaluation of Addition of IRWST Lower Narrow Range Level Instrumentation Channels

As described in UFSAR Subsection 6.3.7.4.3 and UFSAR Sections 7.2 and 7.5, there are four existing IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048) that perform the following safety-related functions:

a. These existing IRWST wide range level instrumentation channels are used to perform the ESFAS automatic actuation function to open the containment recirculation squib valves to provide redundant flow paths from the containment to the reactor on a two-out-of-four Low-3 IRWST level logic coincident with an automatic RCS depressurization (fourth stage automatic depressurization system (ADS) actuation signal). This ESFAS automatic actuation function is identified in COL Appendix C and plant-specific DCD Tier 1 Table 2.5.2-3 as “IRWST Containment Recirculation.”

b. Each existing IRWST wide range level instrumentation channel provides level indication in the main control room and provides a Low-2 IRWST level alarm, with three channels required to function short-term (24 hours), and two channels required to function long-term (4 months), following a design basis accident for performing the PAMS IRWST level instrumentation function.

This proposed change moves these design functions to the new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069), which are proposed to perform the safety-related functions previously performed by the existing IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048). Because of the narrow range of these instrumentation channels, they can accurately measure the Low-3 IRWST level setpoint within the bounds of the assumptions in the safety analysis, and provide a more accurate Low-2 IRWST level alarm function and PAMS monitoring function.

As described in UFSAR Section 7.2 and COL Appendix C and plant-specific DCD Tier 1 Subsection 2.5.2, the safety-related PMS initiates reactor trip and actuation of engineered safety features in response to plant conditions monitored by process instrumentation and provides safety-related displays. The PMS has the following affected safety-related functions:

a. The PMS initiates automatic actuation of engineered safety features, as identified in COL Appendix C and plant-specific DCD Tier 1 Table 2.5.2-3, when plant process signals reach specified limits.

b. The PMS provides capability for manual initiation of reactor trip and selected engineered safety features as identified in COL Appendix C and plant-specific DCD Tier 1 Table 2.5.2-4.

As described in UFSAR Subsections 6.3.1.1 and 6.3.2, the seismic Category I, safety-related PXS provides emergency core cooling during design basis events. The PXS has the following affected safety-related functions:

a. The PXS provides core decay heat removal during transients, accidents or whenever the normal heat removal paths are lost. The PRHR heat exchanger provides core decay heat removal during design basis events. This heat removal function is available at RCS conditions including shutdowns. During refueling operations, when the IRWST is drained into the refueling cavity, other passive means of core decay heat removal are utilized.

b. The PXS provides safety injection to the RCS to provide adequate core cooling for the complete range of loss of coolant accidents (LOCAs), up to and including the double-ended rupture of the largest primary loop RCS piping. The CMTs, accumulators, IRWST, and containment recirculation provide RCS makeup, boration, and safety injection during design basis events.

c. The PXS has the capability to bring the plant to a stable condition using the PRHR heat exchanger for events not involving a loss of coolant. For these events, the PXS, in conjunction with the passive containment cooling system (PCS), has the capability to establish safe shutdown conditions, cooling the RCS to about 420°F in 36 hours, with or without the reactor coolant pumps operating.

The PXS is designed to operate without the use of active equipment such as pumps and ac power sources. The PXS depends on reliable passive components and processes such as gravity injection and expansion of compressed gases. The PXS does require a one-time alignment of the fourth stage ADS squib valves, squib valves in the IRWST injection lines, and squib valves in the containment recirculation lines upon actuation of the specific components.

For LOCAs and other postulated events where ac power sources are lost, or when the CMT levels reach the ADS actuation setpoint, the ADS initiates. This results in injection from the accumulators and subsequently from the IRWST, once the RCS is nearly depressurized. For these conditions, the RCS depressurizes to saturated conditions at about 250°F within 24 hours. The PXS is designed to maintain this safe shutdown condition for the plant.

As described in UFSAR Subsection 6.3.1, the PXS is designed to perform its safety-related functions based on the following considerations:

a. The PXS has component redundancy to provide confidence that its safety-related functions are performed, even in the unlikely event of the most limiting single failure occurring coincident with postulated design basis events.

b. The PXS is designed to be sufficiently reliable, considering redundancy and diversity, to support the plant core melt frequency and significant release frequency goals.

As described in UFSAR Subsection 6.3.1.2, the safety-related PXS has the following additional design basis requirements:

a. The PXS is designed to be sufficiently reliable to support the probabilistic risk analysis (PRA) goals for core damage frequency (CDF) and severe release frequency. In assessing the reliability for PRA purposes, an analysis that is more realistic is used for both the PXS performance and for plant response.

b. In the event of a small LOCA, the PXS limits the increase in peak clad temperature and core uncovery with design basis assumptions. For pipe ruptures of less than eight-inch nominal diameter size, the PXS is designed to prevent core uncovery with best estimate assumptions.

c. The PRHR heat exchanger and the IRWST are designed to delay significant steam release to the containment for at least one hour.

As described in COL Appendix C and plant-specific DCD Tier 1 Subsection 2.2.3, the requirements for the PXS include the following affected design bases:

a. The seismic Category I equipment identified in Table 2.2.3-1 can withstand seismic design basis loads without loss of safety function. (Item 5.a)

b. The Class 1E equipment identified in Table 2.2.3-1 as being qualified for a harsh environment can withstand the environmental conditions that would exist before, during, and following a design basis accident without loss of safety function for the time required to perform the safety function. (Item 7.a)

c. The Class 1E components identified in Table 2.2.3-1 are powered from their respective Class 1E division. (Item 7.b)

d. Separation is provided between PXS Class 1E divisions, and between Class 1E divisions and non-Class 1E cable. (Item 7.c)

e. Safety-related displays of the parameters identified in Table 2.2.3-1 can be retrieved in the main control room (MCR). (Item 10)

As described in UFSAR Subsection 6.3.2.1.3, the IRWST is located in the containment at an elevation slightly above the RCS loop piping. RCS injection is possible only after the RCS has been depressurized by the ADS or by a loss of coolant accident. Squib valves in the IRWST injection lines open automatically on a fourth stage automatic depressurization signal. Check valves, arranged in series with the squib valves, open when the reactor pressure decreases to below the IRWST injection head.

After the accumulators, CMTs, and the IRWST inject, the containment is flooded up to a level sufficient to provide recirculation flow through the gravity injection lines back into the RCS.

The time that it takes until the initiation of containment recirculation flow varies greatly, depending on the specific event. With a break in a direct vessel injection line, the IRWST spills out through the break and floods the containment, along with RCS leakage, and recirculation can occur in several hours. In the event of automatic depressurization without a RCS break and with PXS condensate return, the IRWST level decreases very slowly. Recirculation may not initiate for several days.

Containment recirculation initiates when the recirculation line valves are open and the containment floodup level is sufficiently high. When the IRWST level decreases to a low level, the containment recirculation squib valves automatically open to provide redundant flow paths from the containment to the reactor.

These recirculation flow paths can also provide a suction flow path from the containment to the normal residual heat removal pumps, when they are operating after containment flood up. In addition, the squib valves in the recirculation paths containing normally open motor-operated valves can be manually opened to drain the IRWST to the reactor cavity during severe accidents. This action is modeled in the AP1000 PRA.

The four new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069) are proposed to perform the safety-related functions previously performed by the existing IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048). Because of the narrow range of these instrumentation channels, they can accurately measure the Low-3 IRWST level setpoint within the bounds of the assumptions in the safety analysis, and provide a more accurate Low-2 IRWST level alarm function and PAMS monitoring function.

The new IRWST lower narrow range level transmitters are similar to the existing IRWST wide range level transmitters, except that the instrument span is smaller at 35 inches verses the larger 24 foot span of the existing IRWST wide range level transmitters. Therefore, the instrument accuracy over the smaller span results in the new IRWST lower narrow range level transmitters having the capability with a Low-3 level setpoint of approximately 109'-3", including uncertainty, to not exceed the upper and lower bounding analytical limits (i.e., 107.8' to 110.0') of the existing safety analyses.

IRWST sloshing and steaming could have the potential to fill the upper instrument reference lines directly or through condensation in the lines, causing the instruments to indicate lower IRWST levels than actual. Therefore, the upper instrument reference lines for the four new IRWST lower narrow range level transmitters are left open to the containment atmosphere, are routed above the containment flood-up level, and are turned downward to prevent water or steam from entering. The IRWST is partially vented to the containment, and at steady-state or relatively slow changing containment pressure conditions there is no difference expected between containment and IRWST pressures. Therefore, this change to the upper instrument reference lines does not impact the accuracy and calculated uncertainty of the remaining IRWST wide range level instrumentation channels (PXS-046, PXS-047, and PXS-048) or the new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069). There is not a significant difference in the temperature and humidity levels during normal operations between the containment atmosphere and the IRWST air space. Therefore, venting the upper instrument reference lines to the containment atmosphere rather than to the IRWST air space does not increase the probability of condensate buildup in the upper instrument reference lines. The upper instrument reference lines for the four new IRWST lower narrow range level transmitters can be drained during outages through the added branch test/drain line for each of the upper instrument reference lines and normally closed IRWST lower narrow range level transmitter reference leg drain isolation valves (PXS-PL-V162A, PXS-PL-V162B, PXS-PL-V162C, and PXS-PL-V162D).

As described in COL Appendix C and plant-specific DCD Tier 1 Section 3.7, the Design Reliability Assurance Program (D-RAP) is a program that is being performed during the detailed design and equipment specification phase prior to initial fuel load. The D-RAP evaluates and sets priorities for the structures, systems, and components (SSCs) in the design, based on their degree of risk significance. The risk-significant components are listed in Table 3.7-1. Table 3.7-1 includes the four existing IRWST wide range level sensors (PXS-045, PXS-046, PXS-047, and PXS-048). The proposed four new IRWST lower narrow range level sensors (PXS-066, PXS-067, PXS-068, and PXS-069) are added to the D-RAP as they will perform the risk-significant functions previously performed by the four existing IRWST wide range level sensors (PXS-045, PXS-046, PXS-047, and PXS-048).

As described in UFSAR Table 3.11-1, the existing IRWST wide range level transmitters (PXS-JE-LT045, PXS-JE-LT046, PXS-JE-LT047, and PXS-JE-LT048) are required to be environmentally qualified to operate after a design basis accident in a harsh environment for a PAMS function with a required 4 month operating time, and for an ESFAS function with a required 24 hour operating time. The proposed four new IRWST lower narrow range level transmitters (PXS-JE-LT066, PXS-JE-LT067, PXS-JE-LT068, and PXS-JE-LT069) are specified to meet the same environmental qualification requirements, with the exception of a PAMS function, with only a required 24 hours operating time. Two of the three remaining IRWST wide range level transmitters (PXS-JE-LT047 and PXS-JE-LT048) remain required to be environmentally qualified for a PAMS function with a required 4 month operating time.

The proposed addition of the four new IRWST lower narrow range level instruments requires no change to the PRA. The four new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069) perform the same functions as the original four IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048) using the same number of separated and qualified safety-related instruments interfacing in the same channel configuration with PMS, which is employing the same two-out-of-four logic arrangement.

There is no interface between the four new IRWST lower narrow range level instruments and the diverse actuation system (DAS). Therefore, the design functions of the DAS to provide diverse manual actuation of the IRWST injection squib valves and the containment recirculation squib valves are not affected.

Based on the proposed design of the four new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069), including moving the Low-2 IRWST level alarm function and Low-3 IRWST level ESFAS automatic actuation function to open the containment recirculation squib valves from the original IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048), the proposed changes do not adversely affect the design functions of the PMS and the PXS described above. The proposed changes are acceptable as they address the accuracy required to initiate IRWST containment recirculation following a design basis accident in order to mitigate the consequences of the accident.

Licensing Basis Changes for Addition of IRWST Lower Narrow Range Level Instrumentation Channels

The following changes are proposed to address the addition of the four channels of IRWST lower narrow range level instrumentation:

1. COL Appendix C (and plant-specific DCD Tier 1) is revised as follows:
   a. Table 2.2.3-1 is revised to add IRWST Lower Narrow Range Level Sensor PXS-066, IRWST Lower Narrow Range Level Sensor PXS-067, IRWST Lower Narrow Range Level Sensor PXS-068 and IRWST Lower Narrow Range Level Sensor PXS-069, and to specify for each Seismic Category I, Class 1E, Qualified for Harsh Environment, and Safety-Related Display as Yes.
   b. Table 3.7-1 is revised to add IRWST Lower Narrow Range Level Sensors with Tag No. as PXS-066, PXS-067, PXS-068 and PXS-069.
2. COL Appendix A Technical Specifications are revised as follows:
   a. Technical Specifications Table 3.3.8-1 (Page 2) is revised to rename Engineered Safeguards Actuation System Instrumentation Function 18 IRWST Level - Low 3 as IRWST Lower Narrow Range Level - Low 3.
3. The UFSAR is proposed to be revised as follows:
   a. Table 3.2-3 is revised to add PXS-PL-V161A (IRWST Lower Narrow Range Level Transmitter A Isolation), PXS-PL-V161B (IRWST Lower Narrow Range Level Transmitter B Isolation), PXS-PL-V161C (IRWST Lower Narrow Range Level Transmitter C Isolation), PXS-PL-V161D (IRWST Lower Narrow Range Level Transmitter D Isolation), PXS-PL-V162A (IRWST Lower Narrow Range Level Transmitter A Reference Leg Isolation), PXS-PL-V162B (IRWST Lower Narrow Range Level Transmitter B Reference Leg Isolation), PXS-PL-V162C (IRWST Lower Narrow Range Level Transmitter C Reference Leg Isolation), and PXS-PL-V162D (IRWST Lower Narrow Range Level Transmitter D Reference Leg Isolation), and to specify for each AP1000 Class as C, Seismic Category as I, Principle Construction Code as ASME III-3, with no Comments.
   b. Table 3.11-1 is revised to add IRWST Lower Narrow Range Level PXS-JE-LT066, IRWST Lower Narrow Range Level PXS-JE-LT067, IRWST Lower Narrow Range Level PXS-JE-LT068, and IRWST Lower Narrow Range Level PXS-JE-LT069 to the list of Transmitters, and to specify for each Environmental Zone as 1, Function as ESF (Engineered Safety Feature) with Operating Time of 24 hours, Function as PAMS (Post-Accident Monitoring) with Operating Time of 24 hours, and Qualification Program as E* (Electrical Equipment Program Harsh Environment).
   c. Table 3.11-1 is revised to add IRWST Lower Narrow Range Level Transmitter A Isolation (PXS-PL-V161A), IRWST Lower Narrow Range Level Transmitter B Isolation (PXS-PL-V161B), IRWST Lower Narrow Range Level Transmitter C Isolation (PXS-PL-V161C), IRWST Lower Narrow Range Level Transmitter D Isolation (PXS-PL-V161D), IRWST Lower Narrow Range Level Transmitter A Reference Leg Isolation (PXS-PL-V162A), IRWST Lower Narrow Range Level Transmitter B Reference Leg Isolation (PXS-PL-V162B), IRWST Lower

Narrow Range Level Transmitter C Reference Leg Isolation (PXS-PL-V162C), and IRWST Lower Narrow Range Level Transmitter D Reference Leg Isolation (PXS-PL-V162D) to the list of Non-active Valves, and to specify for each Environmental Zone as 1, Function as PB (Pressure Boundary) with Operating Time of 1 yr, and Qualification Program as M* (Mechanical Equipment Program Harsh Environment).

d. Table 3I.6-2 is revised to add IRWST Lower Narrow Range Level PXS-JE-LT066, IRWST Lower Narrow Range Level PXS-JE-LT067, IRWST Lower Narrow Range Level PXS-JE-LT068, and IRWST Lower Narrow Range Level PXS-JE-LT069.

e. Table 3I.6-3 is revised to add IRWST Lower Narrow Range Level Transmitter A Isolation (PXS-PL-V161A), IRWST Lower Narrow Range Level Transmitter B Isolation (PXS-PL-V161B), IRWST Lower Narrow Range Level Transmitter C Isolation (PXS-PL-V161C), IRWST Lower Narrow Range Level Transmitter D Isolation (PXS-PL-V161D), IRWST Lower Narrow Range Level Transmitter A Reference Leg Isolation (PXS-PL-V162A), IRWST Lower Narrow Range Level Transmitter B Reference Leg Isolation (PXS-PL-V162B), IRWST Lower Narrow Range Level Transmitter C Reference Leg Isolation (PXS-PL-V162C), and IRWST Lower Narrow Range Level Transmitter D Reference Leg Isolation (PXS-PL-V162D), to the list of Nonactive Valves, and to specify for each 2 for the Comment.

f. Subsection 6.3.7.4.3 is revised to:

- Change the total number of level channels installed on the in-containment refueling water storage tank to nine, and to add the four new IRWST lower narrow range level channels used to provide containment recirculation valve repositioning, and
- Clarify that the existing two narrow range channels are “upper” narrow range “level” channels used to confirm that in-containment refueling water storage tank “normal” level is within the bounds of the assumptions used in the safety analysis.

g. Figure 6.3-2 is revised to add IRWST Lower Narrow Range Level LT066, LT067, LT068, and LT069, and specify as PMS instruments.

h. Figure 7.2-1 is revised to rename the level bistables for Low-3 IRWST level as Low-3 IRWST lower narrow range level.

i. Table 7.3-1 is revised to rename Actuation Signal for Low IRWST level (Low-3 setpoint) as Low IRWST lower narrow range level (Low-3 setpoint), for Actuation Signal 23, Open All Containment Recirculation Valves.

j. Table 7.5-1 is revised to add new Variable for IRWST lower narrow range water level, and specify Range/Status as 0-100% of span, Type/Category as D2, Environmental Qualification as Harsh, Seismic Qualification as Yes, Number of Instruments Required as 3 (Note 4), Power Supply as 1E, and QDPS Indication as No.

k. Table 7.5-7 is revised to rename Variable for IRWST water level as IRWST lower narrow range water level for the System listed as Safeguards.

I. Table 17.4-1 is revised to add System, Structure, or Component (SSC) for IRWST Lower Narrow Range Level (PXS-066, -067, -068, -069) for System: General I&C under Low Pressure/DP Sensors, to specify RAW/CCF for Rationale, and to remove Insights and Assumptions text stating "IRWST level supports IRWST recirculation actions" and revise text to state "These in-containment refueling water storage tank (IRWST) level sensors support PMS functions. They are used in automatic actuation of refueling cavity and SFS isolation, and IRWST recirculation actions, and IRWST recirculation actions, and they provide indications to the operator."

2.2 Changes to IRWST Wide Range Level Instrumentation Channels

As previously described, the existing IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048) cannot provide the ESFAS IRWST level Low-3 actuation setpoint within the accuracy assumed in the safety analysis. Therefore, the design is proposed to be changed as described above to add four IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069) to provide the Low-2 IRWST level alarm function, and to provide the Low-3 IRWST level ESFAS automatic actuation function to open the containment recirculation squib valves.

The PMS design is proposed to be changed to delete one of the four existing IRWST wide range level instrumentation channels (PXS-045), to rename the remaining instrumentation channels (PXS-046, PXS-047, and PXS-048) as IRWST wide range level instrumentation channels where not already specified, and to move the Low-2 IRWST level alarm function and Low-3 IRWST level ESFAS function to the new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069). This results in removal of IRWST wide range level transmitter isolation valves (PXS-PL-V150A and PXS-PL-V151A) for the one removed IRWST wide range level instrumentation channel (PXS-045).

The three remaining IRWST wide range level instrumentation channels (PXS-046, PXS-047, and PXS-048) remain specified and required to be qualified as Regulatory Guide 1.97, Revision 3, Type B1, D2, and F2 PAMS IRWST level instrumentation, with the three channels required to function short-term (24 hours), and two channels (PXS-047 and PXS-048) required to function long-term (4 months), following a design basis accident. As specified in UFSAR Table 7.5-1, Note 4, the number of instruments required after stable plant conditions is two (PXS-047 and PXS-048). The third channel (PXS-046) is available to resolve information ambiguity if necessary.

IRWST sloshing and steaming could have the potential to fill the upper instrument reference lines directly or through condensation in the lines, causing the instruments to indicate lower IRWST levels than actual. Therefore, the upper instrument reference lines for the three remaining IRWST wide range level transmitters are removed from connecting to the IRWST and are left open to the containment atmosphere. This results in removal of normally open IRWST wide range level transmitter isolation valves (PXS-PL-V150B, PXS-PL-V150C, and PXS-PL-V150D) that isolated the upper instrument reference lines for the remaining IRWST wide range level instrumentation channels (PXS-046, PXS-047, and PXS-048) from the IRWST. These valves were originally used for isolating the upper instrument reference lines from the IRWST during local calibration of the IRWST wide range level transmitters, and are no longer necessary for that purpose.

As previously described for the new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069), condensate buildup in the upper instrument reference lines is not a concern.

Technical Evaluation of Changes to IRWST Wide Range Level Instrumentation Channels

Based on deleting one of the IRWST wide range level instrumentation channels (PXS-045), moving the Low-2 IRWST level alarm function and Low-3 IRWST level ESFAS automatic actuation function to open the containment recirculation squib valves to the four new IRWST lower narrow range level instrumentation channels (PXS-066, PXS-067, PXS-068, and PXS-069), and the existing design of the three remaining IRWST wide range level instrumentation channels (PXS-046, PXS-047, and PXS-048), the proposed changes do not adversely affect the design functions of the PMS and the PXS described above. The proposed changes are acceptable as they retain the performance and qualification requirements required as Regulatory Guide 1.97, Revision 3, Type B1, D2, and F2 PAMS IRWST level instrumentation. The three remaining IRWST wide range level instrumentation channels (PXS-046, PXS-047, and PXS-048) remain specified and required to be qualified as Regulatory Guide 1.97, Revision 3, Type B1, D2, and F2 PAMS IRWST level instrumentation, with the three channels required to function short-term (24 hours), and two channels (PXS-047 and PXS-048) required to function long-term (4 months), following a design basis accident. As specified in UFSAR Table 7.5-1, Note 4, the number of instruments required after stable plant conditions is two (PXS-047 and PXS-048). The third channel (PXS-046) is available to resolve information ambiguity if necessary. For IRWST Wide Range Level PXS-JE-LT047 and IRWST Wide Range Level PXS-JE-LT048 retain an Engineered Safety Feature (ESF) Function with operating time of 24 hours (as shown on UFSAR Table 3.11-1) to address the addition of the new P-9 permissive and interlock for refueling cavity and SFS isolation actuated by the new PMS logic and the new Low IRWST wide range level setpoint, as described later.

Licensing Basis Changes for Changes to IRWST Wide Range Level Instrumentation Channels

The following changes are proposed to address the deletion of one channel and changes to name and functions of the remaining three channels of IRWST wide range level instrumentation:

1. COL Appendix C (and plant-specific DCD Tier 1) is revised as follows:
   a. Table 2.2.3-1 is revised to delete IRWST Level Sensor PXS-045, and to rename IRWST Level Sensor PXS-046, IRWST Level Sensor PXS-047, and IRWST Level Sensor PXS-048 as IRWST Wide Range Level Sensor PXS-046, IRWST Wide Range Level Sensor PXS-047, and IRWST Wide Range Level Sensor PXS-048, respectively.
   b. Table 3.7-1 is revised to delete IRWST Level Sensor PXS-045, and to rename IRWST Level Sensors as IRWST Wide Range Level Sensors for PXS-046, PXS-047, and PXS-048.
2. COL Appendix A Technical Specifications are revised as follows:
   a. Technical Specifications Table 3.3.17-1 (Page 1) is revised to rename Post-Accident Monitoring Instrumentation Function 11 In-Containment Refueling Water Storage Tank (IRWST) Water Level as In-Containment Refueling Water Storage Tank (IRWST) Wide Range Water Level.
3. The UFSAR is revised as follows:
   a. Table 3.2-3 is revised to delete PXS-PL-V150A and PXS-PL-V151A (IRWST Level Transmitter A Isolation), PXS-PL-V150B (IRWST Level Transmitter B Isolation), PXS-PL-V150C (IRWST Level Transmitter C Isolation), and PXS-PL-V150D (IRWST Level Transmitter D Isolation) from the list for the Passive Core Cooling System, and to rename PXS-PL-V151B (IRWST Level Transmitter B Isolation), PXS-PL-V151C, (IRWST Level Transmitter C Isolation), and PXS-PL-V151D (IRWST Level Transmitter D Isolation) as PXS-PL-V151B (IRWST Wide Range Level Transmitter B Isolation), PXS-PL-V151C (IRWST Wide Range Level Transmitter C Isolation), and PXS-PL-V151D (IRWST Wide Range Level Transmitter D Isolation), respectively, in the list for the Passive Core Cooling System.
   b. Table 3.11-1 is revised to delete IRWST Level PXS-JE-LT045, and to rename IRWST Level PXS-JE-LT046, IRWST Level PXS-JE-LT047, and IRWST Level PXS-JE-LT048 as IRWST Wide Range Level PXS-JE-LT046, IRWST Wide Range Level PXS-JE-LT047, and IRWST Wide Range Level PXS-JE-LT048, respectively, in the list of Transmitters.

c. Table 3.11-1 is revised to delete IRWST Level Transmitter A Isolation (PXS-PL-V150A and PXS-PL-V151A), IRWST Level Transmitter B Isolation (PXS-PL-V150B), IRWST Level Transmitter C Isolation (PXS-PL-V150C), and IRWST Level Transmitter D Isolation (PXS-PL-V150D) from the list of Non-active Valves, and to rename IRWST Level Transmitter B Isolation (PXS-PL-V151B), IRWST Level Transmitter C Isolation (PXS-PL-V151C), and IRWST Level Transmitter D Isolation (PXS-PL-V151D) as IRWST Wide Range Level Transmitter B Isolation (PXS-PL-V151B), IRWST Wide Range Level Transmitter C Isolation (PXS-PL-V151C), and IRWST Wide Range Level Transmitter D Isolation (PXS-PL-V151D), respectively, in the list of Non-active Valves.

d. Table 3I.6-2 is revised to delete IRWST Level PXS-JE-LT045, and to rename remaining as IRWST Wide Range Level PXS-JE-LT046, IRWST Wide Range Level PXS-JE-LT047, and IRWST Wide Range Level PXS-JE-LT048.

e. Table 3I.6-3 is revised to delete IRWST Level Transmitter A Isolation (PXS-PL-V150A and PXS-PL-V151A), IRWST Level Transmitter B Isolation (PXS-PL-V150B), IRWST Level Transmitter C Isolation (PXS-PL-V150C), and IRWST Level Transmitter D Isolation (PXS-PL-V150D), from the list of Nonactive Valves, and to rename IRWST Level Transmitter B Isolation (PXS-PL-V151B), IRWST Level Transmitter C Isolation (PXS-PL-V151C), and IRWST Level Transmitter D Isolation (PXS-PL-V151D) as IRWST Wide Range Level Transmitter B Isolation (PXS-PL-V151B), IRWST Wide Range Level Transmitter C Isolation (PXS-PL-V151C), and IRWST Wide Range Level Transmitter D Isolation (PXS-PL-V151D), respectively, in the list of Nonactive Valves

f. Subsection 6.3.7.4.3 is revised to change the total number of level channels installed on the in-containment refueling water storage tank to nine, and specify that there are three remaining IRWST wide range level channels.

g. Figure 6.3-2 is revised to delete IRWST Wide Range Level LT045.

h. Table 7.5-1 is revised to rename Variable for IRWST water level as IRWST wide range water level.

i. Table 7.5-5 is revised to rename Variable for IRWST water level as IRWST wide range water level for the Function Monitored listed as Heat Sink Maintenance.

j. Table 7.5-7 is revised to add Variable for IRWST wide range water level with D2 for Type/Category for the System listed as Safeguards.

k. Table 7.5-9 is revised to rename Variable for IRWST water level as IRWST wide range water level for the Variable listed as Monitoring for preplanned manual nonsafety-related system actions.

l. Table 9A-2 is revised to rename Description for IRWST Level as IRWST Wide Range Level for Fire Area/Fire Zone 1000 AF 01/1100 AF 11300A and Fire Area/Fire Zone 1000 AF 01/1100 AF 11300B and System PXS, and to delete LT-045 for Fire Area/Fire Zone 1000 AF 01/1100 AF 11300B.

m. Table 17.4-1 is revised to rename System, Structure, or Component (SSC) for IRWST level sensors as IRWST Wide Range Level for System: General I&C under Low Pressure/DP Sensors, to delete PXS-045.

2.3 Addition of P-9 Permissive and Interlock for, and Renaming of, Low-2 Steam Generator Narrow Range Water Level Reactor Trip

The existing Low Steam Generator Water Level Trip reactor trip actuation name is proposed to be changed to Low-2 Steam Generator Narrow Range Water Level Trip in the COL Appendix C and Plant-specific DCD Tier 1, COL Appendix A Technical Specifications, and UFSAR where necessary for consistency with standard nomenclature. The current licensing basis is not consistent when referring to this setpoint designator. For example, a given setpoint may be referred to with its specific designator, such as Low-2, but in other instances it is referred to with the generic "low." Therefore, it is necessary to revise some generic "low" references to avoid any confusion as to which specific setpoint designator is used for a given PMS function. In addition, the format used for the setpoint designator is inconsistent, including the lack of using narrow range where applicable. In some instances a given setpoint designator is used for more than one setpoint. To avoid confusion and address the human factor issues related to labeling different setpoints with the same setpoint designator, a given setpoint is referred to with its own unique setpoint designator in the proposed licensing basis changes and throughout this discussion.

As described in UFSAR Subsection 7.2.1.1.5, a loss of heat sink reactor trip is actuated by the PMS from low (proposed to be revised to Low-2, with "Low-2" used throughout the remaining discussion) steam generator narrow range water level in any steam generator. This trip protects the reactor from loss of heat sink in the event of a loss of feedwater to the steam generators. The reactor is tripped when two-out-of-four steam generator narrow range water level sensors in any steam generator produce signals below the setpoint value. UFSAR Figure 7.2-1, sheet 7, shows the logic for the trip. There are no existing interlocks or permissives associated with this trip.

Routine maintenance and testing is typically performed for the steam generators, and associated feedwater and steam systems, in MODES 4, 5, and 6 when the normal residual heat removal system (RNS) is in service. This may include draining the secondary side of the steam generators, which could result in undesired and unnecessary Low-2 steam generator narrow range water level reactor trips to occur. However, the design of the PMS does not allow blocking of a loss of heat sink reactor trip from Low-2 steam generator narrow range water level in any steam generator during routine operations, maintenance, or testing performed during shutdown.

Therefore, the PMS design is proposed to be changed so that a loss of heat sink reactor trip from Low-2 steam generator narrow range water level in any steam generator can be manually blocked when T_{avg} is below the P-9 permissive setpoint of 200°F, and is automatically unblocked when T_{avg} is above the P-9 permissive.

Technical Evaluation of Addition of P-9 Permissive and Interlock for, and Renaming of, Low-2 Steam Generator Narrow Range Water Level Reactor Trip

The existing Low Steam Generator Water Level Trip reactor trip actuation name is proposed to be changed to Low-2 Steam Generator Narrow Range Water Level Trip. Both the “Low-2” and “narrow range” designation is revised and/or added as necessary for clarification, in the COL Appendix C and Plant-specific DCD Tier 1, COL Appendix A Technical Specifications, and UFSAR for consistency with standard nomenclature. There is no change to the actual setpoint value for this safety-related loss of heat sink reactor trip between the existing Low steam generator water level reactor trip and the proposed Low-2 steam generator narrow range water level reactor trip setpoint. Nor does this activity change the setpoint value assumed in the safety analysis. Therefore, there is no change to the physical design of the steam generator level instrumentation, only a change to the name of this actuation setpoint in the licensing basis from the existing level instrumentation name. These changes do not impact any setpoint, but provide clarity to the licensing basis so that it is clear which setpoint designator is used for the specified PMS reactor trip functions. The proposed change is consistent with the PMS design.

As described in UFSAR Subsection 7.2.1, considerations, such as mechanical or hydraulic limitations on equipment or heat transfer requirements on the reactor core, define a safe operating region for the plant. Maneuvering of the plant within this safe operating region is permitted in response to normal power generation demands. The plant design provides margin to the safety limits so that an unsafe condition is not caused by the transients induced by normal operating changes. The PLS attempts to keep the reactor operating away from any safety limit. Excursions toward a limit occur because of abnormal demands, malfunctions in the control system, or by severe transients induced by occurrence of a Condition II or III event, as discussed in UFSAR Chapter 15. Hypothetical events (Condition IV) are analyzed with respect to plant safety limits. Conditions that result in a reactor trip are listed in UFSAR Table 15.0-6. This table correlates the accident conditions (II, III, or IV events) to each reactor trip. The RTS keeps the reactor within the safe region by shutting down the reactor whenever safety limits are approached. Reactor trip is a protective function performed by the PMS when it anticipates an approach of a parameter to its safety limit. Reactor shutdown occurs when electrical power is removed from the rod drive mechanism coils, allowing the rods to fall by gravity into the reactor core.

The PMS initiates a reactor trip whenever a condition monitored by the system reaches a preset level. The reactor trips are listed in UFSAR Table 7.2-2 and are discussed in UFSAR Subsection 7.2.1.1. The variables which are monitored for these trips are listed in UFSAR Subsection 7.2.1.2.2. UFSAR Table 7.2-1 lists the ranges, accuracies, and response times for these variables.

As described in UFSAR Table 15.0-6 and Section 15.2, the Low-2 steam generator low narrow range water level in any steam generator reactor trip function is credited in the analysis of design basis events involving decrease in heat removal by the secondary system. This includes the following events:

- Loss of external load/turbine trip (UFSAR Subsections 15.2.2 and 15.2.3),
- Loss of nonemergency ac power to the station auxiliaries (UFSAR Subsection 15.2.6),
- Loss of normal feedwater flow (UFSAR Subsection 15.2.7), and
- Feedwater system pipe break (UFSAR Subsection 15.2.8).

As described in UFSAR Subsection 7.2.1.1.12, interlocks used in the reactor trip functions are designated as P-xx permissives. UFSAR Table 7.2-3 provides a listing of these interlocks. Manual blocks to reactor trip are listed on UFSAR Table 7.2-4.

As described in COL Appendix A Technical Specifications Table 3.3.1-1, the Reactor Trip System Instrumentation Function 10 (Low-2 steam generator narrow range water level) is required to be OPERABLE in MODES 1 and 2. As defined in Technical Specification Table 1.1-1, MODES 1 and 2 are when reactivity condition (k_{eff}) is greater than or equal to 0.99. Prior to reaching MODE 2 with k_{eff} greater than or equal to 1.0 during startup (i.e., the reactor reaching criticality), COL Appendix A Technical Specifications 3.4.2 requires that the T_{avg} in each reactor coolant system loop be verified to be greater than or equal to 551°F. The addition of the P-9 permissive and interlock to allow manual blocking of the loss of heat sink reactor trip during shutdown allows routine maintenance and testing of the steam generators, and associated feedwater and steam systems, while preventing undesired and unnecessary Low-2 steam generator narrow range water level reactor trips.

Therefore, it is acceptable to allow manual block of the loss of heat sink reactor trip from Low-2 steam generator narrow range water level signals when T_{avg} is less than 200°F because:

1. The Low-2 steam generator narrow range water level reactor trip is only required to be operable in MODES 1 or 2, and the P-9 permissive is at an RCS average temperature of 200°F, which is below the required T_{avg} temperature to operate the plant in MODES 1 or 2 of greater than or equal to 551°F; and
2. The accident analyses in UFSAR Chapter 15 only require this reactor trip for events occurring in MODES 1 or 2.

The proposed changes do not adversely affect the design functions of the Low-2 steam generator narrow range water level reactor trip function described above. The proposed changes are acceptable as they allow blocking of an RTS function that is not applicable during shutdown conditions, while automatically reinstating the RTS function prior to reaching the MODES required for this RTS function during plant startup.

Licensing Basis Changes for Addition of P-9 Permissive and Interlock for, and Renaming of, Low-2 Steam Generator Narrow Range Water Level Reactor Trip

The following changes are proposed to address the addition of the new P-9 permissive and interlock for the existing loss of heat sink reactor trip:

1. COL Appendix C (and plant-specific DCD Tier 1) is revised as follows:
   a. Table 2.5.2-2 is revised to rename Low Steam Generator Water Level Trip as Low-2 Steam Generator Narrow Range Water Level Trip for PMS Automatic Reactor Trips.
   b. Table 2.5.2-6 is revised to add Low-2 Steam Generator Water Level Trip under Reactor Trip Functions for PMS Blocks.
2. COL Appendix A Technical Specifications are revised as follows:
   a. Technical Specifications Table 3.3.1-1 is revised to change the name of Function 10 from Steam Generator (SG) Narrow Range Water Level – Low to Steam Generator (SG) Narrow Range Water Level – Low 2.
3. The UFSAR is revised as follows:
   a. Subsection 7.2.1.1.5 is revised to add manual block and automatic unblock for the existing Low water level in any steam generator signal for loss of heat sink reactor trip below and above the P-9 permissive and interlock, respectively, to change the name to Low-2 steam generator narrow range water level in any steam generator, to rename water level sensors as narrow range water level sensors in one place, to delete the statement that there are no interlocks or permissives associated with this trip, and to add reference to UFSAR Figure 7.2-1, Sheet 7, for development of the new P-9 permissive and interlock.
   b. Subsection 7.2.1.1.12 is revised to add a description of the steam generator Low-2 water level block (one control for each division) including stating that the steam generator Low-2 reactor trip may be manually blocked upon the occurrence of the P-9 permissive, that this trip function is automatically reset when the permissive condition is not met, and that Figure 7.2-1, sheet 7, illustrates the functional logic relating to this function.
   c. Table 7.2-2 is revised to add P-9 permissive and interlock to the existing Low Steam Generator Water Level signal for loss of heat sink reactor trip, and to change the name to Low-2 Steam Generator Narrow Range Water level.
   d. Table 7.2-3 is revised to add $\overline{\text{P-9}}$ permissive for T_{avg} below setpoint, with function to allow manual block of the Low-2 steam generator narrow range water level reactor trip, and to add P-9 interlock for T_{avg} above setpoint, with function to automatically unblock the Low-2 steam generator narrow range water level reactor trip.
   e. Table 7.2-4 is revised to add the new Low Steam Generator Level PRHR Actuation Block (on P-9 below setpoint), Divisions A through D, to system-level manual inputs to the reactor trip functions, and add reference to UFSAR Figure 7.2-1, Sheet 7.

f. Figure 7.2-1 (Sheet 2) is revised to change the name of the existing Low steam generator water level reactor trip to Low-2 steam generator water level.

g. Figure 7.2-1 (Sheet 7) is revised to add the new P-9 permissive and interlock to the existing Low steam generator water level (narrow range) reactor trip including the low steam generator level PRHR actuation block control (as shown on UFSAR Figure 7.2-1 (Sheets 2 and 7)), and to change the name to Low-2 steam generator water level (narrow range) reactor trip.

h. Section 7A.8 is added to address changes required to WCAP-16675 (Proprietary and Non-Proprietary), AP1000 Protection and Safety Monitoring System Architecture Technical Report, as follows:

WCAP-16675-P and WCAP-16675-NP, "AP1000 Protection and Safety Monitoring System Architecture Technical Report"

The UFSAR incorporates by reference Tier 2 documents WCAP-16675-P and WCAP-16675-NP, "AP1000 Protection and Safety Monitoring System Architecture Technical Report." See Table 1.6-1. WCAP-16675, Revision 5, includes the following revisions and additions as indicated by strikethroughs and underlines.

- Revise Section 1.1, Reactor Trip Functions, as follows:

The PMS generates an automatic reactor trip for the following conditions ***:

* * *

14. ~~Reactor Trip on Low Water Level in any~~ Steam Generator <u>1 Water Level Low-2</u> as described in Reference 9.

<u>15. Steam Generator 2 Water Level Low-2 as described in Reference 9.</u>

i. Table 15.0-4a (Sheet 1) is revised to rename low steam generator narrow range level as Low-2 steam generator narrow range water level in two places.

j. Table 15.0-6 (Sheet 2) is revised to rename Steam generator low narrow range level as Low-2 steam generator narrow range water level in four places.

k. Subsection 15.2.3.2.1 is revised to rename low steam generator water level as Low-2 steam generator narrow range water level in one place.

l. Subsection 15.2.7.1 is revised to rename low steam generator water level as Low-2 steam generator narrow range water level in one place.

m. Subsection 15.2.7.2.1 is revised to rename steam generator low (narrow range) level as Low-2 steam generator narrow range water level in one place.

n. Subsection 15.2.7.2.2 is revised to rename low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

o. Subsection 15.2.8.1 is revised to rename low steam generator level (narrow range) as Low-2 steam generator narrow range water level in one place, and Low steam generator water level as Low-2 steam generator narrow range water level in one place.

p. Subsection 15.2.8.2.1 is revised to rename low steam generator narrow range level as Low-2 steam generator narrow range water level in one place.

q. Subsection 15.2.8.2.2 is revised to rename low steam generator water level as Low-2 steam generator water level in one place.

r. Table 15.2-1 (Sheet 5) is revised to rename Low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

s. Table 15.2-1 (Sheet 6) is revised to rename Low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

t. Table 15.2-1 (Sheet 7) is revised to rename Low steam generator water level as Low-2 steam generator narrow range water level in one place.

u. Table 15.2-1 (Sheet 8) is revised to rename Low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

v. Subsection 19E.4.3.2 is revised to rename low steam generator level as Low-2 steam generator narrow range water level in one place.

w. Subsection 19E.4.3.3 is revised to rename low steam generator level as Low-2 steam generator narrow range water level in one place.

x. Subsection 19E.4.3.4 is revised to rename low steam generator level as Low-2 steam generator narrow range water level in one place.

y. Table 19E.4.10-1 is revised to rename Low steam generator water level (narrow-range) as Low-2 steam generator narrow range water level in one place.

2.4 Addition of ESFAS P-9 Permissive and Interlock for CMT Actuation, Reactor Coolant Pump Trip, PRHR Heat Exchanger Actuation, and BDS Isolation

The existing Low steam generator wide range water level and Low steam generator narrow range water level setpoint ESFAS automatic actuation names are proposed to be changed to Low-2 steam generator wide range water level and Low-2 steam generator narrow range water level, respectively, and to designate as wide range or narrow range as necessary for clarification, in the COL Appendix A Technical Specifications, and UFSAR where necessary for consistency with standard nomenclature. The current licensing basis is not consistent when referring to these setpoint designators. For example, a given setpoint may be referred to with its specific designator, such as Low-2, but in other instances it is referred to with the generic “low.” Therefore, it is necessary to revise some generic “low” references to avoid any confusion as to which specific setpoint designator is used for a given PMS function. In addition, the format used for the setpoint designator is inconsistent, including the lack of using

wide range or narrow range where applicable. In some instances a given setpoint designator is used for more than one setpoint. To avoid confusion and address the human factor issues related to labeling different setpoints with the same setpoint designator, a given setpoint is referred to with its own unique setpoint designator in the proposed licensing basis changes and throughout this discussion.

As described in UFSAR Subsection 7.3.1.2.3, the PMS signals for CMT actuation include low (proposed to be revised to Low-2, with "Low-2" used throughout the remaining discussion) steam generator wide range water level; requiring both steam generator 1 and steam generator 2 wide range water level below the Low-2 setpoint (derived from two of the four wide range water level measurement divisions for each steam generator).

As described in UFSAR Subsection 7.3.1.2.5, the PMS signals for reactor coolant pump trip include Low-2 steam generator wide range water level; requiring both steam generator 1 and steam generator 2 wide range water level below the Low-2 setpoint (derived from two of the four wide range water level measurement divisions for each steam generator).

As described in UFSAR Subsection 7.3.1.2.7, the PMS signals for PRHR heat exchanger actuation include Low-2 steam generator wide range level and Low-2 steam generator narrow range level coincident with a startup feedwater flow signal. PRHR heat exchanger actuation opens the PRHR discharge isolation valves, closes the IRWST gutter isolation valves, and provides a confirmatory open signal to the PRHR inlet isolation valve. The inlet isolation valve is normally open but can be closed by the operator. PRHR heat exchanger actuation overrides any closure signal to this valve. The Low-2 steam generator wide range water level signals result from the coincidence of two of the four divisions of steam generator wide range level below the Low-2 setpoint in either of the two steam generators. The Low-2 steam generator narrow range water level signals result from the coincidence of two of the four divisions of steam generator narrow range level below the Low-2 setpoint, after a preset time delay, coincident with a startup feedwater flow signal in a particular steam generator. This function is provided for each of the two steam generators.

As described in UFSAR Subsection 7.3.1.2.11, the PMS signals for BDS isolation include PRHR heat exchanger actuation and Low-2 steam generator narrow range water level. PRHR heat exchanger actuation closes the blowdown isolation valves in both steam generators. The Low-2 steam generator narrow range level closes the blowdown isolation valves only for the affected steam generator.

Routine maintenance and testing is typically performed for the steam generators, and associated feedwater and steam systems, in MODES 4, 5, and 6 when RNS is in service. This may include draining the secondary side of the steam generators, which could result in undesired and unnecessary Low-2 steam generator wide range level or Low-2 steam generator narrow range level ESFAS actuations to occur. However, the design of the PMS does not allow blocking of Low-2 steam generator wide range water level or Low-2 steam generator narrow range water level ESFAS automatic actuations during routine operations, maintenance, or testing performed during shutdown.

Therefore, the PMS design is proposed to be changed so that:

a. CMT actuation and reactor coolant pump trip from Low-2 steam generator wide range level signals can be manually blocked when T_{avg} is below the P-9 permissive setpoint of 200°F, and automatically unblocked when T_{avg} is above the P-9 permissive;

b. PRHR heat exchanger actuation (and subsequent BDS isolation) from either Low-2 steam generator wide range level or Low-2 steam generator narrow range level signals can be manually blocked when T_{avg} is below the P-9 permissive setpoint of 200°F, and automatically unblocked when T_{avg} is above the P-9 permissive; and

c. BDS isolation from Low-2 steam generator narrow range level signals can be manually blocked when T_{avg} is below the P-9 permissive setpoint of 200°F, and automatically unblocked when T_{avg} is above the P-9 permissive.

<u>Technical Evaluation of Addition of P-9 Permissive and Interlock for CMT Actuation (Including Reactor Coolant Pump Trip), PRHR Heat Exchanger Actuation, and BDS Isolation</u>

The existing Low steam generator wide range water level and Low steam generator narrow range water level setpoint actuation names are proposed to be changed to Low-2 steam generator wide range water level and Low-2 steam generator narrow range water level, respectively, and to designate as wide range or narrow range as necessary for clarification, in the COL Appendix A Technical Specifications, and UFSAR where necessary for consistency with standard nomenclature. There are no changes to the actual setpoint values for the safety-related loss of heat sink ESFAS automatic actuations between the existing Low steam generator wide range water level and Low steam generator narrow range water level setpoints and the proposed Low-2 steam generator wide range water level and Low-2 steam generator narrow range water level setpoints. Nor does this activity change the setpoint values assumed in the safety analysis. Therefore, there is no change to the physical design of the steam generator level instrumentation, only a change to the names of the actuation setpoints in the licensing basis from existing level instrumentation. Thus, these are administrative changes only. These changes do not impact any setpoint, but provide clarity to the licensing basis so that it is clear which setpoint designator is used for the specified PMS ESFAS automatic actuation functions. The proposed setpoint names are in agreement with the plant design.

The PMS initiates ESFAS actuations whenever a condition monitored by the system reaches a preset level. The ESFAS actuations are listed in UFSAR Table 7.3-1, and the ESFAS actuations and variables which are monitored for these ESFAS actuations are discussed in UFSAR Subsection 7.3.1.2. UFSAR Table 7.3-4 lists the ranges, accuracies, and response times for these variables.

As described in UFSAR Subsection 6.3.2.1.2, the CMTs provide RCS makeup and boration during events not involving loss of coolant when the normal makeup system is unavailable or insufficient. The boration capability of these tanks provides adequate core shutdown margin following a steam line break. The CMTs automatically provide injection to the RCS as the temperature decreases and pressurizer level decreases.

As described in UFSAR Subsection 6.3.1.1.1, the PRHR heat exchanger automatically actuates to provide RCS cooling and to prevent water relief through the pressurizer safety valves for postulated non-LOCA events, where a loss of capability to remove core decay heat via the steam generators occurs. During a steam generator tube rupture event, the PRHR heat exchanger removes core decay heat and reduces RCS temperature and pressure, equalizing with steam generator pressure and terminating break flow, without overfilling the steam generator.

As described in UFSAR Subsection 6.2.3.3, the BDS isolation valves and piping are designed to prevent uncontrolled blowdown from more than one steam generator. For main steam-line breaks upstream of an isolation valve, uncontrolled blowdown from more than one steam generator is prevented by BDS isolation, as well as the main steam line isolation valves, main steam line isolation valve bypass valves, and main feedwater isolation valves.

The addition of the P-9 permissive and interlock to allow manual blocking of the Low-2 steam generator wide range water level or Low-2 steam generator narrow range water level ESFAS automatic actuations during shutdown allows routine maintenance and testing of the steam generators, and associated feedwater and steam systems, while preventing undesired and unnecessary Low-2 steam generator wide range water level and Low-2 steam generator narrow range water level ESFAS automatic actuations. CMT actuation and reactor coolant pump trip on Low-2 steam generator wide range water level are not required to be OPERABLE by the COL Appendix A Technical Specifications Limiting Conditions for Operation (LCO) 3.3.8 requirements. However, this ESFAS automatic actuation is modeled in the PRA for several initiating events in the following fault tree and containment event tree models:

- Failure of the CMT subsystem to inject water into the RCS following a transient with failure of all heat removal capability and anticipated transient without scram (Fault Tree CM2AB);
- Failure of the CMT subsystem to inject water into the RCS following a loss of offsite power (Fault Tree CM2P);
- Failure to trip all four RCPs (Fault Tree RCT); and
- Post-core damage RCS depressurization following system recovery of anticipated transient without scram (Containment Event Tree DP/ADALT).

The PRA models these events as transients that disrupt normal plant operation sufficiently to cause reactor trip and require decay heat removal, but do not directly result in a LOCA. Therefore, these events are all assumed to occur during power operations when reactor trip and subsequent decay heat removal ESFAS automatic actuations are required to be OPERABLE. As shown in COL Appendix A Technical Specifications Table 3.3.1-1, reactor trip from any of the specified RTS functions is only required to be OPERABLE in MODES 1 and 2. In addition, the decay heat removal ESFAS automatic actuations credited in the PRA include those that are Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS automatic actuation functions. As shown in COL Appendix A Technical Specifications Table 3.3.8-1, Functions 20 and 21, the Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS automatic actuation functions are only required to be OPERABLE in MODES 1, 2, 3, and 4 (with the RCS not being cooled by the RNS). In MODE 4 when the RCS is being cooled by the RNS, and in MODES 5 and 6, the steam generators are not required to provide the normal RCS heat sink. In addition, the RCS could be at a reduced inventory during a refueling or plant maintenance outage. If the CMTs are actuated when the RCS is in a reduced inventory condition, the water in the CMTs drains into the RCS and could cause an undesirable increase in inventory.

Therefore, it is acceptable to allow manual block of CMT actuation and reactor coolant pump trip from Low-2 steam generator wide range water level signals when T_{avg} is less than 200°F because:

1. There are no COL Appendix A Technical Specifications LCO 3.3.8 requirements for this ESFAS automatic actuation function;
2. The PRA assumes this ESFAS automatic actuation function for events that occur during power operations when reactor trip and the decay heat removal ESFAS automatic actuations are required to be OPERABLE; and
3. The steam generators have limited capability to remove core decay heat at an RCS T_{avg} of 200°F or less (i.e., below the P-9 permissive).

CMT manual actuation and reactor coolant pump trip capability is not allowed to be blocked in any mode by the proposed PMS design.

As shown in COL Appendix A Technical Specifications Table 3.3.8-1, Functions 20 and 21, the Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS automatic actuation functions are only required to be OPERABLE in MODES 1, 2, 3, and 4 (with the RCS not being cooled by the RNS). In MODE 4 when the RCS is being cooled by the RNS, and in MODES 5 and 6, the steam generators are not required to provide the normal RCS heat sink. In addition, the RCS could be at a reduced inventory during a refueling or plant maintenance outage. If the PRHR heat exchanger is actuated when the RCS is in a reduced inventory condition, the water in the PRHR heat exchanger drains into the RCS and could cause an undesirable increase in inventory.

Therefore, it is acceptable to allow manual block of PRHR heat exchanger actuation and BDS isolation from Low-2 steam generator wide range water level or Low-2 steam generator narrow range water level signals when T_{avg} is less than 200°F because:

1. The Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS automatic actuation functions are only required to be operable in MODES 1, 2, 3, and 4 (with the RCS not being cooled by RNS): and
2. The steam generators have limited capability to remove core decay heat at an RCS T_{avg} of 200°F or less (i.e., below the P-9 permissive).

PRHR heat exchanger manual actuation capability and BDS manual isolation capability are not allowed to be blocked by the proposed PMS design.

The proposed changes do not adversely affect the design functions of the ESFAS Low-2 wide range steam generator level and Low-2 narrow range steam generator level functions described above. The proposed changes are acceptable, as they allow blocking of ESFAS functions that are not applicable during cold shutdown conditions, while automatically reinstating the ESFAS functions prior to reaching the MODES required for these ESFAS functions during plant startup.

Licensing Basis Changes for Addition of P-9 Permissive and Interlock for CMT Actuation (Including Reactor Coolant Pump Trip), PRHR Heat Exchanger Actuation, and BDS Isolation

The following changes are proposed to address the addition of the new P-9 permissive and interlock for the existing CMT actuation logic (including reactor coolant pump trip), the existing PRHR heat exchanger actuation logic, and the existing closure of steam generator blowdown valves on either both or the affected steam generator logic:

1. COL Appendix A Technical Specifications are revised as follows:
   a. Technical Specifications Table 3.3.8-1 (Page 2) is revised to change the name of Function 20 from SG Narrow Range Water Level – Low to SG Narrow Range Water Level – Low 2.
   b. Technical Specifications Table 3.3.8-1 (Page 2) is revised to change the name of Function 21 from SG Wide Range Water Level – Low to SG Wide Range Water Level – Low 2.
2. The UFSAR is revised as follows:
   a. Subsection 6.3.3 is revised to rename steam generator low narrow range level as Low-2 steam generator narrow range water level in one place, and steam generator low wide range level as Low-2 steam generator wide range level in two places.
   b. Subsection 6.3.3.4.1 is revised to rename low steam generator water level as Low-2 steam generator narrow range water level in one place.
   c. Subsection 7.1.7 is revised to add the statement “(as modified by changes provided in UFSAR Appendix 7A)” for Reference 19, WCAP-16675-P (Proprietary) and WCAP-16675-NP (Non-Proprietary), AP1000 Protection and Safety Monitoring System Architecture Technical Report, Revision 5.

d. Figure 7.2-1 (Sheet 7) is revised to add the new P-9 permissive and interlock to the existing PRHR heat exchanger actuation logic from a Low steam generator water level (narrow range) signal coincident with a startup feedwater flow signal in either steam generator 1 or 2 (as shown on UFSAR Figure 7.2-1 (Sheets 7 and 8)), and to change the name to Low-2 steam generator water level (narrow range).

e. Figure 7.2-1 (Sheet 7) is revised to add the new P-9 permissive and interlock from a Low steam generator water level (narrow range) signal in either steam generator 1 or 2 (as shown on UFSAR Figure 7.2-1 (Sheets 7 and 8)), and to change the name to Low-2 steam generator water level (narrow range).

f. Figure 7.2-1 (Sheet 7) is revised to add the new P-9 permissive and interlock from either a Low steam generator 1 water level (wide range) signal or a Low steam generator 2 water level (wide range) signal and to change the names to Low-2 steam generator 1 water level (wide range) and Low-2 steam generator 2 water level (wide range).

g. Figure 7.2-1 (Sheet 7) is revised to add the new P-9 permissive and interlock to the existing Low steam generator 1 water level (wide range) signal and a Low steam generator 2 water level (wide range) signals and to change the name to Low-2 steam generator 1 water level (wide range) and Low-2 steam generator water level (wide range).

h. Figure 7.2-1 (Sheet 8) is revised to change the name of the existing Low steam generator 1 water level (narrow range), Low steam generator 2 water level (narrow range), Low steam generator 1 water level (wide range), and Low steam generator 2 water level (wide range) to Low-2 steam generator 1 water level (narrow range), Low-2 steam generator 2 water level (narrow range), Low-2 steam generator 1 water level (wide range), and Low-2 steam generator 2 water level (wide range).

i. Figure 7.2-1 (Sheet 12) is revised to change the name of the existing Low steam generator level to Low-2 steam generator wide range level.

j. Subsection 7.3.1.2.3 is revised to add manual block and automatic unblock for the existing Low wide range steam generator level signal for CMT actuation logic below and above P-9 permissive and interlock, respectively, and to change the name to Low-2 in one place, to rename wide range level as wide range water level in one place, and to add reference to UFSAR Figure 7.2-1, Sheet 7, for development of the new P-9 permissive and interlock.

k. Subsection 7.3.1.2.5 is revised to change the name of the existing Low wide range steam generator level signal for reactor coolant pump trip to Low-2 steam generator wide range water level in one place, to change Low to Low-2 in one place, and to rename wide range level as wide range water level in one place.

l. Subsection 7.3.1.2.7 is revised to add manual block and automatic unblock for the existing Low wide range steam generator level signal for PRHR actuation logic below and above P-9 permissive and interlock, respectively, to change the name to Low-2 steam generator wide range level in two places, to rename wide range steam generator level below the Low setpoint as steam generator wide range water level below the Low-2 setpoint in one place, and to add reference to UFSAR Figure 7.2-1, Sheet 7, for development of the new P-9 permissive and interlock.

m. Subsection 7.3.1.2.7 is revised to add manual block and automatic unblock for the existing Low narrow range steam generator level signal for PRHR heat exchanger actuation logic below and above P-9 permissive and interlock, respectively, to change the name to Low-2 steam generator narrow range level in three places, to rename narrow range steam generator level below the Low setpoint as steam generator narrow range water level below the Low-2 setpoint in one place, and to add reference to UFSAR Figure 7.2-1, Sheet 7, for development of the new P-9 permissive and interlock.

n. Subsection 7.3.1.2.11 is revised to add manual block and automatic unblock for the existing Low narrow range steam generator level signal for closure of steam generator blowdown valves for the affected steam generator below and above P-9 permissive and interlock, respectively, to change the name to Low-2 steam generator narrow range level in one place, to rename narrow range steam generator level below the Low setpoint as steam generator narrow range water level below the Low-2 setpoint in one place, and to add reference to UFSAR Figure 7.2-1, Sheet 7, for development of the new P-9 permissive and interlock.

o. Table 7.3-1 is revised under Actuation Signal 5, Reactor Coolant Pump Trip, for Actuation Signal d. Low wide range steam generator water level, to change Permissives and Interlocks as Manual block permitted below P-9, Automatically unblocked above P-9, and to change the name to Low-2 steam generator wide range water level.

p. Table 7.3-1 is revised under Actuation Signal 6, Core Makeup Tank Injection, for Actuation Signal d. Low wide range steam generator water level, to change Permissives and Interlocks as Manual block permitted below P-9, Automatically unblocked above P-9, and to change the name to Low-2 steam generator wide range water level.

q. Table 7.3-1 is revised under Actuation Signal 9, Steam Generator Blowdown System Isolation, for Actuation Signal b. Low narrow range steam generator water level, to change Permissives and Interlocks as Manual Block permitted below P-9, Automatically unblocked above P-9, and to change the name to Low-2 steam generator narrow range water level.

r. Table 7.3-1 is revised under Actuation Signal 12, Passive Residual Heat Removal, for Actuation Signal b. Low narrow range steam generator water level, to change Permissives and Interlocks as Manual Block permitted below P-9, Automatically unblocked above P-9, and to change the name to Low-2 steam generator narrow range water level.

s. Table 7.3-1 is revised under Actuation Signal 12, Passive Residual Heat Removal, for Actuation Signal c. Low steam generator wide range water level, to change Permissives and Interlocks as Manual Block permitted below P-9, Automatically, unblocked above P-9, and to change the name to Low-2 steam generator wide range water level.

t. Table 7.3-2 is revised to add P-9 Designation, with Derivation as reactor coolant average temperature above setpoint, and to add Function(s) as: a) Automatically unblocks core makeup tank actuation on Low-2 steam generator wide range level, b) Automatically unblocks steam generator blowdown system isolation on Low-2 steam generator narrow range water level, and c) Automatically unblocks passive residual heat removal actuation on Low-2 steam generator wide range water level and on Low-2 steam generator narrow range water level.

u. Table 7.3-2 is revised to add $\overline{\text{P-9}}$ Designation, with Derivation as reactor coolant average temperature below setpoint, and to add Function(s) as: a) Permits manual block of core makeup tank actuation on Low-2 steam generator wide range water level, b) Permits manual block of steam generator blowdown system isolation on Low-2 steam generator narrow range water level, and c) Permits manual block of passive residual heat removal actuation on Low-2 steam generator wide range water level and on Low-2 steam generator narrow range water level.

v. Subsection 7.4.1.1 is revised to rename low steam generator water level as Low-2 steam generator wide range water level in one place.

w. Table 7.5-1 (Sheet 1) is revised to rename Variable for Steam generator water level (wide range) as Steam generator wide range water level, and Steam generator water level (narrow range) as Steam generator narrow range water level.

x. Table 7.5-7 (Sheet 1) is revised to rename Variable for Steam generator level (wide range) as Steam generator wide range water level, and Steam generator level (narrow range) as Steam generator narrow range water level, for the System listed as Secondary Pressure and Level Control.

y. Table 7.5-9 is revised to rename Variable for Steam generator level (NR) as Steam generator narrow range water level for the Variable listed as Monitoring for preplanned manual nonsafety-related system actions.

z. Table 7.5-9 is revised to rename Variable for Steam generator level (WR) as Steam generator wide range water level for the Variable listed as Monitoring for nonsafety-related system performance.

aa. Table 9A-2 (Sheet 2) is revised to rename Description for Steam Generator 2 Wide Range Level as Steam Generator 2 Wide Range Water Level for Fire Area/Fire Zone 1000 AF 01/1100 AF 11300A and System SGS.

bb. Table 9A-2 (Sheets 3 and 4) are revised to rename Description for Steam Generator 1 Narrow Range Level as Steam Generator 1 Narrow Range Water Level, Steam Generator 2 Narrow Range Level as Steam Generator 2 Narrow Range Water Level, Steam Generator 2 Wide Range Level as Steam Generator 2 Wide Range Water Level, and Steam Generator 1 Wide Range Level as Steam Generator 1 Wide Range Water Level for Fire Area/Fire Zone 1000 AF 01/1100 AF 11300B and System SGS.

cc. Table 9A-2 (Sheet 5) is revised to rename Description for Steam Generator 1 Wide Range Level as Steam Generator 1 Wide Range Water Level for Fire Area/Fire Zone 1000 AF 01/1100 AF 11300 and System SGS.

dd. Table 9A-2 (Sheet 7) is revised to rename Description for Steam Generator 1 Narrow Range Level as Steam Generator 1 Narrow Range Water Level, and Steam Generator 2 Narrow Range Level as Steam Generator 2 Narrow Range Water Level, for Fire Area/Fire Zone 1000 AF 01/1100 AF 11500 and System SGS.

ee. Subsection 10.4.8.2.2.7 is revised to rename low steam generator water levels as Low-2 steam generator narrow range water levels in one place.

ff. Subsection 10.4.8.2.3.5, is revised to rename low (narrow range) steam generator level as Low-2 steam generator narrow range water level in one place, and low (narrow range) water level as Low-2 steam generator narrow range water level in one place.

gg. Subsection 10.4.9.5 is revised to rename low, narrow range steam generator level as Low-2 steam generator narrow range level in one place.

hh. Subsection 14.2.9.3.5 is revised to rename low steam generator level as Low-2 steam generator narrow range level in one place.

ii. Table 14.3-2 is revised to rename low steam generator water level as Low-2 steam generator wide range water level in one place.

jj. Table 14.3-2 is revised to rename low steam generator water levels as Low-2 steam generator narrow range water levels in one place.

kk. Table 14.3-2 is revised to rename the low steam generator water level (wide range) as Low-2 steam generator wide range water level in one place.

ll. Table 15.0-4a (Sheet 1) is revised to rename low steam generator wide range level as Low-2 steam generator wide range water level in one place.

mm. Table 15.0-6 (Sheet 2) is revised to rename Steam generator low narrow range level as Low-2 steam generator narrow range water level in three places, and Steam generator low wide range level as Low-2 steam generator wide range level in three places.

nn. Subsection 15.1.5.2.3 is revised to rename low wide-range level as Low-2 steam generator wide range water level in one place.

oo. Subsection 15.2.6.2.1 is revised to rename low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

pp. Subsection 15.2.7.1 is revised to rename low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place, and low steam generator water level (wide range) as Low-2 steam generator wide range water level in one place.

qq. Subsection 15.2.7.2.1 is revised to rename low steam generator water level narrow range as Low-2 steam generator narrow range water level in one place, and low steam generator water level wide range as Low-2 steam generator wide range water level in one place.

rr. Subsection 15.2.8.2.1 is revised to rename low steam generator water level (wide range) as Low-2 steam generator wide range water level in one place, and low steam generator level (wide range) level as Low-2 steam generator wide range water level in one place.

ss. Subsection 15.2.8.2.2 is revised to rename low steam generator water level wide range as Low-2 steam generator wide range water level in one place.

tt. Table 15.2-1 for accident Loss of ac power to the plant auxiliaries is revised to rename low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

uu. Table 15.2-1 for loss of normal feedwater flow is revised to rename low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

vv. Table 15.2-1 for loss of normal feedwater flow with a consequential loss of ac power is revised to rename low steam generator water level (narrow range) as Low-2 steam generator narrow range water level in one place.

ww. Table 15.2-1 for Feedwater system pipe break is revised to rename low steam generator water level (wide range) as Low-2 steam generator wide range water level in two places.

xx. Subsection 19E.2.2.2.2 is revised to rename low steam generator level as Low-2 steam generator wide range water level in one place.

yy. Subsection 19E.4.3.2 is revised to rename low steam generator level as Low-2 steam generator wide range water level in one place.

zz. Subsection 19E.4.3.3 is revised to rename low steam generator level as Low-2 steam generator wide range water level in one place.

aaa. Subsection 19E.4.3.4 is revised to rename low steam generator level as Low-2 steam generator wide range water level in one place

bbb. Subsection 19E.4.10.2 is revised to rename low steam generator narrow range level as Low-2 steam generator narrow range water level in one place.

ccc. Table 19E.4.10-1 is revised to rename Low Steam Generator Water Level (Wide-Range) as Low-2 Steam Generator Wide Range Water Level in one place.

2.5 Changes to ESFAS Refueling Cavity and SFS Isolation, including Addition of P-9 Permissive and Interlock

As described in UFSAR Subsection 7.3.1.2.21, the SFS lines are isolated by the PMS upon the coincidence of spent fuel pool level below the Low setpoint in two of three divisions. This helps to maintain the water inventory in the refueling cavity due to line leakage.

The SFS contains a line that connects the IRWST and the refueling cavity to the SFS pumps and therefore penetrates the containment boundary. The containment isolation valves close automatically on a containment isolation signal to preclude the possibility of draining the IRWST during an accident. These valves also close on a low spent fuel pool level to preclude the possibility of draining the refueling cavity and/or spent fuel pool during refueling operations.

Refueling cavity isolation is also included in the list of the ESF system-level actuations initiated by the PMS as item 21 in WCAP-16675 (Proprietary and Non-Proprietary), AP1000 Protection and Safety Monitoring System Architecture Technical Report, Revision 5, which is incorporated by reference in UFSAR Table 1.6-1 (Sheet 12).

The SFS suction line is isolated by two motor-operated containment isolation valves, one located inside (SFS-PL-V034) and one outside (SFS-PL-V035) of containment. The SFS discharge line is isolated by one containment isolation check valve located inside (SFS-PL-V037) of containment and one motor-operated containment isolation valve located outside (SFS-PL-V038) of containment. As described in UFSAR Subsection 6.2.3, containment isolation valves are designed so that fluid lines that penetrate the primary containment boundary are isolated in the event of an accident to prevent or limit the escape of fission products that may result from postulated accidents. This minimizes the release of radioactivity to the environment. UFSAR Table 6.2.3-1 (Sheet 2) includes these containment isolation valves, and includes the requirements for closing the motor-operated containment isolation valves (SFS-PL-V034, SFS-PL-V035, and SFS-PL-V038) on a “T” (containment isolation) signal. UFSAR Subsection 7.3.1.2.1 describes the conditions that initiate a “T” (containment isolation) signal.

When the IRWST piping is aligned to the SFS for purification, cooling, and inventory control, a seismic or other event resulting in a pipe rupture in the nonsafety-related, nonseismic SFS could potentially result in a loss of IRWST inventory. The initiating event frequency of such a pipe rupture while the SFS is connected to the IRWST is estimated at 2.01E-5/year. This is above the cutoff frequency established by ANS 51.1 (1.0E-6/year) and the AP1000 PRA cutoff frequency (10E-7/year). Therefore, a defense-in-depth change addresses the potential for a pipe rupture while the SFS is connected to the IRWST. As a result, a new defense-in-depth ESFAS automatic actuation to close the existing SFS containment isolation valves on Low IRWST wide range level is proposed.

Therefore, the PMS design is proposed to be changed to:

a. Add ESFAS actuation of refueling cavity and SFS isolation on one of two divisions of Low IRWST wide range level, and

b. Allow closure of the containment isolation valves in the SFS lines between the IRWST and the SFS by Low IRWST wide range level to be manually blocked when T_{avg} is below the P-9 permissive setpoint of 200°F, and automatically unblocked when T_{avg} is above the P-9 permissive.

In addition, the existing spent fuel pool level setpoint actuation and alarm names are proposed to be changed to Low-2, Low, and High spent fuel pool level in the UFSAR where necessary for consistency with standard nomenclature. The current UFSAR is not consistent when referring to these setpoint designators. For example, a given setpoint may be referred to with its specific designator, such as Low-2, but in other instances it is referred to with the generic "low." Therefore, it is necessary to revise some generic "low" and "high" references to avoid any confusion as to which specific setpoint designator is used for a given PMS function. In addition, the format used for the setpoint designator is inconsistent. In some instances a given setpoint designator is used for more than one setpoint. To avoid confusion and address the human factor issues related to labeling different setpoints with the same setpoint designator, a given setpoint is referred to with its own unique setpoint designator. The proposed setpoint names are in concurrence with the PMS design.

Technical Evaluation of Changes to ESFAS Refueling Cavity and SFS Isolation, including Addition of P-9 Permissive and Interlock

As described in UFSAR Subsection 9.1.3, the SFS is designed to remove decay heat which is generated by stored fuel assemblies from the water in the spent fuel pool. This is done by pumping the high temperature water from within the fuel pool through a heat exchanger, and then returning the water to the pool. A secondary function of the spent fuel pool cooling system is clarification and purification of the water in the spent fuel pool, the refueling cavity, and the IRWST. The SFS has the safety-related function of containment isolation. The SFS is not a safety-related system and is not required to operate following events such as earthquake, fire, passive failures or multiple active failures.

The SFS removes radioactive corrosion products, fission product ions and dust to maintain low refueling cavity activity levels and to maintain water clarity during refueling operations. The SFS purification capability is such that the occupational radiation exposure is minimized to support as low as reasonably achievable (ALARA) goals. The SFS is designed to transfer water from the IRWST to the refueling cavity prior to refueling operations and then back to the IRWST upon completion of the refueling operations, and removes radioactive corrosion products and fission ions to maintain low IRWST activity levels during normal plant operation prior to a scheduled refueling.

As previously described, when the IRWST piping is aligned to the SFS for purification, cooling, and inventory control, a seismic or other event resulting in a pipe rupture in the nonsafety-related, nonseismic SFS could potentially result in a loss of IRWST inventory. As a result, the PMS design is proposed to be changed to:

a. Add ESFAS automatic actuation of refueling cavity and SFS isolation on one of two divisions of Low IRWST wide range level, and

b. Allow closure of the containment isolation valves in the SFS lines between the IRWST and the SFS by Low IRWST wide range level to be manually blocked when T_{avg} is below the P-9 permissive setpoint of 200°F, and automatically unblocked when T_{avg} is above the P-9 permissive.

The SFS may be connected to the IRWST for purification, cooling, and inventory control for the IRWST during any operational condition. However, this new defense-in-depth ESFAS automatic actuation function is not required to protect the core and mitigate the consequences of design basis events when required. Instead, the existing ESFAS containment isolation function performs the necessary safety-related design function to meet the requirements of the safety analysis, without crediting the proposed defense-in-depth design function of closure of the SFS containment isolation valves on Low IRWST wide range level. The SFS may also be connected to the refueling cavity and the IRWST during cold shutdown conditions for purification and cooling, and to transfer water between the spent fuel pool, refueling cavity, and IRWST. This includes draining the IRWST inventory to the refueling cavity in MODES 5 and 6 to support refueling activities, which may cause undesired and unnecessary actuation of the proposed defense-in-depth design function to close the existing SFS containment isolation valves on Low IRWST wide range level.

The use of a 1-out-of-2 actuation logic is acceptable for this function as the SFS isolation valves are normally maintained closed, and the safety-related ESFAS containment isolation function performs the necessary safety-related design function to meet the requirements of the safety analysis, without crediting the proposed defense-in-depth design function of closure of the SFS containment isolation valves on Low IRWST wide range level when required. In addition, the use of the SFS for IRWST purification, cooling, and inventory control is only infrequently used during operations with T_{avg} above the P-9 permissive setpoint of 200°F. This is consistent with other existing 1-out-of-2 actuation logics for ESFAS automatic actuations only required during infrequent operations.

As described in Technical Specifications Bases 3.5.6, 3.5.7 and 3.5.8, the IRWST must meet the water volume requirements defined in the Surveillance Requirements to be considered OPERABLE in MODES 1 through 6. In MODES 1, 2, 3, and 4, the IRWST provides the heat sink for the PRHR heat exchanger, provides the heat sink for the depressurization spargers, and provides the source of low head (ambient containment pressure) safety injection during LOCAs. In MODE 5 with the RCS pressure boundary intact or with the RCS open with pressurizer level ≥ 20%, the IRWST is an RCS injection source of borated water for core cooling and reactivity control. Additionally, in MODE 5 with the RCS pressure boundary intact, the IRWST provides the heat sink for the PRHR heat exchanger. In MODE 6, the IRWST is an RCS injection source of borated water for core cooling and reactivity control, and the volume in the IRWST plus the refueling cavity is required to meet the IRWST water volume requirement. No LOCAs are postulated during plant operation in MODES 5 and 6; therefore, the rupture of the direct vessel injection line (DVI) is not assumed. In addition, due to the large volume of the IRWST, online monitoring of water volume, and frequent surveillances, the normal deviation of IRWST water volume is expected to be minor. The long-term core cooling analysis performed to justify PRA success criteria as described in Appendix A of the PRA, which assumed multiple failures with as many as 3 CMTs/accumulators not injecting, shows that there is significant margin with respect to the water supplies that support containment recirculation operation. If IRWST inventory is reduced as a result of a seismic or other event resulting in a pipe rupture in the nonsafety-related, nonseismic SFS, the capability to manually isolate the IRWST from the SFS remains available as required by COL Appendix A Technical Specifications Table 3.3.9-1, Function 12. In addition, if the COL Appendix A Technical Specifications 3.5.6, 3.5.7, and 3.5.8 water volume requirements are not met as a result of this event, then the required ACTIONS minimize this adverse impact by requiring that the plant be placed in a condition in which the probability and consequences of an event are minimized to the extent possible.

Therefore, it is acceptable to allow manual block of refueling cavity and SFS isolation on Low IRWST wide range level when T_{avg} is less than 200°F because:

1. The capability to manually isolate the IRWST from the SFS remains available as required by COL Appendix A Technical Specifications Table 3.3.9-1, Function 12. This new defense-in-depth ESFAS automatic actuation function is not required to protect the core and mitigate the consequences of design basis events;
2. In MODE 6 the refueling cavity is filled providing significant water available for core cooling before requiring any remaining IRWST inventory; and
3. If this function fails or is manually blocked during a seismic or other event resulting in a pipe rupture in the nonsafety-related, nonseismic SFS, the probable consequence includes inoperability of the IRWST as a result of loss of inventory, which is addressed by COL Appendix A Technical Specifications 3.5.6, 3.5.7, and 3.5.8.

The proposed changes do not adversely affect the design functions of the PXS, including the IRWST, or the SFS. In addition, there is no adverse impact on the existing ESFAS functions for containment isolation of the SFS lines and containment recirculation involving the IRWST described above. In addition, the new ESFAS automatic actuation function for Low IRWST wide range level addresses an event that would potentially result in a loss of IRWST inventory. The proposed changes to add the P-9 permissive and interlock to the new ESFAS Low IRWST wide range level function are acceptable as they allow blocking of a defense-in-depth ESFAS automatic actuation function during cold shutdown conditions, while automatically reinstating the new defense-in-depth ESFAS automatic actuation function prior to reaching the MODES necessary during plant startup. Providing the P-9 permissive and interlock from division A and B only (as shown on UFSAR Figure 7.2-1 (Sheet 7)) coincident with divisions C and D of the new Low IRWST wide range level (one-out-of-two logic) is acceptable as no single failure prevents automatic unblocking above the P-9 permissive and interlock, and no single failure prevents the ESFAS automatic actuation function for refueling cavity and SFS isolation on Low IRWST wide range level.

In addition to these proposed changes, the existing spent fuel pool level setpoint actuation and alarm names are proposed to be changed to Low-2, Low, and High spent fuel pool level in the UFSAR where necessary for consistency with standard nomenclature. There is no change to the actual setpoint value for the safety-related ESFAS actuation for refueling cavity and SFS isolation, and associated alarm, between the existing Low spent fuel pool level actuation and alarm setpoint and the proposed Low-2 spent fuel pool level actuation and alarm setpoint. In addition, there are no changes to the actual setpoint values for the nonsafety-related Low spent fuel pool level and High spent fuel pool level alarms. Nor does this activity change the setpoint values assumed in the safety analysis. Therefore, there is no change to the physical design of the spent fuel pool level instrumentation, only a change to the names of the actuation and level setpoints in the UFSAR from existing level instrumentation. These changes do not impact any setpoint, but provide clarity to the licensing basis so that it is clear which setpoint designator is used for the specified PMS ESFAS automatic actuation functions. The proposed changes are consistent with the plant design.

Additional changes are required to WCAP-16675 (Proprietary and Non-Proprietary), AP1000 Protection and Safety Monitoring System Architecture Technical Report, which is incorporated by reference in UFSAR Table 1.6-1, to change the title of item 21 in Section 1.2 from “Refueling Cavity Isolation as described in Reference 9” to “Refueling Cavity and Spent Fuel Pool Cooling System (SFS) Isolation as described in Reference 9”. This is a conforming change to address the new closure signal on low IRWST wide range level added by the proposed design change.

IRWST Wide Range Level PXS-JE-LT047 and IRWST Wide Range Level PXS-JE-LT048 retain an Engineered Safety Feature (ESF) Function with an operating time of 24 hours (as shown on UFSAR Table 3.11-1) to address the addition of the new P-9 permissive and interlock for refueling cavity and SFS isolation actuated by the new PMS logic. The existing basis for this Table entry was for the ESFAS actuation function that was replaced by narrow range instrumentation as described previously.

Licensing Basis Changes for Changes to ESFAS Refueling Cavity and SFS Isolation, including Addition of P-9 Permissive and Interlock

The following changes are proposed to address the addition of the new P-9 permissive and interlock for refueling cavity and SFS isolation actuated by the new PMS logic and the new Low IRWST wide range level setpoint:

1. COL Appendix C (and plant-specific DCD Tier 1) is revised as follows:
   a. Table 2.5.2-3 is revised to rename Refueling Cavity Isolation as Refueling Cavity and Spent Fuel Pool Cooling System (SFS) Isolation for PMS Automatically Actuated Engineered Safety Features.
   b. Table 2.5.2-6 is revised to add Refueling Cavity and Spent Fuel Pool Cooling System (SFS) Isolation under Engineered Safety Features for PMS Blocks.
2. COL Appendix A Technical Specifications are revised as follows:
   a. LCO 3.3.14 is revised to rename Spent Fuel Pool Level – Low as Spent Fuel Pool Level – Low-2.
3. The UFSAR is revised as follows:
   a. Table 1.6-1 is revised to add the statement "(as modified by changes provided in UFSAR Appendix 7A)" for WCAP-16675-P and WCAP-16675-NP, AP1000 Protection and Safety Monitoring System Architecture Technical Report, Revision 5.
   b. Table 1.7-1 is revised to change the title from Turbine Trip to Turbine Trip and Refueling Cavity and SFS Isolation for I&C Functional and Electrical One-line Diagram, Figure 7.2-1 (Sheet 14).
   c. Subsection 6.3.2.2.3 is revised to add description of the new PMS isolation of the SFS by closing the SFS containment isolation valves on Low IRWST wide range level to prevent loss of inventory in the event of a leak in the nonsafety-related SFS, to add description that actuation on Low IRWST wide range level can be blocked while the plant is in Mode 6, below permissive P-9, to allow the SFS to transfer the IRWST to the refueling cavity and perform cooling and purification of the refueling cavity, and to add description that the manual block of actuation on Low IRWST wide range level can also be used during other modes when the plant is below P-9 so that, if required, operators can continue to use the SFS to cool, purify, sample or transfer water to the IRWST when the level is below the low setpoint.
   d. Subsection 6.3.7.4.3 is revised to change the total number of level channels installed on the in-containment refueling water storage tank to nine, and specify that there are three remaining IRWST wide range level channels.
   e. Subsection 7.1.7 is revised to add the statement "(as modified by changes provided in UFSAR Appendix 7A)" for Reference 19, WCAP-16675-P (Proprietary) and WCAP-16675-NP (Non-Proprietary), AP1000 Protection and Safety Monitoring System Architecture Technical Report, Revision 5.

f. Figure 7.2-1 (Sheet 7) is revised to add the new P-9 permissive and interlock link to refueling cavity and SFS isolation logic on UFSAR Figure 7.2-1 (Sheet 14).

g. Figure 7.2-1 (Sheet 13) is revised to delete the logic for 2 of 3 divisions of Low spent fuel pool level for refueling cavity isolation. This logic is relocated and modified by the changes to refueling cavity and SFS isolation logic shown on UFSAR Figure 7.2-1 (Sheet 14), as described below.

h. Figure 7.2-1 (Sheet 14) is revised to add the new P-9 permissive and interlock from division A and B only (as shown on UFSAR Figure 7.2-1 (Sheet 7)) coincident with divisions C and D of the new Low IRWST wide range level (one-out-of-two logic), for refueling cavity and SFS isolation logic. In addition, Note 3 is added for the new P-9 permissive and interlock stating divisions A and B only, and Note 2 is added for the SFS isolation block control stating that there are separate momentary controls, one for each division. The logic for 2 of 3 divisions of Low spent fuel pool level for refueling cavity and SFS isolation is relocated from UFSAR Figure 7.2-1 (Sheet 13), and changed to Low-2 spent fuel pool level. Finally, the title is changed to Functional Diagram Turbine Trip and Refueling Cavity and SFS Isolation.

i. Subsection 7.3.1.2.21 is revised to change the title to Refueling Cavity and Spent Fuel Pool Cooling System Isolation, to clarify that the signals isolate the spent fuel pool cooling system lines by closing the spent fuel pool cooling system containment isolation valves, and to describe isolating the spent fuel pool cooling lines by closing the spent fuel pool cooling system containment isolation valves from the renamed Low-2 spent fuel pool level setpoint in two of three divisions as Condition 1.

j. Subsection 7.3.1.2.21 is revised to add Condition 2 as the new Low IRWST wide range level in one of two divisions for isolating the spent fuel pool cooling lines by closing the spent fuel pool cooling system containment isolation valves to maintain the water inventory in the IRWST in the event of a leak in the nonsafety-related spent fuel pool cooling system, and to add manual block and automatic unblock for the Low IRWST wide range level signal below and above P-9 permissive and interlock, respectively. In addition, a description that the manual block can be used below the P-9 permissive setpoint with the plant in Mode 6 to allow the spent fuel pool cooling system to transfer the IRWST to the refueling cavity and perform cooling and purification of the refueling cavity is added, and a description that the manual block can be used at any time below the P-9 permissive setpoint to allow the spent fuel pool cooling system to cool, purify, sample or transfer water to the IRWST when the level is below the Low IRWST wide range level setpoint is added. Finally, reference to UFSAR Figure 7.2-1 (Sheet 13) is revised to UFSAR Figure 7.2-1 (Sheet 14), and reference to UFSAR Figure 7.2-1, Sheet 7, for development of the new P-9 permissive and interlock, is added.

k. Table 7.3-1 is revised to change Actuation Signal 20 from Refueling Cavity Isolation to Refueling Cavity and SFS Isolation, revise reference to Figure 7.2-1 (Sheet 14), change Low spent fuel pool level to Low-2 spent fuel pool level for Actuation Signal a, and to add Actuation Signal b. Low IRWST wide range level with footnote (8) and specify No. of Divisions/Controls as 2, Actuation Logic as 1/2, and Permissives and Interlocks as Manual Block permitted below P-9, Automatically unblocked above P-9.

l. Table 7.3-2 is revised to add P-9 Designation, with Derivation as reactor coolant average temperature above setpoint, and to add Function as: d) Automatically unblocks refueling cavity and spent fuel pool cooling system isolation on Low IRWST wide range level.

m. Table 7.3-2 is revised to add $\overline{\text{P-9}}$ Designation, with Derivation as reactor coolant average temperature below setpoint, and to add Function as: d) Permits manual block of refueling cavity and spent fuel pool cooling system isolation on Low IRWST wide range level.

n. Table 7.3-3 is revised to add SFS isolation block control #1 and #2 to System-Level Manual Input for Divisions A and B to the Engineered Safety Features Actuation System, and to reference UFSAR Figure 7.2-1 Sheet 14.

o. Section 7A.8 is added to address changes required to WCAP-16675 (Proprietary and Non-Proprietary), AP1000 Protection and Safety Monitoring System Architecture Technical Report as follows:

<u>WCAP-16675-P and WCAP-16675-NP, "AP1000 Protection and Safety Monitoring System Architecture Technical Report"</u>

The UFSAR incorporates by reference Tier 2 documents WCAP-16675-P and WCAP-16675-NP, "AP1000 Protection and Safety Monitoring System Architecture Technical Report." See Table 1.6-1. WCAP-16675, Revision 5, includes the following revisions and additions as indicated by strikethroughs and underlines.

- Revise Section 1.2, Engineered Safety Features Actuation System Functions, as follows:

  The following is a list of the ESF system-level actuations initiated by the PMS
  * * *:

  21. Refueling Cavity <u>and Spent Fuel Pool Cooling System (SFS)</u> Isolation as described in Reference 9.

p. Subsection 9.1.3.7 is revised to change "low-low-level setpoint" to "Low-2 level setpoint" in the first paragraph, and to change "high-level" to "High level" and "low-level" to "Low level" in the second paragraph.

q. Table 17.4-1 is revised to change Insights and Assumptions text to state "These in-containment refueling water storage tank (IRWST) level sensors support PMS functions. They are used in automatic actuation of refueling cavity and SFS isolation, and IRWST recirculation, and they provide indications to the operator."

2.6 Technical Evaluation of Other Impacts

WCAP-15776, "Safety Criteria for the AP1000 Instrumentation and Control Systems," describes the design bases for AP1000 safety systems and their compliance with IEEE 603, including the design basis for permissive conditions, which states:

- Where operating requirements necessitate automatic or manual block of a protective function, the block is automatically removed whenever the appropriate permissive conditions are not met. Hardware and software used to achieve automatic removal of the block of a protective function are part of the PMS and, as such, are designed in accordance with the criteria in this report.
- Blocks of a protective function are automatically cleared when the protective function is required to function.

The design changes to add RTS P-9 permissive and interlock for Low-2 steam generator narrow range water level and Low-2 steam generator wide range level coincident with high wide range hot leg temperature reactor trip functions; ESFAS P-9 permissive and interlock for CMT actuation, RCP Trip, PRHR heat exchanger actuation, and BDS isolation for Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS functions; and ESFAS P-9 permissive and interlock for refueling cavity and SFS isolation for Low IRWST wide range level defense-in-depth ESFAS function; meet the design requirements of IEEE 603 as discussed in WCAP-15776, including design for indication of P-9 status.

An impact review determined that these proposed changes would have negligible impact on the AP1000 PRA presented in UFSAR Chapter 19, including the Fire PRA, results and insights (e.g., CDF and large release frequency (LRF)). The proposed new IRWST lower narrow range level instruments are performing the same function as was intended for the previous level instruments, using the same number of separated and qualified safety-related instruments interfacing in the same channel configuration with PMS, which is employing the same two-out-of-four logic arrangement. Both the IRWST wide range level instruments and the new IRWST lower narrow range level instruments are considered D-RAP risk significant (DCD Tier 1 Table 3.7-1 and UFSAR Table 17.4-1). There is no interface with the diverse actuation system (DAS), and no change to the design functions of the DAS to provide diverse manual actuation of the IRWST injection squib valves and the containment recirculation squib valves. In addition, the new defense-in-depth ESFAS automatic actuation function for refueling cavity and SFS isolation on Low IRWST wide range level addresses a seismic or other event resulting in a pipe rupture in the nonsafety-related, nonseismic SFS that could potentially result in a loss of IRWST inventory.

The proposed PMS changes do not adversely affect any function or feature used for the prevention and mitigation of accidents or their safety analyses. No safety-related structure, system, component (SSC) or function is adversely involved. The proposed changes do not involve nor interface with any SSC accident initiator or initiating sequence of events related to the accidents evaluated in the plant-specific DCD or UFSAR. The proposed changes do not affect the radiological source terms (i.e., amounts and types of radioactive materials released, their release rates and release durations) used in the accident analyses.

The proposed changes do not require a change to procedures or method of control that adversely affects the performance of the PMS (including RTS and ESFAS), PXS, BDS, and SFS safety-related or nonsafety-related design functions as described in the UFSAR. The physical operation of the PMS, including as-installed inspections, testing, and maintenance requirements, as described in the UFSAR are not changed, and thus there are no changes to procedures or method of control required to address the proposed changes to the licensing basis. The proposed changes maintain the design functions of the PMS to be available to mitigate the required transient and accident conditions.

The proposed PMS changes do not adversely interface with or adversely affect safety-related equipment or a fission product barrier. The proposed new instruments and their application is similar in function and qualification to many safety-related instruments already performing similar safety functions. No system or design function or equipment qualification is adversely affected by the proposed changes. The proposed new P-9 interlocks and blocks, and the new defense-in-depth ESFAS Low IRWST wide range level function, are designed and comply with the regulatory requirements described in the UFSAR. The proposed changes do not result in a new failure mode, malfunction or sequence of events that could adversely affect a radioactive material barrier or safety-related equipment. The proposed changes do not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

The proposed PMS changes do not adversely affect safety-related equipment or equipment whose failure could initiate an accident. The proposed instrumentation changes do not adversely interface with or adversely affect safety-related equipment or a radioactive material barrier. The proposed changes do not adversely affect any safety-related equipment, design code limit allowable value, safety-related function or design analysis, nor do they adversely affect any safety analysis input or result, or design/safety margin.

The Technical Specification Safety Limits are not affected. The Limiting Safety System Settings, Limiting Control Settings, and Limiting Conditions for Operation requirements continue to be met by the new IRWST lower narrow range level instruments requirements so that affected safety system functions are met and maintained operable. The respective Technical Specifications Bases (provided in Enclosure 4 for information only) will be revised under the Technical Specifications Bases Control Program to support the identified COL Appendix A Technical Specifications changes and additional changes to the UFSAR.

There are no radiation zone changes or radiological access control changes required because of these proposed changes. The physical design and operation of the PMS as described in the UFSAR that may affect the radiation protection requirements are not changed, and thus there are no changes required to the radiation protection design features described in UFSAR Section 12.3.

There are no fire area changes required because of these proposed changes. The physical design changes proposed for the PMS do not require any changes to the fire protection analysis described in UFSAR Appendix 9A, with the exception of the changes to the IRWST wide range level, steam generator wide range water level, and steam generator narrow range water level instrumentation, which are addressed in the proposed changes to UFSAR Table 9A-2.

There is no change to the risk significant designation of SSCs within the Design Reliability Assurance Program as described in UFSAR Table 17.4-1, with the exception of the addition of the new IRWST lower narrow range level instrumentation, which is addressed in the proposed changes to UFSAR Table 17.4-1.

The proposed changes do not affect the containment, control, channeling, monitoring, processing or releasing of radioactive and non-radioactive materials. No effluent release path is affected. The types and quantities of expected effluents are not changed. Therefore, radioactive or non-radioactive material effluents are not affected.

The proposed changes do not affect plant radiation zones, controls under 10 CFR 20, and expected amounts and types of radioactive materials, as the physical design changes proposed for the PMS do not result in any changes to these radiological conclusions as described in the UFSAR. Therefore, individual and cumulative radiation exposures do not change.

The proposed changes do not affect the results of the aircraft impact assessment described in UFSAR Subsection 19F.4.

3. TECHNICAL EVALUATION (Incorporated into Section 2)

4. REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 52.98(f) requires NRC approval for any modification to, addition to, or deletion from the terms and conditions of a Combined License (COL). The proposed changes involve a change to COL Appendix C (and plant-specific Design Control Document [DCD] Tier 1) Inspections, Tests, Analyses and Acceptance Criteria (ITAAC), and COL Appendix A Technical Specifications (TS). Therefore, NRC approval is required prior to making the plant-specific proposed changes in this license amendment request.

10 CFR 52, Appendix D, Section VIII.B.5.a allows an applicant or licensee who references this appendix to depart from Tier 2 information, without prior NRC approval, unless the proposed departure involves a change to or departure from Tier 1 information, Tier 2* information, or the Technical Specifications, or requires a license amendment under paragraphs B.5.b or B.5.c of the section. The proposed Tier 2 changes, involve a revision to COL Appendix C (and plant-specific DCD Tier 1) and COL Appendix A Technical Specifications. Therefore, NRC prior approval is required.

10 CFR 52, Appendix D, VIII.C.6 states that after issuance of a license, "Changes to the plant-specific TS will be treated as license amendments under 10 CFR 50.90." 10 CFR 50.90 addresses the applications for amendments of licenses, construction permits and early site permits. As discussed above, changes to Technical Specifications Table 3.3.8-1, LCO 3.3.14, and Table 3.3.17-1 are requested. Therefore, NRC approval is required for these Technical Specification changes.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2 requires that structures, systems and components important to safety be designed to withstand the effects of natural phenomena, such as earthquakes. The proposed changes to the PMS for the addition of the IRWST lower narrow range level instruments, changes to the IRWST wide range level instruments, addition of the new RTS P-9 permissive and interlock, addition of the new ESFAS P-9 permissive and interlock, and addition of the new ESFAS refueling cavity and SFS isolation function are designed to the existing seismic design requirements, including seismic Category I requirements. The proposed changes do not involve physical modifications or addition of systems, structures, and components, except for the PMS, and do not impact the existing seismic design requirements for the PXS, BDS, and SFS. Therefore, the proposed changes comply with the requirements of GDC 2.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 13 requires that instrumentation be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. The proposed changes to the PMS for the addition of the IRWST lower narrow range level instruments, changes to the IRWST wide range level instruments, addition of the new ESFAS P-9 permissive and interlock, and addition of the new ESFAS refueling cavity and SFS isolation function, do not adversely impact the design features needed to monitor plant safety variables.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 20 requires the protection system to be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety. The proposed changes to the PMS for the addition of the IRWST lower narrow range level instruments, changes to the IRWST wide range level instruments, addition of the new ESFAS P-9 permissive and interlock, and addition of the new ESFAS refueling cavity and SFS isolation function, do not adversely impact the design features needed to monitor plant safety variables. In addition, the proposed changes do not alter the PMS design in a manner that would prevent its ability to initiate safety systems upon demand.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 29 requires the protection and reactivity control systems to be designed to assure an extremely high probability of accomplishing their safety functions in the event of anticipated operational occurrences. The proposed changes to the PMS do not alter previous design features used to ensure safety functions are available upon demand. The changes described in this request have been determined to have no adverse impact on the PMS design.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 34 requires that a system to remove residual heat be provided. The proposed changes to the PMS for the addition of the IRWST lower narrow range level instruments, changes to the IRWST wide range level instruments, addition of the new ESFAS P-9 permissive and interlock, and addition of the new ESFAS refueling cavity and SFS isolation function, do not adversely affect the functions of residual heat removal. Therefore, the proposed changes comply with the requirements of GDC 34.

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 35 requires that a system to provide abundant emergency core cooling be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts. The proposed changes to the PMS for the addition of the IRWST lower narrow range level instruments, changes to the IRWST wide range level instruments, addition of the new ESFAS P-9 permissive and interlock, and addition of the new ESFAS refueling cavity and SFS isolation function, maintain the safety-related and nonsafety-related design functions of the PXS, including providing adequate core cooling to ensure that regulatory requirements are met. Therefore, the proposed changes comply with the requirements of GDC 35.

4.2 Precedent

None.

4.3 Significant Hazards Consideration Determination

The proposed changes would revise the Combined License (COL) in regards to detailed design of the protection and safety monitoring system (PMS), involving in-containment refueling water storage tank (IRWST) water level instrumentation and reactor coolant average temperature (T_{avg}) P-9 permissive and interlock for the reactor trip system (RTS) and engineered safety feature actuation system (ESFAS).

The proposed changes to the PMS include addition of IRWST lower narrow range level instruments, changes to the IRWST wide range level instruments, addition of defense-in-depth ESFAS automatic actuation of refueling cavity and spent fuel pool cooling system (SFS) isolation Low IRWST wide range level, including a P-9 interlock and block; addition of P-9 interlock and block for Low-2 steam generator narrow range water level reactor trip function; and addition of P-9 interlock and block for Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS automatic actuation functions.

The requested amendment proposes changes to Updated Final Safety Analysis Report (UFSAR) Tier 2 information, which involve changes to COL Appendix C (and plant-specific DCD Tier 1) and COL Appendix A Technical Specifications.

An evaluation to determine whether a significant hazards consideration is involved with the requested amendment was completed by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below:

4.3.1 Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

The proposed change to add IRWST lower narrow range level instruments addresses the accuracy required to initiate IRWST containment recirculation following a design basis accident in order to mitigate the consequences of the accident. The proposed change to add the new defense-in-depth refueling cavity and SFS isolation on Low IRWST wide range level addresses a seismic or other event resulting in a pipe rupture in the nonsafety-related, nonseismic SFS when connected to the IRWST that could potentially result in a loss of IRWST inventory. Isolation of the SFS from the IRWST to mitigate the consequences of a design basis accident continues to be implemented by the existing containment isolation function, and does not rely on the new defense-in-depth refueling cavity and SFS isolation on Low IRWST wide range level. The addition of RTS and ESFAS P-9 interlocks and blocks does not affect the availability of the actuated equipment to perform their design functions to mitigate the consequences of an accident. The proposed changes do not involve any accident initiating component/system failure or event, thus the probabilities of the accidents previously evaluated are not affected.

The affected equipment does not adversely affect or interact with safety-related equipment or a radioactive material barrier, and this activity does not involve the containment of radioactive material. Thus, the proposed changes would not adversely affect any safety-related accident mitigating function. The radioactive material source terms and release paths used in the safety analyses are unchanged, thus the radiological releases in the UFSAR accident analyses are not affected.

These proposed changes to the PMS design do not have an adverse effect on any of the design functions of the affected actuated systems. The proposed changes do not affect the support, design, or operation of mechanical and fluid systems required to mitigate the consequences of an accident. There is no change to plant systems or the response of systems to postulated accident conditions. There is no change to the predicted radioactive releases due to postulated accident conditions. The plant response to previously evaluated accidents or external events is not adversely affected, nor do the proposed changes create any new accident precursors.

Therefore, the requested amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

4.3.2 Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed change to add IRWST lower narrow range level instruments include requirements similar in function and qualification to many safety-related instruments already performing the affected safety functions as described in the current licensing basis to enable the RTS and ESFAS to perform required design functions, and are consistent with other Updated Final Safety Analysis Report (UFSAR) information. The proposed change to add the new defense-in-depth refueling cavity and SFS isolation on Low IRWST wide range level addresses a seismic or other event resulting in a postulated pipe rupture in the nonsafety-related, nonseismic SFS when connected to the IRWST that could potentially result in a loss of IRWST inventory. Isolation of the SFS from the IRWST to mitigate the consequences of a design basis accident continues to be implemented by the existing containment isolation function, and does not rely on the new defense-in-depth refueling cavity and SFS isolation on Low IRWST wide range level. The addition of RTS and ESFAS P-9 interlocks and blocks does not affect the availability of the actuated equipment to perform their design functions to mitigate the consequences of an accident. This activity does not allow for a new radioactive material release path, result in a new radioactive material barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

The proposed changes revise the PMS design. The proposed changes do not adversely affect the design requirements for the PMS, or the design requirements of associated actuated systems. The proposed changes do not adversely affect the design function, support, design, or operation of mechanical and fluid systems.

The proposed changes to the PMS do not result in a new failure mechanism or introduce any new accident precursors. No design function described in the UFSAR is adversely affected by the proposed changes.

Therefore, the requested amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

4.3.3 Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No

No safety analysis or design basis acceptance limit or acceptance criterion is challenged or exceeded by the proposed changes, and no margin of safety is reduced. The proposed change to add the new defense-in-depth refueling cavity and SFS isolation on Low IRWST wide range level addresses a seismic or other event resulting in a postulated pipe rupture in the nonsafety-related, nonseismic SFS when connected to the IRWST, maintaining the required IRWST inventory and preserving the original margin of safety assumed for the PXS and SFS. Therefore, the requested amendment does not involve a significant reduction in a margin of safety.

4.4 Conclusions

Based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public. Therefore, it is concluded that the requested amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5 ENVIRONMENTAL CONSIDERATIONS

Section 2 of this license amendment request provide the details of the proposed changes.

The requested amendment revises the design of the protection and safety monitoring system (PMS), involving in-containment refueling water storage tank (IRWST) water level instrumentation and reactor coolant average temperature (T_{avg}) P-9 permissive and interlock for the reactor trip system (RTS) and engineered safety feature actuation system (ESFAS), as described in the Updated Final Safety Analysis Report (UFSAR) and related Combined License (COL) Appendix C [and plant-specific Design Control Document (DCD) Tier 1] and COL Appendix A Technical Specifications.

The proposed changes to the PMS include addition of IRWST lower narrow range level instruments, addition of defense-in-depth ESFAS automatic actuation of refueling cavity and spent fuel pool cooling system (SFS) isolation on Low IRWST wide range level, and addition of P-9 interlocks and blocks for Low-2 steam generator narrow range water level reactor trip functions, Low-2 steam generator narrow range water level and Low-2 steam generator wide range water level ESFAS functions; and the new refueling cavity and SFS isolation for Low IRWST wide range level defense-in-depth ESFAS function.

A review has determined that the requested amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, or would change an inspection or surveillance requirement. However, facility construction and operation following implementation of the requested amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the requested amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9), in that:

i) There is no significant hazards consideration.

As documented in Section 4.3, Significant Hazards Consideration Determination, of this license amendment request, an evaluation was completed to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment.” The Significant Hazards Consideration determined that (1) the requested amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) the requested amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated; and (3) the requested amendment does not involve a significant reduction in a margin of safety. Therefore, it is concluded that the requested amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of “no significant hazards consideration” is justified.

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

The proposed changes are unrelated to any aspect of plant construction or operation that would introduce any change to effluent types (e.g., effluents containing chemicals or biocides, sanitary system effluents, and other effluents), or affect any plant radiological or non-radiological effluent release quantities. Furthermore, the proposed changes do not affect any effluent release path or diminish the design functions or operational features that are credited with controlling the release of effluents during plant operation. Therefore, it is concluded that the requested amendment does not involve a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed changes do not adversely affect walls, floors, or other structures that provide shielding. Plant radiation zones are not affected, and there are no changes to the controls required under 10 CFR Part 20 that preclude a significant increase in occupational radiation exposure. Therefore, the requested amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

Based on the above review of the requested amendment, it has been determined that anticipated construction and operational impacts of the requested amendment do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the requested amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the requested amendment.

6. REFERENCES

None.

Southern Nuclear Operating Company

ND-17-0271

Enclosure 2

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Exemption Request:

Addition of IRWST Lower Narrow Range Level Instrumentation

(LAR-16-032)

(Enclosure 2 consists of 12 pages, including this cover page)

1.0 Purpose

Southern Nuclear Operating Company (SNC, or the "Licensee") requests a permanent exemption from the provisions of 10 CFR 52, Appendix D, Section III.B, *Design Certification Rule for the AP1000 Design, Scope and Contents*, to allow a departure from elements of the certification information in Tier 1 of the generic AP1000 Design Control Document (DCD). The regulation, 10 CFR 52, Appendix D, Section III.B, requires an applicant or licensee referencing Appendix D to 10 CFR Part 52 to incorporate by reference and comply with the requirements of Appendix D, including certified information in DCD Tier 1. The Tier 1 information for which a plant-specific departure and exemption is being requested includes clarifications related to the addition of In-Containment Refueling Water Storage Tank (IRWST) Lower Narrow Range level instrumentation, Refueling Cavity and Spent Fuel Pool Cooling System (SFS) isolations for Protection and Safety Monitoring System (PMS) Engineered Safety Features, and conforming nomenclature changes for certain PMS instrumentation features.

This request for exemption applies to the requirements of 10 CFR 52, Appendix D, Section VIII.A.4 to allow departures from plant-specific DCD Tier 1 information due to proposed changes to the following ITAAC Tables (specific details are provided in Enclosure 1 of the accompanying license amendment request).

- Tier 1 Equipment Table 2.2.3-1
    - Add IRWST Lower Narrow Range Level Sensor passive core cooling system (PXS)-066, IRWST Lower Narrow Range Level Sensor PXS-067, IRWST Lower Narrow Range Level Sensor PXS-068 and IRWST Lower Narrow Range Level Sensor PXS-069, and specify for each Seismic Category I, Class 1E, Qualified for Harsh Environment, and Safety-Related Display as Yes.
    - Delete IRWST Level Sensor PXS-045, and rename IRWST Level Sensor PXS-046, IRWST Level Sensor PXS-047, and IRWST Level Sensor PXS-048 as IRWST Wide Range Level Sensor PXS-046, IRWST Wide Range Level Sensor PXS-047, and IRWST Wide Range Level Sensor PXS-048, respectively.
- Tier 1 Table 2.5.2-2, "PMS Automatic Reactor Trip"
    - Rename Low Steam Generator Water Level Trip to Low-2 Steam Generator Narrow Range Water Level Trip.
- Tier 1 Table 2.5.2-3, "PMS Automatically Actuated Engineered Safety Features"
    - Rename Refueling Cavity Isolation as Refueling Cavity and SFS Isolation for PMS Automatically Actuated Engineered Safety Features.

- Tier 1 Table 2.5.2-6, “PMS Blocks”
    - Add Refueling Cavity and Spent Fuel Pool Cooling System (SFS) Isolation under Engineered Safety Features for PMS Blocks.
    - Add Low-2 Steam Generator Narrow Range Water Level Trip under Reactor Trip Functions.
- Tier 1 Table 3.7-1, “Risk-Significant Components”
    - Add IRWST Lower Narrow Range Level Sensors with Tag Nos. as PXS-066, PXS-067, PXS-068 and PXS-069.
    - Delete IRWST Level Sensor PXS-045, and rename IRWST Level Sensors as IRWST Wide Range Level Sensors for PXS-046, PXS-047, and PXS-048.

This request will apply the requirements for granting exemptions from design certification information, as specified in 10 CFR 52, Appendix D, Section VIII.A.4, 10 CFR 52.63, 10 CFR 52.7, and 10 CFR 50.12**.**

2.0 Background

The Licensee is the holder of Combined License Nos. NPF-91 and NPF-92, which authorize construction and operation of two Westinghouse Electric Company AP1000 nuclear plants, named Vogtle Electric Generating Plant (VEGP) Units 3 and 4, respectively.

Addition of IRWST Lower Narrow Range Level Instrumentation

As described in Updated Final Safety Analysis Report (UFSAR) Subsection 6.3.7.4.3 and UFSAR Sections 7.2 and 7.5, there are four existing IRWST wide range level instrumentation channels (PXS-045, PXS-046, PXS-047, and PXS-048). The existing IRWST wide range level instrumentation channels cannot provide the Low-3 IRWST level actuation setpoint within the accuracy assumed in the safety analysis. When the Low-3 IRWST level setpoint is reached in the IRWST, the containment recirculation subsystem isolation valves open and water from the containment reactor coolant system (RCS) compartment flows into the reactor vessel through the passive core cooling system (PXS) piping. This IRWST injection/containment recirculation time scale is dependent upon the accuracy of the Low-3 IRWST level setpoint in order to remain within the bounds assumed in the long-term cooling safety analysis. Therefore, four narrow range level instrument channels are added.

Refueling Cavity and SFS Isolations

The SFS contains a line that connects the IRWST and the refueling cavity to the SFS pumps and therefore penetrates the containment boundary. The containment isolation valves close automatically on a containment isolation signal to preclude the possibility of draining the IRWST during an accident. These valves also close on a low spent fuel pool level to preclude the possibility of draining the refueling cavity and/or spent fuel pool during refueling operations. When the IRWST piping is aligned to the SFS for purification, cooling, and inventory control, a seismic or other event resulting in a pipe rupture in the nonsafety-related, nonseismic SFS could potentially result in a loss of IRWST inventory. Therefore, a defense-in-depth change addresses the potential for a pipe rupture while the SFS is connected to the IRWST. As a result, a new defense-in-depth ESFAS automatic actuation to close the existing SFS containment isolation valves on Low IRWST wide range level is proposed. During cold shutdown conditions this alignment also provides for draining the IRWST inventory to the refueling cavity to support refueling activities, which may cause undesired and unnecessary ESFAS actuation that close SFS containment isolation valves on Low - IRWST wide range level. Therefore, a new reactor coolant average temperature (P-9) permissive and interlock is added to allow blocking this IRWST low level isolation actuation.

Tier 1 Table 2.2.3-1 for the PXS equipment classifications, Table 2.5.2-3 for the Protection and Safety Monitoring System (PMS) automatically actuated Engineered Safety Features, and Table 2.5.2-6 for PMS blocks provide component and PMS actuation design details impacted by the requested changes. Table 3.7-1 provides a list for Risk-Significant Components. This activity requests a permanent exemption from elements of the AP1000 certified design information to allow the Licensee to depart from the design details contained in these Tier 1 tables.

Low-2 Steam Generator Narrow Range Water Level and P-9 Permissive and Interlock

The existing Low Steam Generator Water Level Trip reactor trip actuation name is proposed to be changed to Low-2 Steam Generator Narrow Range Water Level Trip for consistency with standard nomenclature. The current licensing basis is not consistent when referring to this setpoint designator. Therefore, it is necessary to revise some generic “low” references to avoid any confusion as to which specific setpoint designator is used for a given PMS function. In addition, the format used for the setpoint designator is inconsistent, including the lack of using narrow range where applicable.

Additionally, a loss of heat sink reactor trip is actuated by the PMS from Low-2 steam generator narrow range water level in any steam generator. This trip protects the reactor from loss of heat sink in the event of a loss of feedwater to the steam generators. The reactor is tripped when two-out-of-four steam generator narrow range water level sensors in any steam generator produce signals below the setpoint value. There are no existing interlocks or permissives associated with this trip. Routine maintenance and testing is typically performed for the steam generators, and associated feedwater and steam systems, in MODES 4, 5, and 6 when the normal residual heat removal system (RNS) is in service. This may include draining the secondary side of the steam generators, which could result in undesired and unnecessary Low-2 steam generator narrow range water level reactor trips to occur. However, the design of the PMS does not allow blocking of a loss of heat sink reactor trip from Low-2 steam generator narrow range water level in any steam generator during routine operations, maintenance, or testing performed during shutdown. Therefore, the PMS design is proposed to be changed so that a loss of heat sink reactor trip from Low-2 steam generator narrow range water level in any steam generator can be manually blocked when T_{avg} is below the P-9 permissive setpoint of 200°F, and automatically unblocked when T_{avg} is above the P-9 permissive.

Tier 1 Table 2.5.2-2 for PMS Automatic Reactor Trips and Table 2.5.2-6 for PMS Blocks provide PMS actuation design details impacted by the requested changes. This activity requests a permanent exemption from elements of the AP1000 certified design information to allow the Licensee to depart from the design details contained in these Tier 1 tables.

Editorial Nomenclature Changes for Certain PMS Instrumentation Features

Editorial nomenclature changes for certain PMS instrumentation features are proposed for consistency with standard nomenclature. The current licensing basis is not consistent when referring to this setpoint designator. IRWST Level Sensor PXS-046, IRWST Level Sensor PXS-047, and IRWST Level Sensor PXS-048 are renamed as IRWST Wide Range Level Sensors. The Low Steam Generator Water Level Trip reactor trip actuation name is proposed to be changed to Low-2 Steam Generator Narrow Range Water Level Trip. The proposed names are consistent with the plant design.

3.0 Technical Justification of Acceptability

Addition of IRWST Lower Narrow Range Level Instrumentation

The proposed changes to the plant-specific DCD Tier 1 tables are at a level of detail that is consistent with the information currently provided therein. The proposed changes neither adversely impact the ability to meet the design functions of the structures, systems, or components (SSCs) nor involve a significant decrease in the level of safety provided by the SSCs. The proposed changes to plant-specific DCD Tier 1 continue to provide the detail necessary to implement the corresponding ITAAC. Further, application of the current generic design information in Tier 1 as required by 10 CFR Part 52, Appendix D, Section III.B, in the particular circumstances discussed in this request, would not serve the underlying purpose of the rule since it could be read to be inconsistent with the existing design information provided in Tier 2 of the plant-specific DCD.

The proposed changes move specific PMS design functions to the new IRWST lower narrow range level instrumentation channels, which will now perform the safety-related functions previously performed by the existing IRWST wide range level instrumentation channels. Due to the narrow range of these instrumentation channels, they can more precisely measure the Low-3 IRWST level actuation signal within the bounds of the assumptions in the safety analysis, and provide a more accurate Low-2 IRWST level alarm function and post accident monitoring system (PAMS) monitoring function.

The new IRWST lower narrow range level transmitters are similar to the existing IRWST wide range level transmitters, except that the instrument span is smaller at 35 inches verses the larger 24-foot span of the existing IRWST wide range level transmitters. Therefore, the instrument span accuracy over the smaller span results in the new IRWST lower narrow range level transmitters having the capability with a Low-3 level setpoint of approximately 109'-3", including uncertainty, to not exceed the upper and lower bounding analytical limits (i.e., 107.8' to 110.0') of the existing safety analyses.

The addition of the four new IRWST lower narrow range level instruments requires no change to the probabilistic risk assessment (PRA). The four new IRWST lower narrow range level instrumentation channels perform the same functions as the original four IRWST wide range level instrumentation channels using the same number of separated and qualified safety-related instruments interfacing in the same channel configuration with PMS, which is employing the same two-out-of-four logic arrangement.

Based on the proposed design of the four new IRWST lower narrow range level instrumentation, the proposed changes are acceptable as they address the accuracy required to initiate IRWST containment recirculation following a design basis accident in order to mitigate the consequences of the accident.

Refueling Cavity and SFS isolations

When the IRWST piping is aligned to the SFS for purification and cooling, a seismic or other event resulting in a pipe rupture in the nonsafety, nonseismic SFS could potentially render the IRWST inoperable. A postulated pipe rupture in the nonsafety, nonseismic SFS when connected to the IRWST leads to a loss of IRWST inventory.

Therefore, to address the potential for a pipe rupture while the SFS is connected to the IRWST, a new ESFAS actuation to close the existing SFS containment isolation valves on Low IRWST wide range level is proposed. During cold shutdown conditions, the IRWST inventory is drained to the refueling cavity to support refueling activities, which may cause undesired and unnecessary ESFAS actuation that closes SFS containment isolation valves on Low - IRWST wide range level. Therefore, a new reactor coolant average temperature (P-9) permissive and interlock is added to allow blocking this IRWST low level isolation actuation. The new actuation is added to Tier 1 Table 2.5.2-3, and the associated permissive and interlock allowing blocking the actuation is added to Tier 1 Table 2.5.2-6.

P-9 Permissive and Interlock for Low-2 Steam Generator Narrow Range Water Level

The existing Low Steam Generator Water Level Trip reactor trip actuation name is proposed to be changed to Low-2 Steam Generator Narrow Range Water Level Trip. There is no change to the actual setpoint value for this safety-related loss of heat sink reactor trip between the existing Low steam generator water level reactor trip and the proposed Low-2 steam generator narrow range water level reactor trip setpoint. Therefore, there is no change to the physical design of the steam generator level instrumentation, only a change to the name of this actuation setpoint in the licensing basis from existing level instrumentation.

The Reactor Trip System Instrumentation Function 10 (Low-2 steam generator narrow range water level) is required to be OPERABLE in MODES 1 and 2. As defined in Technical Specification Table 1.1-1, MODES 1 and 2 are when the reactivity condition (keff) is greater than or equal to 0.99. Prior to reaching MODE 2 with keff greater than or equal to 1.0 during startup (i.e., the reactor reaching criticality), COL Appendix A Technical Specifications 3.4.2 requires that the T_{avg} in each reactor coolant system loop be verified to be greater than or equal to 551°F. The addition of the P-9 permissive and interlock to allow manual blocking of the loss of heat sink reactor trip during shutdown allows routine maintenance and testing of the steam generators, and associated feedwater and steam systems, while preventing undesired and unnecessary Low-2 steam generator narrow range water level reactor trip.

Therefore, it is acceptable to allow manual block of the loss of heat sink reactor trip from Low-2 steam generator narrow range water level signals when T_{avg} is less than 200°F because:

- The Low-2 steam generator narrow range water level reactor trip is only required to be operable in MODES 1 or 2, and the P-9 permissive is at an RCS average temperature of 200°F, which is below the required temperature to operate the plant in MODES 1 or 2 of greater than or equal to 551°F; and
- The accident analyses in UFSAR Chapter 15 only require this reactor trip for events occurring in MODES 1 or 2.

The new naming nomenclature is added to Tier 1 Table 2.5.2-2, and the associated permissive and interlock allowing blocking of the actuation is added to Tier 1 Table 2.5.2-6.

Editorial Nomenclature Changes for Certain PMS Instrumentation Features

Editorial nomenclature changes for certain PMS instrumentation features are proposed for consistency with standard nomenclature and the plant design. The current licensing basis is not consistent when referring to setpoint designators. For example, a given setpoint may be referred to with its specific designator, such as Low-2, but in other instances it is referred to with the generic “low.” Therefore, it is necessary to revise some generic “low” references to avoid any confusion as to which specific setpoint designator is used for a given PMS function. In addition, the format used for the setpoint designator is inconsistent, including the lack of using narrow range where applicable.

Additional detail for supporting the Technical Justification of this exemption is provided in Enclosure 1 of the accompanying license amendment request.

4.0 Justification of Exemption

10 CFR Part 52, Appendix D, Section VIII.A.4 and 10 CFR 52.63(b)(1) govern the issuance of exemptions from elements of the certified design information for AP1000 nuclear power plants. The Licensee has identified changes to plant-specific Tier 1 information (as described in Section 1.0), and as a result, an exemption from the certified design information in Tier 1 is requested.

10 CFR Part 52, Appendix D, and 10 CFR 50.12, §52.7, and §52.63 state that the NRC may grant exemptions from the requirements of the regulations provided six conditions are met: 1) the exemption is authorized by law [§50.12(a)(1)]; 2) the exemption will not present an undue risk to the health and safety of the public [§50.12(a)(1)]; 3) the exemption is consistent with the common defense and security [§50.12(a)(1)]; 4) special circumstances are present [§50.12(a)(2)]; 5) the special circumstances outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption [§52.63(b)(1)]; and 6) the design change will not result in a significant decrease in the level of safety [Part 52, App. D, VIII.A.4].

The requested exemption satisfies the criteria for granting specific exemptions, as described below.

1 This exemption is authorized by law

The NRC has authority under 10 CFR 52.63, §52.7, and §50.12 to grant exemptions from the requirements of NRC regulations. Specifically, 10 CFR 50.12 and §52.7 state that the NRC may grant exemptions from the requirements of 10 CFR Part 52 upon a proper showing. No law exists that would preclude the changes covered by this exemption request. Additionally, granting of the proposed exemption does not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations.

Accordingly, this requested exemption is "authorized by law," as required by 10 CFR 50.12(a)(1).

2 This exemption will not present an undue risk to the health and safety of the public

The proposed exemption from the requirements of 10 CFR 52, Appendix D, Section III.B would allow changes to elements of the plant-specific Tier 1 DCD to depart from the AP1000 certified (Tier 1) design information. The plant-specific DCD Tier 1 will continue to reflect the approved licensing basis for VEGP Units 3 and 4, and will maintain a consistent level of detail with that which is currently provided elsewhere in Tier 1 of the DCD. Therefore, the affected plant-specific DCD Tier 1 ITAAC will continue to serve its required purpose.

The changes related to the addition of In-Containment Refueling Water Storage Tank (IRWST) Lower Narrow Range level instrumentation, Refueling Cavity and Spent Fuel Pool Cooling System (SFS) isolations and permissive interlocks for Protection and Safety Monitoring System (PMS) Engineered Safety Features and nomenclature consistency changes do not represent any adverse impact to the design function of the IRWST level instrumentation and will continue to protect the health and safety of the public in the same manner. The change does not introduce any new industrial, chemical, or radiological hazards that would represent a public health or safety risk, nor do they modify or remove any design or operational controls or safeguards intended to mitigate any existing on-site hazards. Furthermore, the proposed change would not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in fuel cladding failures. Accordingly, this change does not present an undue risk from any existing or proposed equipment or systems.

Therefore, the requested exemption from 10 CFR 52, Appendix D, Section III.B would not present an undue risk to the health and safety of the public.

3. The exemption is consistent with the common defense and security

The requested exemption from the requirements of 10 CFR 52, Appendix D, Section III.B would allow the licensee to depart from elements of the plant specific DCD Tier 1 design information. The proposed exemption does not alter the design, function, or operation of any structures or plant equipment that is necessary to maintain a safe and secure status of the plant. The proposed exemption has no impact on plant security or safeguards procedures.

Therefore, the requested exemption is consistent with the common defense and security.

4. Special circumstances are present

10 CFR 50.12(a)(2) lists six "special circumstances" for which an exemption may be granted. Pursuant to the regulation, it is necessary for one of these special circumstances to be present in order for the NRC to consider granting an exemption request. The requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii). That subsection defines special circumstances as when "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."

The rule under consideration in this request for exemption is 10 CFR 52, Appendix D, Section III.B, which requires that a licensee referencing the AP1000 Design Certification Rule (10 CFR Part 52, Appendix D) shall incorporate by reference and comply with the requirements of Appendix D, including Tier 1 information. The VEGP Units 3 and 4 COLs reference the AP1000 Design Certification Rule and incorporate by reference the requirements of 10 CFR Part 52, Appendix D, including Tier 1 information. The underlying purpose of Appendix D, Section III.B is to describe and define the scope and contents of the AP1000 design certification, and to require compliance with the design certification information in Appendix D.

The proposed exemption would revise the ITAAC supporting Tier 1 tables related to the addition of In-Containment Refueling Water Storage Tank (IRWST) Lower Narrow Range level instrumentation and Refueling Cavity, Spent Fuel Pool Cooling System (SFS) isolations and permissive interlocks and nomenclature consistency changes, for Protection and Safety Monitoring System (PMS) Engineered Safety Features, consistent with the design changes proposed in the associated license amendment request. Editorial nomenclature changes for certain PMS instrumentation features are also proposed

These proposed revisions discussed in more detail in Section 2.0, maintain the required design functions. The proposed changes do not affect any function or feature used for the prevention and mitigation of accidents or their safety analyses. The proposed changes do not involve nor interface with any SSC accident initiator or initiating sequence of events related to the accidents evaluated and therefore do not have an adverse effect on any SSC's design function. Accordingly, this exemption from the certification information will enable the Licensee to safely construct and operate the AP1000 facility consistent with the design certified by the NRC in 10 CFR 52, Appendix D.

Therefore, special circumstances are present, because application of the current generic certified design information in Tier 1 as required by 10 CFR Part 52, Appendix D, Section III.B, in the particular circumstances discussed in this request is not necessary to achieve the underlying purpose of the rule.

5. The special circumstances outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption.

Based on the nature of the changes to the plant-specific Tier 1 information and the understanding that these changes support the design function of the IRWST level instrumentation, it is expected that this exemption may be requested by other AP1000 licensees and applicants. However, a review of the reduction in standardization resulting from the departure from the standard DCD determined that even if other AP1000 licensees and applicants do not request this same departure, the special circumstances will continue to outweigh any decrease in safety from the reduction in standardization because the key design functions of the components associated with this request will continue to be maintained. Furthermore, the justification provided in the license amendment request and this exemption request and the associated mark-ups demonstrate that there is a limited change from the standard information provided in the generic AP1000 DCD, which is offset by the special circumstances identified above.

Therefore, the special circumstances associated with the requested exemption outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption.

6. The design change will not result in a significant decrease in the level of safety.

The proposed PMS changes do not adversely interface with or adversely affect safety-related equipment or a fission product barrier, and do not impact the functional capabilities of PMS. The proposed new instruments and their application are similar in function and qualification to many safety-related instruments already performing similar safety functions. No system or design function or equipment qualification is adversely affected by the proposed changes. Because the changes associated with this exemption request will continue to meet existing Codes and Standards and methodologies described in the UFSAR, there are no new failure modes introduced by these changes and the level of safety provided by the current SSCs remains unchanged. Because the proposed changes to the SSCs will not affect the ability of the SSCs to perform their design functions and the level of safety provided is unchanged, it is concluded that the changes associated with the proposed exemption will not result in a significant decrease in the level of safety.

5.0 Risk Assessment

A risk assessment was not determined to be applicable to address the acceptability of this proposal.

6.0 Precedent Exemptions

None

7.0 Environmental Consideration

The Licensee requests a departure from elements of the certified information in Tier 1 of the generic AP1000 DCD. The Licensee has determined that the proposed departure would require a permanent exemption from the requirements of 10 CFR 52, Appendix D, Section III.B, *Design Certification Rule for the AP1000 Design, Scope and Contents,* with respect to installation or use of facility components located within the restricted area, as defined in 10 CFR Part 20, or which changes an inspection or a surveillance requirement; however, the Licensee evaluation of the proposed exemption has determined that the proposed exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9).

Based on the above review of the proposed exemption, the Licensee has determined that the proposed activity does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed exemption meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental impact statement or environmental assessment of the proposed exemption is not required.

Specific details of the environmental considerations supporting this request for exemption are provided in Section 5 of the associated License Amendment Request provided in Enclosure 1 of this letter.

8.0 Conclusion

The proposed changes to Tier 1 are necessary to revise functional arrangement descriptions of PMS components and functions. The exemption request meets the requirements of 10 CFR 52.63, *Finality of design certifications*, 10 CFR 52.7, *Specific exemptions*, 10 CFR 50.12, *Specific exemptions*, and 10 CFR 52 Appendix D, *Design Certification Rule for the AP1000*. Specifically, the exemption request meets the criteria of 10 CFR 50.12(a)(1) in that the request is authorized by law, presents no undue risk to public health and safety, and is consistent with the common defense and security as well as meeting the special circumstances criteria of 10 CFR 50.12(a)(2)(ii). Furthermore, approval of this request does not result in a significant decrease in the level of safety, satisfies the underlying purpose of the AP1000 Design Certification Rule, and does not present a significant decrease in safety as a result of a reduction in standardization.

9.0 References

None

Southern Nuclear Operating Company

ND-17-0271

Enclosure 3

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Proposed Changes to the Licensing Basis Documents

(LAR-16-032)

Note:
Added text is shown as Blue Underline
Deleted text is shown as ~~**Red Strikethrough**~~
Omitted text is shown as three asterisks (* * *)

(Enclosure 3 consists of 57 pages, including this cover page)

Revise COL Appendix C Table 2.2.3-1 and corresponding Plant-Specific Tier 1 Table 2.2.3-1 as shown below:

Table 2.2.3-1 (cont.)

Equipment name	Tag No.	ASME Code Section III	Seismic Cat. I	Remotely Operated Valve	Class 1E/ Qual. Harsh Envir.	Safety-Related Display	Control PMS/ DAS	Active Function	Loss of Motive Power Position
***	***	***	***	***	***	***	***	***	***
CMT B Level Sensor	PXS-014D	-	Yes	-	Yes/Yes	Yes	-/-	-	-
~~IRWST Level Sensor~~	~~PXS-045~~	~~-~~	~~Yes~~	~~-~~	~~Yes/Yes~~	~~Yes~~	~~-/-~~	~~-~~	~~-~~
IRWST Wide Range Level Sensor	PXS-046	-	Yes	-	Yes/Yes	Yes	-/-	-	-
IRWST Wide Range Level Sensor	PXS-047	-	Yes	-	Yes/Yes	Yes	-/-	-	-
IRWST Wide Range Level Sensor	PXS-048	-	Yes	-	Yes/Yes	Yes	-/-	-	-
***	***	***	***	***	***	***	***	***	***
Containment Flood-up Level Sensor	PXS-052	-	Yes	-	Yes/Yes	Yes	-/-	-	-
IRWST Lower Narrow Range Level Sensor	PXS-066	-	Yes	-	Yes/Yes	Yes	-/-	-	-
IRWST Lower Narrow Range Level Sensor	PXS-067	-	Yes	-	Yes/Yes	Yes	-/-	-	-
IRWST Lower Narrow Range Level Sensor	PXS-068	-	Yes	-	Yes/Yes	Yes	-/-	-	-
IRWST Lower Narrow Range Level Sensor	PXS-069	-	Yes	-	Yes/Yes	Yes	-/-	-	-
RNS Suction Leak Test Valve	PXS-PL-V208A	Yes	Yes	No	-/-	No	-/-	-	-
***	***	***	***	***	***	***	***	***	***

Revise COL Appendix C Table 2.5.2-2 and corresponding Plant-Specific Tier 1 Table 2.5.2-2 as shown below:

Table 2.5.2-2 **PMS Automatic Reactor Trips**
* * * Overtemperature Delta-T Trip Overpower Delta-T Trip Pressurizer Low Pressure Trip Pressurizer High Pressure Trip Pressurizer High Water Level Trip Low Reactor Coolant Flow Trip Low Reactor Coolant Pump Speed Trip Low-2 Steam Generator Narrow Range Water Level Trip High-2 Steam Generator Water Level Trip Automatic or Manual Safeguards Actuation Trip * * *

Revise COL Appendix C Table 2.5.2-3 and corresponding Plant-Specific Tier 1 Table 2.5.2-3 as shown below:

Table 2.5.2-3 **PMS Automatically Actuated Engineered Safety Features**
* * * Passive Residual Heat Removal (PRHR) Heat Exchanger Alignment Block of Boron Dilution Chemical and Volume Control System (CVS) Makeup Line Isolation Steam Dump Block (Isolated signal to nonsafety equipment) MCR Isolation and Air Supply Initiation Auxiliary Spray and Letdown Purification Line Isolation Containment Air Filtration System Isolation Normal Residual Heat Removal Isolation Refueling Cavity and Spent Fuel Pool Cooling System (SFS) Isolation In-Containment Refueling Water Storage Tank (IRWST) Injection IRWST Containment Recirculation * * *

Revise COL Appendix C Table 2.5.2-6 and corresponding Plant-Specific Tier 1 Table 2.5.2-6 as shown below:

Table 2.5.2-6 **PMS Blocks**
Reactor Trip Functions: * * * High Steam Generator Water Level Trip Low-2 Steam Generator Narrow Range Water Level Trip * * * Engineered Safety Features: Automatic Safeguards Containment Isolation Main Feedwater Isolation Reactor Coolant Pump Trip Core Makeup Tank Injection Steam Line Isolation Startup Feedwater Isolation Block of Boron Dilution Chemical and Volume Control System Isolation Chemical and Volume Control System Letdown Isolation Refueling Cavity and Spent Fuel Pool Cooling System (SFS) Isolation Steam Dump Block Auxiliary Spray and Letdown Purification Line Isolation * * *

Revise COL Appendix C Table 3.7-1 corresponding Plant-Specific Tier 1 Table 3.7-1 as shown below:

Table 3.7-1 **Risk-Significant Components**	
Equipment Name	**Tag No.**
***	
General I&C	
IRWST Wide Range Level Sensors	PXS-~~045~~-046, -047, -048
IRWST Lower Narrow Range Level Sensors	PXS-066, -067, -068, -069
***	

Revise COL Appendix A Technical Specifications Table 3.3.1-1, "Reactor Trip System Instrumentation," as shown below:

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANANCE REQUIREMENTS
* * *	* * *	* * *	* * *	
10. Steam Generator (SG) Narrow Range Water Level – Low 2	1,2	3 4 per SG	D	SR 3.3.1.1 SR 3.3.1.6 SR 3.3.1.8 SR 3.3.1.11
* * *	* * *	* * *	* * *	

Revise COL Appendix A Technical Specifications Table 3.3.8-1, "Engineered Safeguards Actuation System Instrumentation," as shown below:

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS
* * *	* * *	* * *	* * *
18. IRWST Lower Narrow Range Level – Low 3	1,2,3,4[(b)] 4[(d)],5 6[(h)]	4 4 4	F M N
* * *	* * *	* * *	* * *
20. SG Narrow Range Water Level – Low 2	1,2,3,4[(b)]	4 per SG	F
21. SG Wide Range Water Level – Low 2	1,2,3,4[(b)]	4 per SG	F
* * *	* * *	* * *	* * *

Revise COL Appendix A Technical Specifications LCO to rename Spent Fuel Pool Level.

* * *

3.3 Instrumentation

3.3.14 Engineered Safety Feature Actuation System (ESFAS) Spent Fuel Pool Level Instrumentation

LCO 3.3.14 Three channels of ESFAS Spent Fuel Pool Level – ~~Low~~Low 2 instrumentation shall be OPERABLE.

* * *

Revise COL Appendix A Technical Specifications Table 3.3.17-1, "Post-Accident Monitoring Instrumentation," as shown below:

FUNCTION	REQUIRED CHANNELS	CONDITION REFERENCED FROM REQUIRED ACTION D.1
* * *	* * *	* * *
11. In-Containment Refueling Water Storage Tank (IRWST) Wide Range Water Level	2	E
* * *	* * *	* * *

Technical Specification Bases revisions are provided in Enclosure 4 for information only. The Bases revisions are made after the approval of the amendment request, in accordance with Bases Control Program.

Revise UFSAR Table 1.6-1 as shown below:

DCD Section Number	Westinghouse Topical Report Number	Title
7.1	***	***
	WCAP-16674-P WCAP-16674-NP	AP1000 I&C Data Communication and Manual Control of Safety Systems and Components, Revision 4
	WCAP-16675-P WCAP-16675-NP	AP1000 Protection and Safety Monitoring System Architecture Technical Report, Revision 5 (as modified by changes provided in UFSAR Appendix 7A)
	***	***

Revise UFSAR Table 1.7-1 as shown below:

DCD Figure Number	Title
7.2-1 (Sheet 13)	Containment and Other Protection
7.2-1 (Sheet 14)	Turbine Trip and Refueling Cavity and SFS Isolation

Revise UFSAR Table 3.2-3, "AP1000 Classification of Mechanical and Fluid Systems, Components, and Equipment," as shown below:

Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments
Passive Core Cooling System (Continued)					
***	***	***	***	***	***
~~PXS-PL-V150A~~	~~IRWST Level Transmitter A Isolation~~	~~C~~	~~I~~	~~ASME III-3~~	
~~PXS-PL-V150B~~	~~IRWST Level Transmitter B Isolation~~	~~C~~	~~I~~	~~ASME III-3~~	
~~PXS-PL-V150C~~	~~IRWST Level Transmitter C Isolation~~	~~C~~	~~I~~	~~ASME III-3~~	
~~PXS-PL-V150D~~	~~IRWST Level Transmitter D Isolation~~	~~C~~	~~I~~	~~ASME III-3~~	
~~PXS-PL-V151A~~	~~IRWST Level Transmitter A Isolation~~	~~C~~	~~I~~	~~ASME III-3~~	
PXS-PL-V151B	IRWST Wide Range Level Transmitter B Isolation	C	I	ASME III-3	
PXS-PL-V151C	IRWST Wide Range Level Transmitter C Isolation	C	I	ASME III-3	
PXS-PL-V151D	IRWST Wide Range Level Transmitter D Isolation	C	I	ASME III-3	

(**UFSAR Table 3.2-3 Continued)**

PXS-PL-V161A	IRWST Lower Narrow Range Level Transmitter A Isolation	C	I	ASME III-3	
PXS-PL-V161B	IRWST Lower Narrow Range Level Transmitter B Isolation	C	I	ASME III-3	
PXS-PL-V161C	IRWST Lower Narrow Range Level Transmitter C Isolation	C	I	ASME III-3	
PXS-PL-V161D	IRWST Lower Narrow Range Level Transmitter D Isolation	C	I	ASME III-3	
PXS-PL-V162A	IRWST Lower Narrow Range Level Transmitter A Reference Leg Isolation	C	I	ASME III-3	
PXS-PL-V162B	IRWST Lower Narrow Range Level Transmitter B Reference Leg Isolation	C	I	ASME III-3	
PXS-PL-V162C	IRWST Lower Narrow Range Level Transmitter C Reference Leg Isolation	C	I	ASME III-3	
PXS-PL-V162D	IRWST Lower Narrow Range Level Transmitter D Reference Leg Isolation	C	I	ASME III-3	

Revise UFSAR Table 3.11-1, "Environmentally Qualified Electrical and Mechanical Equipment," as shown below:

Description	AP1000 Tag No.	Envir. Zone (Note 2)	Function (Note 1)	Operating Time Required (Note 5)	Qualification Program (Note 6)
Transmitters					
~~IRWST Level~~	~~PXS-JE-LT045~~	~~1~~	~~PAMS~~ ~~ESF~~	~~4 mos~~ ~~24 hr~~	~~E *~~
IRWST Wide Range Level	PXS-JE-LT046	1	PAMS ~~ESF~~	4 mos ~~24 hr~~	E *
IRWST Wide Range Level	PXS-JE-LT047	1	PAMS ESF	4 mos 24 hr	E *
IRWST Wide Range Level	PXS-JE-LT048	1	PAMS ESF	4 mos 24 hr	E *
IRWST Lower Narrow Range Level	PXS-JE-LT066	1	ESF PAMS	24 hr 24 hr	E *
IRWST Lower Narrow Range Level	PXS-JE-LT067	1	ESF PAMS	24 hr 24 hr	E *
IRWST Lower Narrow Range Level	PXS-JE-LT068	1	ESF PAMS	24 hr 24 hr	E *
IRWST Lower Narrow Range Level	PXS-JE-LT069	1	ESF PAMS	24 hr 24 hr	E *

(**UFSAR Table 3.11-1 Continued)**

Description	AP1000 Tag No.	Envir. Zone (Note 2)	Function (Note 1)	Operating Time Required (Note 5)	Qualification Program (Note 6)
***	***	***	***	***	***
~~IRWST Level Transmitter A Isolation~~	~~PXS-PL-V150A~~	~~1~~	~~PB~~	~~1 yr~~	~~M *~~
~~IRWST Level Transmitter B Isolation~~	~~PXS-PL-V150B~~	~~1~~	~~PB~~	~~1 yr~~	~~M *~~
~~IRWST Level Transmitter C Isolation~~	~~PXS-PL-V150C~~	~~1~~	~~PB~~	~~1 yr~~	~~M *~~
~~IRWST Level Transmitter D Isolation~~	~~PXS-PL-V150D~~	~~1~~	~~PB~~	~~1 yr~~	~~M *~~
~~IRWST Level Transmitter A Isolation~~	~~PXS-PL-V151A~~	~~1~~	~~PB~~	~~1 yr~~	~~M *~~
IRWST Wide Range Level Transmitter B Isolation	PXS-PL-V151B	1	PB	1 yr	M *
IRWST Wide Range Level Transmitter C Isolation	PXS-PL-V151C	1	PB	1 yr	M *

(**UFSAR Table 3.11-1 Continued)**

IRWST Wide Range Level Transmitter D Isolation	PXS-PL-V151D	1	PB	1 yr	M *
IRWST Lower Narrow Range Level Transmitter A Isolation	PXS-PL-V161A	1	PB	1 yr	M *

IRWST Lower Narrow Range Level Transmitter B Isolation	PXS-PL-V161B	1	PB	1 yr	M *
IRWST Lower Narrow Range Level Transmitter C Isolation	PXS-PL-V161C	1	PB	1 yr	M *
IRWST Lower Narrow Range Level Transmitter D Isolation	PXS-PL-V161D	1	PB	1 yr	M *
IRWST Lower Narrow Range Level Transmitter A Reference Leg Isolation	PXS-PL-V162A	1	PB	1 yr	M *
IRWST Lower Narrow Range Level Transmitter B Reference Leg Isolation	PXS-PL-V162B	1	PB	1 yr	M *
IRWST Lower Narrow Range Level Transmitter C Reference Leg Isolation	PXS-PL-V162C	1	PB	1 yr	M *
IRWST Lower Narrow Range Level Transmitter D Reference Leg Isolation	PXS-PL-V162D	1	PB	1 yr	M *
***	***	***	***	***	***

Revise UFSAR Table 3I.6-2, "List of Potential High Frequency Sensitive AP1000 Safety-Related electrical and Electro-mechanical Equipment," as shown below:

Description	AP1000 Tag Number
***	***
~~IRWST Level~~	~~PXS-JE-LT045~~
IRWST Wide Range Level	PXS-JE-LT046
IRWST Wide Range Level	PXS-JE-LT047
IRWST Wide Range Level	PXS-JE-LT048
IRWST Lower Narrow Range Level	PXS-JE-LT066
IRWST Lower Narrow Range Level	PXS-JE-LT067
IRWST Lower Narrow Range Level	PXS-JE-LT068
IRWST Lower Narrow Range Level	PXS-JE-LT069
***	***

Revise UFSAR Table 3I.6-3, "List Of AP1000 Safety-Related Electrical and Mechanical Equipment Not High Frequency Sensitive," as shown below:

Description	AP1000 Tag Number	Comment
***	***	***
~~IRWST Level Transmitter A Isolation~~	~~PXS-PL-V150A~~	~~2~~
~~IRWST Level Transmitter B Isolation~~	~~PXS-PL-V150B~~	~~2~~
~~IRWST Level Transmitter C Isolation~~	~~PXS-PL-V150C~~	~~2~~
~~IRWST Level Transmitter D Isolation~~	~~PXS-PL-V150D~~	~~2~~
~~IRWST Level Transmitter A Isolation~~	~~PXS-PL-V151A~~	~~2~~
IRWST Wide Range Level Transmitter B Isolation	PXS-PL-V151B	2
IRWST Wide Range Level Transmitter C Isolation	PXS-PL-V151C	2
IRWST Wide Range Level Transmitter D Isolation	PXS-PL-V151D	2
IRWST Lower Narrow Range Level Transmitter A Isolation	PXS-PL-V161A	2
IRWST Lower Narrow Range Level Transmitter B Isolation	PXS-PL-V161B	2

(**UFSAR Table 3I.6-3 Continued)**

IRWST Lower Narrow Range Level Transmitter C Isolation	PXS-PL-V161C	2
IRWST Lower Narrow Range Level Transmitter D Isolation	PXS-PL-V161D	2
IRWST Lower Narrow Range Level Transmitter A Reference Leg Isolation	PXS-PL-V162A	2
IRWST Lower Narrow Range Level Transmitter B Reference Leg Isolation	PXS-PL-V162B	2
IRWST Lower Narrow Range Level Transmitter C Reference Leg Isolation	PXS-PL-V162C	2
IRWST Lower Narrow Range Level Transmitter D Reference Leg Isolation	PXS-PL-V162D	2
* * *	* * *	* * *

Revise UFSAR Subsection 6.3.2.2.3, "In-Containment Refueling Water Storage Tank," as shown below:

* * *

In-containment refueling water storage tank level and temperature are monitored by indicators and alarms. The operator can take action, as required, to meet the technical specification requirements for in-containment refueling water storage tank operability.

The protection and safety monitoring system isolates the spent fuel pool cooling system by closing the spent fuel pool cooling system containment isolation valves on low IRWST wide range level to prevent loss of inventory in the event of a leak in the nonsafety spent fuel pool cooling system.

The actuation can be manually blocked while the plant is in Mode 6, below P-9, to allow the spent fuel pool cooling system to transfer the IRWST to the refueling cavity and perform cooling and purification of the refueling cavity. A manual block can also be used during other modes when the plant is below P-9 so that if required, operators can continue to use the spent fuel pool cooling system to cool, purify, sample, or transfer water to the IRWST when the level is below the low setpoint.

* * *

Revise UFSAR Subsection 6.3.3, "Performance Evaluation," as shown below:

*** * ***

The events listed in groups A and B are non-LOCA events where the primary protection is provided by the passive core cooling system passive residual heat removal heat exchanger. For these events, the passive residual heat removal heat exchanger is actuated by the protection and monitoring system for the following conditions:

- Low-2 steam~~Steam~~ generator ~~low~~narrow range water level, coincident with startup feedwater low flow
- Low-2 steam~~Steam~~ generator ~~low~~wide range water level
- Core makeup tank actuation
- Automatic depressurization actuation

* * *

The events listed in group C above are events involving the loss of reactor coolant where the primary protection is by the core makeup tanks and accumulators. For these events the core makeup tanks are actuated by the protection and monitoring system for the following conditions:

- Pressurizer low pressure
- Pressurizer low level
- Steam line low pressure
- Containment high pressure
- Cold leg low temperature
- Low-2 steam~~Steam~~ generator ~~low~~wide range water level, coincident with reactor coolant system high hot leg temperature

Revise UFSAR Subsection 6.3.3.4.1, "Loss of Startup Feedwater During Hot Standby, Cooldowns, and Heat-ups," as shown below:

* * *

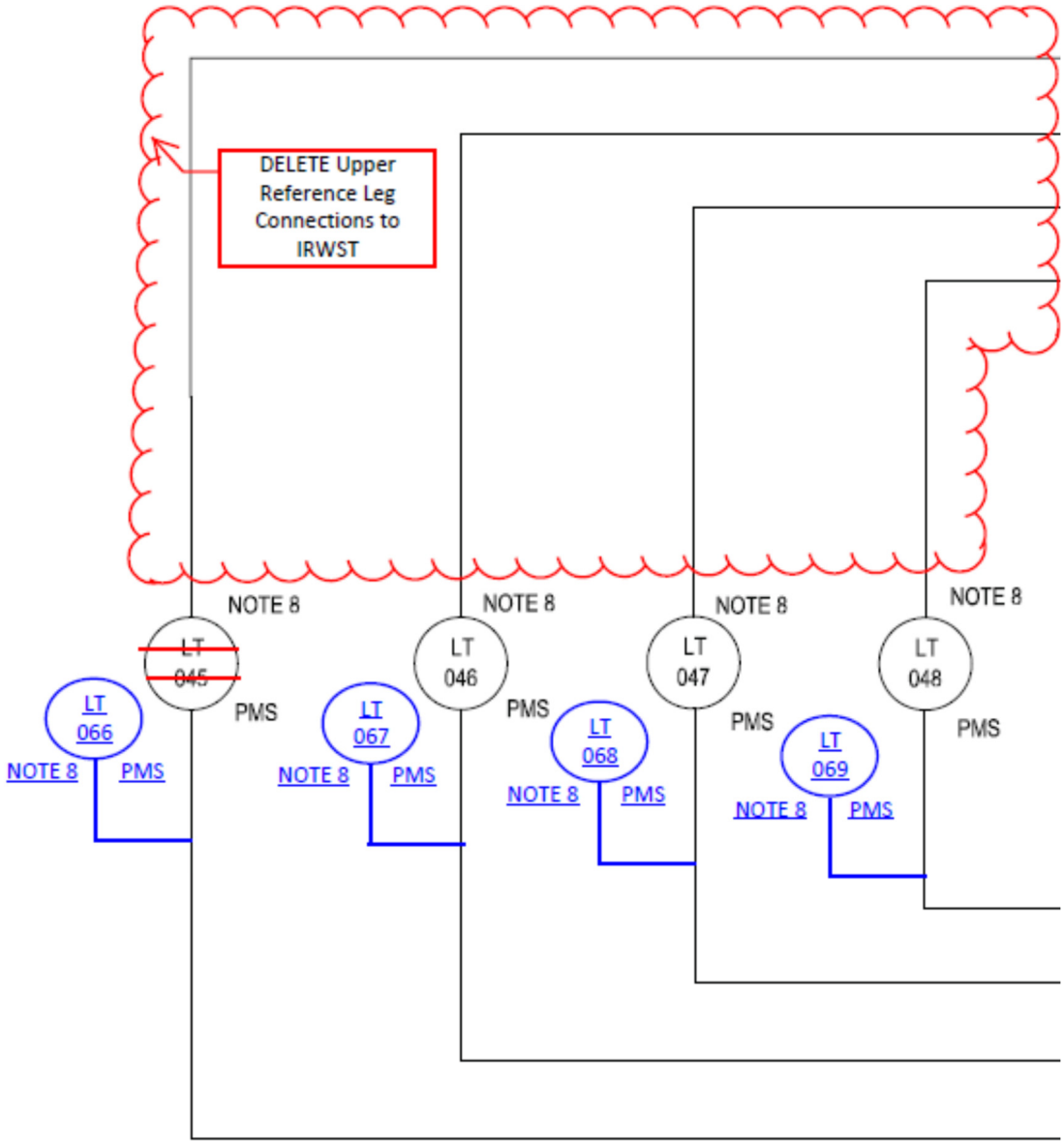
In the event of a loss of startup feedwater, the passive residual heat removal heat exchanger is automatically actuated on ~~low~~Low-2 steam generator narrow range water level and provides safety-related heat removal. The passive residual heat removal heat exchanger can maintain the reactor coolant system temperature, as well as provide for reactor coolant system cooldown to conditions where the normal residual heat removal system can be operated.

* * *

Revise UFSAR Subsection 6.3.7.4.3, "In-Containment Refueling Water Storage Tank Level," as shown below:

~~Six~~ Nine level channels are installed on the in-containment refueling water storage tank. There are two upper narrow range level channels. These level indications are used to confirm that in-containment refueling water storage tank normal level is within the bounds of the assumptions used in the safety analysis. There are ~~four~~ three wide range level channels. Two of these level indications are used to provide refueling cavity and spent fuel pool cooling system isolation. There are four lower narrow range level channels. These level indications are used to provide containment recirculation valve repositioning. Each channel provides level indication in the main control room and provides level alarms.

Revise UFSAR Figure 6.3-2, "Simplified Passive Core Cooling System Piping and Instrumentation Diagram," as shown below:



Revise UFSAR Subsection 7.1.7 Reference 19, WCAP-16675-P (Proprietary) and WCAP-16675-NP (Non-Proprietary), "AP1000 Protection and Safety Monitoring System Architecture Technical Report," as shown below:

7.1.7 References

* * *

18. APP-GW-GLR-017, AP1000 Standard Combined License Technical Report, "Resolution of Common Q NRC Items," Westinghouse Electric Company LLC.

19. WCAP-16675-P (Proprietary) and WCAP-16675-NP (Non-Proprietary), "AP1000 Protection and Safety Monitoring System Architecture Technical Report," Revision 5 (as modified by changes provided in UFSAR Appendix 7A).

* * *

Revise UFSAR Subsection 7.2.1.1.5, "Loss of Heat Sink Trip," as shown below:

Reactor Trip on ~~Low~~Low-2 Steam Generator Narrow Range Water Level in any Steam Generator

This trip protects the reactor from loss of heat sink in the event of a loss of feedwater to the steam generators. The reactor is tripped when two out of the four narrow range water level sensors in any steam generator produce signals below the setpoint value. This trip can be manually blocked when the reactor coolant average temperature is below the P-9 permissive setpoint. This trip is automatically reset when reactor coolant average temperature is above the P-9 permissive setpoint.

Figure 7.2-1, sheet 7, shows the logic for the trip. ~~There are no interlocks or permissives associated with this trip.~~The development of the P-9 permissive is shown on Figure 7.2-1, sheet 7.

Revise UFSAR Subsection 7.2.1.1.12, "Reactor Trip System Interlocks," as shown below:

*** * ***

Power Range (Low Setpoint) Block (One Control for each Division)

The power range low setpoint reactor trip may be manually blocked upon the occurrence of the P-10 permissive and is automatically reset when the permissive condition is not met. Figure 7.2-1, sheet 3, shows this block.

Steam Generator Low-2 Water Level Block (One Control for each Division)

The steam generator Low-2 reactor trip may be manually blocked upon the occurrence of the P-9 permissive. This trip function is automatically reset when the permissive condition is not met. Figure 7.2-1, sheet 7, illustrates the functional logic relating to this function.

*** * ***

Revise UFSAR Subsection Table 7.2-2, "Reactor Trips," as shown below:

Reactor Trip[1]	No. of Channels	Division Trip Logic	Bypass Logic	Permissives and Interlocks (See Table 7.2-3)
* * *				
Reactor Coolant Pump Underspeed	4 (1/pump)	2/4	Yes[2]	P-10
Low-2 Steam Generator Narrow Range Water Level	4/steam generator	2/4 in any steam generator	Yes[2]	P-9
High-2 Steam Generator Water Level	4/steam generator	2/4 in any steam generator	Yes[2]	P-11
* * *				

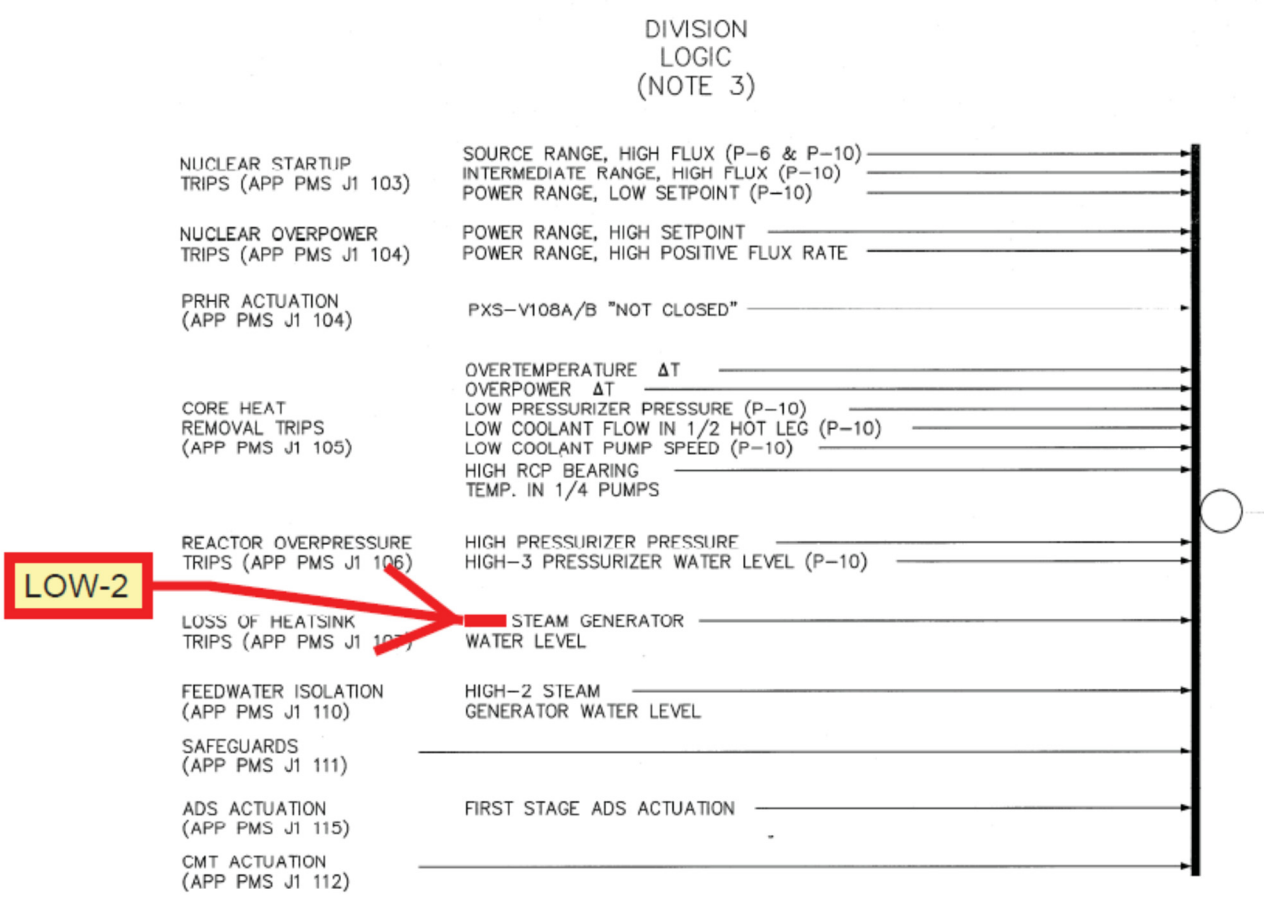
Revise UFSAR Subsection Table 7.2-3, "Reactor Trip Permissives and Interlocks," as shown below:

Designation	Derivation	Function
* * *		
P-6	Intermediate range neutron flux below setpoint	Automatically resets source range reactor trip
P-9	Reactor coolant average temperature above setpoint	Automatically resets Low steam generator water level reactor trip
$\overline{\text{P-9}}$	Reactor coolant average temperature below setpoint	Allows manual block of Low steam generator water level reactor trip
* * *		

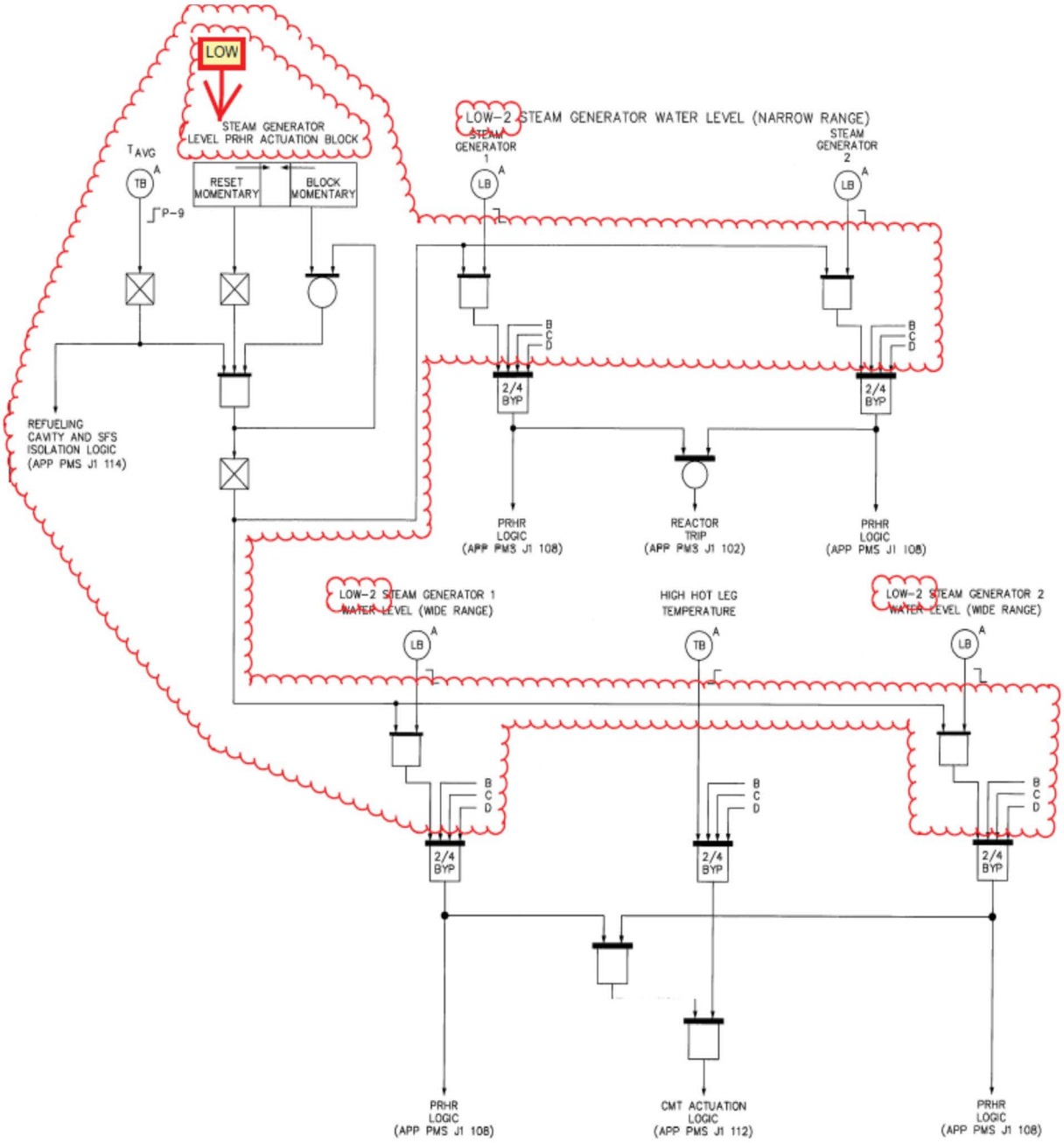
Revise UFSAR Table 7.2-4, "System-Level Manual Inputs to the Reactor Trip Functions," as shown below:

Manual Control	To Divisions				Figure 7.2-1 Sheet
* * *	* * *				* * *
Power Range High Neutron Flux Block (Low Setpoint), Division D				D	3
Low Steam Generator Level PRHR Actuation Block, Division A	A				7
Low Steam Generator Level PRHR Actuation Block, Division B		B			7
Low Steam Generator Level PRHR Actuation Block, Division C			C		7
Low Steam Generator Level PRHR Actuation Block, Division D				D	7
Manual Safeguards Actuation Control #1	A	B	C	D	11
* * *	* * *				* * *

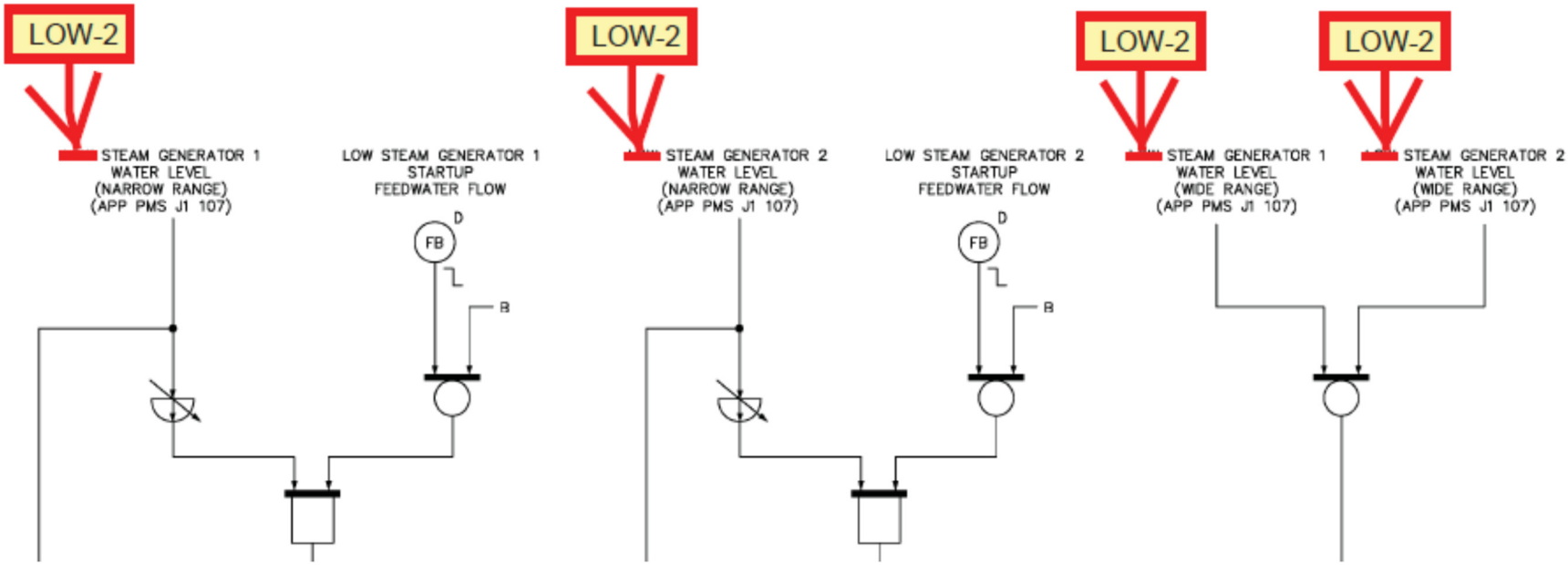
Revise UFSAR Figure 7.2-1 (Sheet 2), "Functional Diagram Reactor Trip Functions," as shown below:



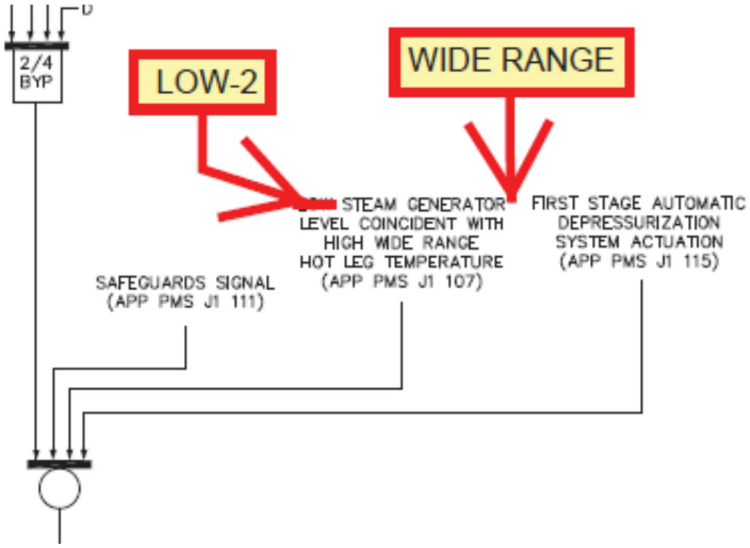
Revise UFSAR Figure 7.2-1 (Sheet 7), "Functional Diagram Loss of Heat Sink Protection," as shown below:



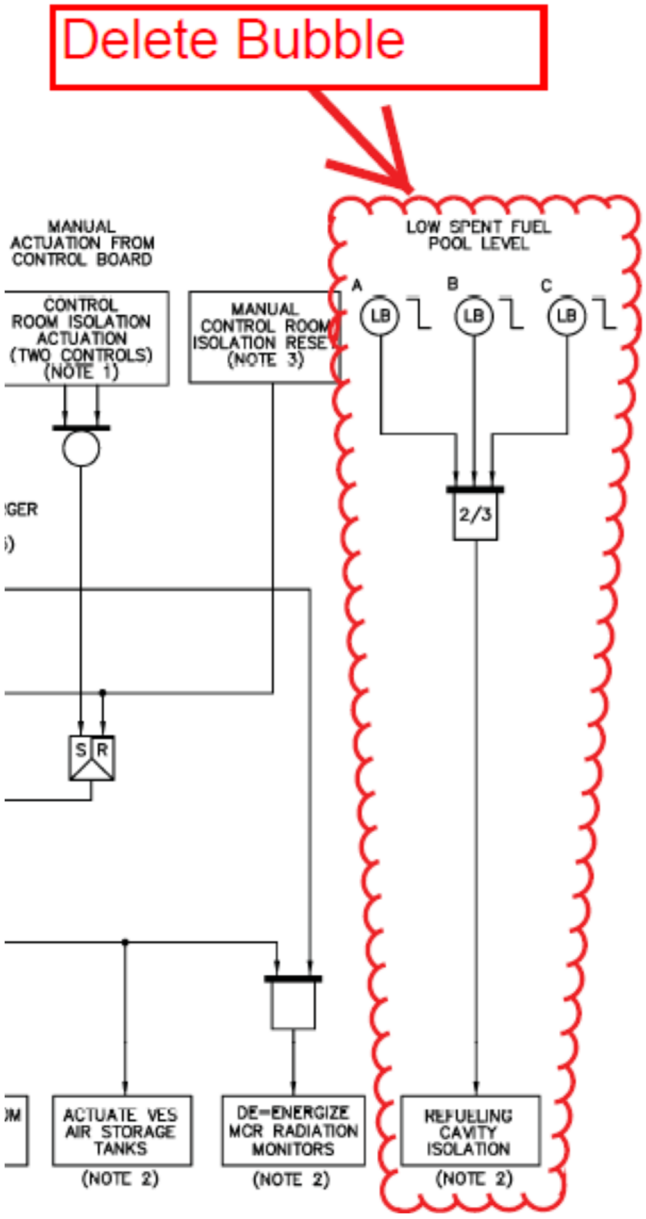
Revise UFSAR Figure 7.2-1 (Sheet 8), "Functional Diagram Loss of Heat Sink Protection," as shown below:



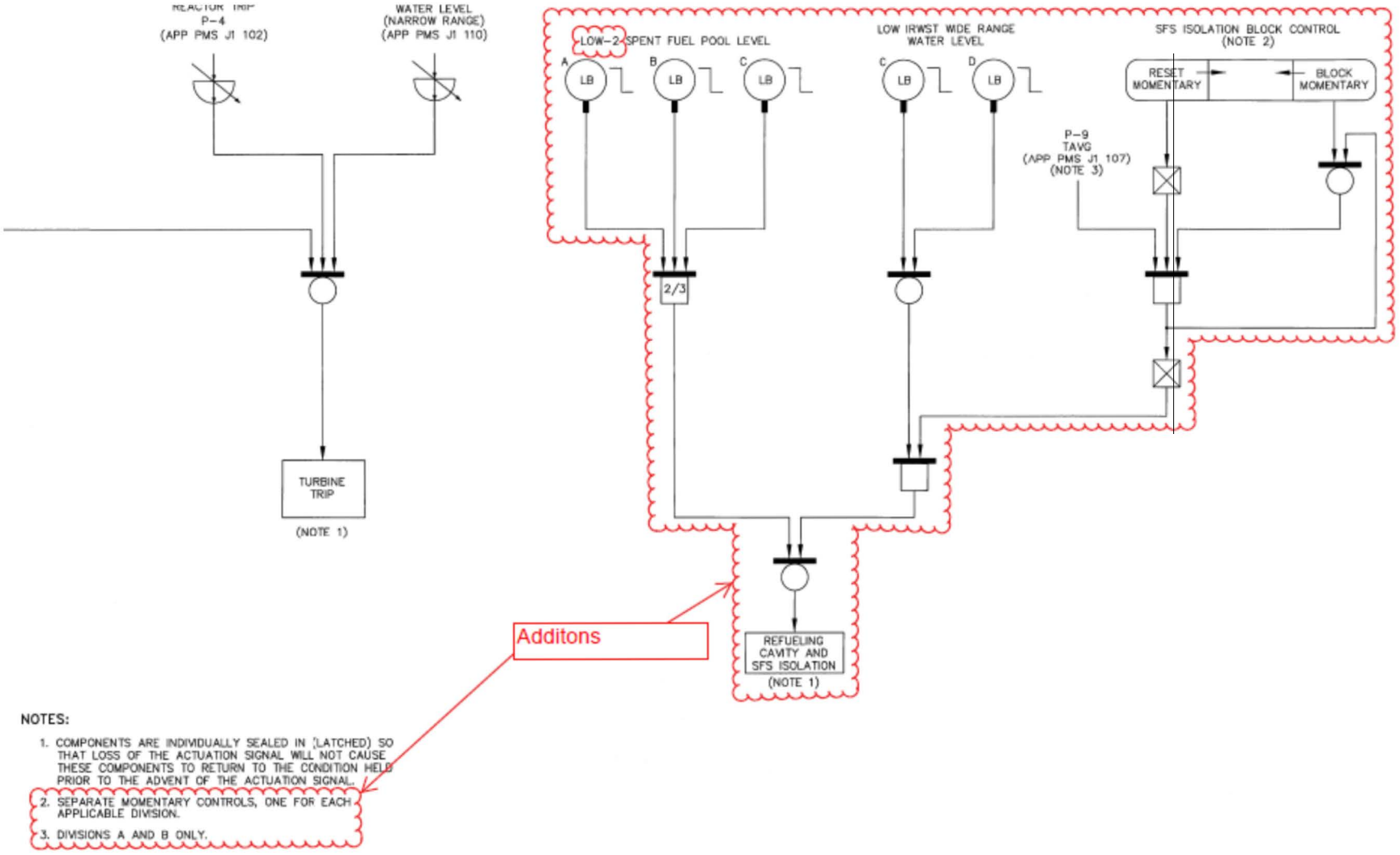
Revise UFSAR Figure 7.2-1 (Sheet 12), "Functional Diagram Loss of Heat Sink Protection," as shown below:



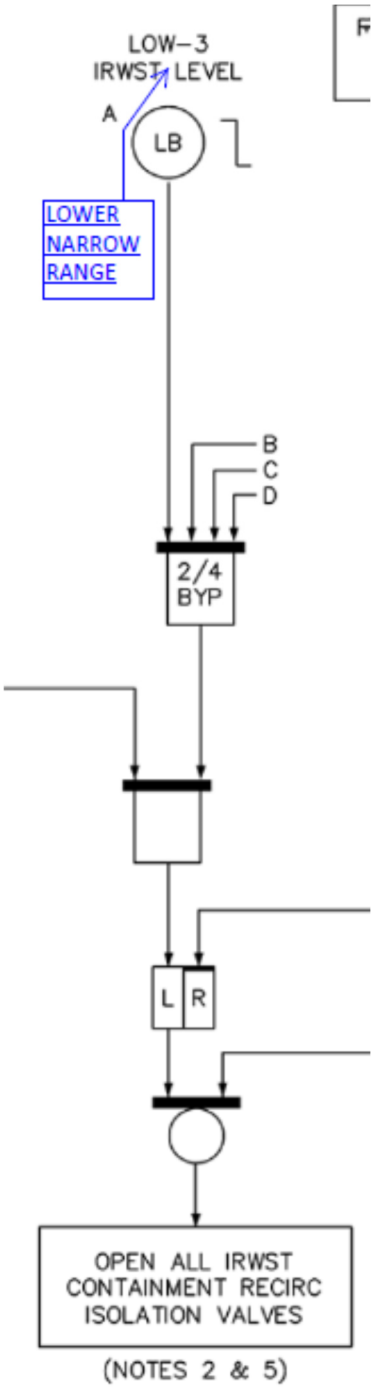
Revise UFSAR Figure 7.2-1 (Sheet 13), "Functional Diagram Containment and Other Protection," as shown below:



Revise UFSAR Figure 7.2-1 (Sheet 14), "Functional Diagram Turbine Trip and Refueling Cavity and SFS Isolation," as shown below:



Revise UFSAR Figure 7.2-1 (Sheet 16), "Functional Diagram In-containment Refueling Water Storage Tank Actuations," as shown below:



Revise UFSAR Subsection 7.3.1.2.3, "Core Makeup Tank Injection," as shown below:

7.3.1.2.3 Core Makeup Tank Injection

Signals to align the core makeup tanks for injection are generated from the following conditions:
1. Automatic or manual safeguards actuation (Subsection 7.3.1.1)
2. Automatic or manual actuation of the first stage of the automatic depressurization system (Subsection 7.3.1.2.4)
3. Low-2 pressurizer level
4. ~~Low wide range~~Low-2 steam generator wide range water level coincident with High hot leg temperature

* * *

Condition 4 is derived from a coincidence of:

- Both steam generator 1 and steam generator 2 wide range level below the Low-2 setpoint (derived from two of the four wide range water level measurement divisions for each steam generator), and

- Two of the four divisions of hot leg temperature above the High (T_{hot}) setpoint

Low-2 steam generator wide range level can be manually blocked when the reactor coolant system average temperature is below the P-9 permissive setpoint, and is automatically unblocked when the reactor coolant average temperature is above the P-9 permissive.

Condition 5 consists of two momentary controls. Manual actuation of either of the two controls will align the core makeup tanks for injection.

The functional logic relating to core makeup tank injection is illustrated in Figure 7.2-1, sheets 7, 12 and 15. The development of the P-9 permissive is shown on Figure 7.2-1, sheet 7.

Revise UFSAR Subsection 7.3.1.2.5, "Reactor Coolant Pump Trip" as shown below:

* * *

1. Low-2 pressurizer level

2. ~~Low wide range~~Low-2 steam generator wide range water level coincident with High hot leg temperature

* * *

Condition 4 is derived from a coincidence of:

- Both steam generator 1 and steam generator 2 wide range level below the Low-2 setpoint (derived from two of the four wide range water level measurement divisions for each steam generator), and

Revise UFSAR Subsection 7.3.1.2.7, "Passive Residual Heat Removal Heat Exchanger Alignment" as shown below:

A signal to align the passive heat removal heat exchanger to passively remove core heat is generated from any of the following conditions:
1. Core makeup tank injection alignment signal (Subsection 7.3.1.2.3)
2. First stage automatic depressurization system actuation (Subsection 7.3.1.2.4)
3. Low-2 ~~wide range~~ steam generator wide range water level
4. Low-2 ~~narrow range~~ steam generator narrow range water level coincident with Low startup feedwater flow
5. High-3 pressurizer water level
6. Manual initiation

* * *

Condition 3 results from the coincidence of two of the four divisions of ~~wide range~~ steam generator wide range water level below the Low-2 setpoint in either of the two steam generators. Low-2 steam generator wide range water level can be manually blocked when the reactor coolant system average temperature is below the P-9 permissive setpoint, and is automatically unblocked when the reactor coolant average temperature is above the P-9 permissive.

Condition 4 results from the coincidence of two of the four divisions of ~~narrow range~~ steam generator narrow range water level below the Low-2 setpoint, after a preset time delay, coincident with a Low startup feedwater flow in a particular steam generator. This function is provided for each of the two steam generators. The ~~low~~Low-2 ~~narrow range~~ steam generator narrow range water level also isolates blowdown in the affected steam generator. Low-2 steam generator narrow range water level can be manually blocked when the reactor coolant system average temperature is below the P-9 permissive setpoint, and is automatically unblocked when the reactor coolant average temperature is above the P-9 permissive.

* * *

Condition 6 consists of two momentary controls. Manual actuation of either of the two controls will align the passive residual heat removal heat exchanger initiating heat removal by this path.
The functional logic relating to alignment of the passive residual heat removal heat exchanger is illustrated in Figure 7.2-1, sheet 8. The development of the P-9 permissive is shown on Figure 7.2-1, sheet 7.

Revise UFSAR Subsection 7.3.1.2.11, "Steam Generator Blowdown System Isolation," as shown below:

* * *

Signals to close the isolation valves of the steam generator blowdown system in both steam generators are generated from the following conditions:

1. Passive residual heat removal heat exchanger alignment signal (Subsection 7.3.1.2.7)
2. Low-2 ~~narrow range~~ steam generator narrow range water level

Condition 2 results from the coincidence of two of the four divisions of ~~narrow range~~ steam generator narrow range water level below the Low-2 setpoint. This condition only closes the blowdown system isolation valves of the affected steam generator. Low-2 steam generator narrow range water level can be manually blocked when the reactor coolant system average temperature is below the P-9 permissive setpoint, and is automatically unblocked when the reactor coolant average temperature is above the P-9 permissive.

The functional logic relating to steam generator blowdown isolation is illustrated in Figure 7.2-1, sheets 7 and 8. The development of the P-9 permissive is shown on Figure 7.2-1, sheet 7.

Revise UFSAR Subsection 7.3.1.2.21, "Refueling Cavity Isolation," as shown below:

7.3.1.2.21 Refueling Cavity and Spent Fuel Pool Cooling System Isolation

Signals~~A signal~~ for isolating the spent fuel pool cooling system lines ~~is~~ by closing the spent fuel pool cooling system containment isolation valves are generated ~~upon~~ from either of the following conditions:

1. Low-2 spent fuel pool level
2. Low IRWST wide range level

Condition 1 results from the coincidence of spent fuel pool level below the Low-2 setpoint in two of three divisions. This helps to maintain the water inventory in the refueling cavity due to line leakage. ~~The functional logic relating to this is illustrated in Figure 7.2-1, sheet 13.~~

Condition 2 results from IRWST wide range level below the Low setpoint in one of two divisions. This helps to maintain the water inventory in the IRWST in the event of a leak in the nonsafety-related spent fuel pool cooling system. Low IRWST wide range level can be manually blocked when the reactor coolant system average temperature is below the P-9 permissive setpoint and the plant is in Mode 6, to allow the spent fuel pool cooling system to transfer the IRWST inventory to the refueling cavity and perform cooling and purification of the refueling cavity. A manual block can also be used when the reactor coolant system average temperature is below the P-9 permissive setpoint to use the spent fuel pool cooling system to cool, purify, sample, or transfer water to or from the IRWST when the level is below the Low IRWST wide range level setpoint. Low IRWST wide range level is automatically unblocked when the reactor coolant average temperature is above the P-9 permissive.

The functional logic relating to refueling cavity and spent fuel pool cooling system isolation is illustrated in Figure 7.2-1, sheet 14. The development of the P-9 permissive is shown on Figure 7.2-1, sheet 7.

Revise UFSAR Table 7.3-1, "Engineered Safety Features Actuation Signals," as shown below:

Actuation Signal	No. of Divisions/ Controls	Actuation Logic	Permissives and Interlocks
* * *			
5. Reactor Coolant Pump Trip (Figure 7.2-1, Sheets 5, 7, 12, and 15) **(Trips All Reactor Coolant Pumps)**			
d. ~~Low wide range~~Low-2 steam generator wide range water level coincident with	4/steam generator	2/4-BYP[1] in both steam generators	~~None~~Manual block permitted below P-9 Automatically unblocked above P-9
* * *	* * *	* * *	* * *
6. Core Makeup Tank Injection (Figure 7.2-1, Sheets 7, 12 and 15)			
* * *	* * *	* * *	* * *
c. Low-2 pressurizer level	4	2/4-BYP[1]	Manual block permitted below P-12 Automatically unblocked above P-12
d. Low-2 ~~wide range~~ generator wide range water level coincident with	4/steam generator	2/4-BYP[1] in both steam generators	~~None~~Manual block permitted below P-9 Automatically unblocked above P-9
* * *	* * *	* * *	* * *
9. Steam Generator Blowdown System Isolation (Figure 7.2-1 Sheets 7 and 8)			
a. Passive residual heat removal heat exchanger actuation	(See items 12a through 12f)		
b. Low-2 ~~narrow range~~ steam generator narrow range water level	4/steam generator	2/4 BYP[1] in either steam generator	~~None~~Manual block permitted below P-9 Automatically unblocked above P-9
* * *	* * *	* * *	* * *
12. Passive Residual Heat Removal (Figure 7.2-1, Sheet 8)			
* * *	* * *	* * *	* * *
b. Low-2 ~~narrow range~~ steam generator narrow range water level coincident with	4/steam generator	2/4 BYP[1] in either steam generator	~~None~~Manual block permitted below P-9 Automatically unblocked above P-9
Low startup feedwater flow	2/feedwater line	1/2 in either feedwater line	None

c. Low-2 steam generator wide range water level	4/steam generator	2/4 BYP[1] in either steam generator	~~None~~Manual block permitted below P-9 Automatically unblocked above P-9
* * *	* * *	* * *	* * *
20. Refueling Cavity and SFS Isolation (Figure 7.2-1, Sheet ~~13~~14)			
a. ~~Low~~Low-2 spent fuel pool level	3	2/3	None
b. Low IRWST wide range level[(8)]	2	1/2	Manual block permitted below P-9 Automatically unblocked above P-9
* * *	* * *	* * *	* * *
23. Open All Containment Recirculation Valves (Figure 7.2-1, Sheet 16)			
a. Automatic reactor coolant system depressurization (fourth stage) coincident with		(See items 3d through 3f)	
Low IRWST lower narrow range level (Low-3 setpoint)	4	2/4-BYP[1]	None

Revise UFSAR Table 7.3-2, "Interlocks for Engineered Safety Features Actuation System," as shown below:

Designation	Derivation	Function
* * *	* * *	* * *
P-6	Intermediate range neutron flux channels below setpoint	Automatically resets the manual block of flux doubling actuation of the boron dilution block
P-9	Reactor coolant average temperature above setpoint	(a) Automatically unblocks core makeup tank actuation on low steam generator wide range water level (b) Automatically unblocks steam generator blowdown system isolation on low steam generator narrow range water level (c) Automatically unblocks passive residual heat removal actuation on low steam generator narrow range water level and on low steam generator wide range water level (d) Automatically unblocks refueling cavity and spent fuel pool cooling system isolation on low IRWST wide range level
$\overline{\text{P-9}}$	Reactor coolant average temperature below setpoint	(a) Permits manual block of core makeup tank actuation on low steam generator wide range water level (b) Permits manual block of steam generator blowdown system isolation on low steam generator narrow range water level (c) Permits manual block of passive residual heat removal actuation on low steam generator narrow range water level and on low steam generator wide range water level (d) Permits manual block of refueling cavity and spent fuel pool cooling system isolation on low IRWST wide range level

Revise UFSAR Subsection Table 7.3-3, "System-Level Manual Input to the Engineered Safety Features Actuation System," as shown below:

Manual Control	To Divisions				Figure 7.2-1 Sheet
* * *	* * *				* * *
RCS pressure CVS/PRHR block control #4				D	6
SFS isolation block control #1	A				14
SFS isolation block control #2		B			14
Normal residual heat removal system isolation safeguards block control #1	A				13
* * *	* * *				* * *

Revise Subsection 7.4.1.1, "Safe Shutdown Using Safety-Related Systems," as shown below:

* * *

The initial response of the passive safety systems is to actuate the passive residual heat removal heat exchanger due to ~~low~~Low-2 steam generator wide range water level. The passive residual heat removal heat exchanger removes decay heat from the core by transferring this heat to the in-containment refueling water storage tank.

* * *

Revise UFSAR Table 7.5-1, "Post-Accident Monitoring System," as shown below:

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
* * *	* * *	* * *	* * *	* * *	* * *	* * *	* * *	* * *
IRWST wide range water level	0-100% of span	B1, D2, F2	Harsh	Yes	3 (Note 4)	1E	Yes	
IRWST lower narrow range water level	0-100% of span	D2	Harsh	Yes	3 (Note 4)	1E	No	
RCS subcooling (Note 6)	200°F Sub-cooling to 35°F super heat	B1, F2	Harsh	Yes	2	1E	Yes	Diverse measurement: Core exit temperature & wide range RCS pressure
* * *	* * *	* * *	* * *	* * *	* * *	* * *	* * *	* * *

Revise UFSAR Table 7.5-5, "Summary of Type B Variables," as shown below:

Function Monitored	Variable	Type/Category
* * *	* * *	* * *
Reactor Core Cooling	Core exit temperature	B1
	RCS subcooling	B1
	RCS wide range Thot	B2
	RCS wide range Tcold	B2
	RCS wide range pressure	B2
	Reactor vessel - hot leg water level	B2
Heat Sink Maintenance	IRWST wide range water level	B1
	PRHR flow	B1
	PRHR outlet temperature	B1
	PCS storage tank water level	B1
	Passive containment cooling water flow	B1
	IRWST to RNS suction valve status	B1
* * *	* * *	* * *

Revise UFSAR Table 7.5-7, "Summary of Type D Variables," as shown below:

System	Variable	Type/Category
* * *	* * *	* * *
Secondary Pressure and Level Control	* * *	* * *
	Main feedwater isolation valve status	D2
	Steam generator wide range water level ~~(wide range)~~	D2
	Steam generator narrow range water level ~~(narrow range)~~	D2
* * *	* * *	* * *
Safeguards (continued)	IRWST bottom temperature	D3
	IRWST wide range water level	D2
	IRWST lower narrow range water level	D2
	IRWST gutter bypass isolation valve status	D2
	Remotely operated containment isolation valve status	D2
* * *	* * *	* * *

Revise UFSAR Table 7.5-9, "Summary of Type F Variables," as shown below:

Variable	Type/Category
Monitoring for preplanned manual nonsafety-related system actions	
* * *	* * *
RCS wide range Tcold	F2
Steam generator narrow range water level ~~(NR)~~	F2
Pressurizer level	F2
* * *	* * *
Containment water level	F2
IRWST wide range water level	F2
Startup feedwater flow	F2
* * *	* * *
Monitoring for nonsafety-related system performance	
* * *	* * *
Main feedwater flow	F3
Steam generator wide range water level ~~(WR)~~	F3

Add New Revise UFSAR Appendix 7A.8 WCAP-16675, "AP1000 Protection and Safety Monitoring System Architecture Technical Report," as shown below:

7A.8 WCAP-16675-P and WCAP-16675-NP, "AP1000 Protection and Safety Monitoring System Architecture Technical Report"

The UFSAR incorporates by reference Tier 2 documents WCAP-16675-P and WCAP-16675-NP, "AP1000 Protection and Safety Monitoring System Architecture Technical Report." See Table 1.6-1. WCAP-16675, Revision 5, includes the following revisions and additions as indicated by strikethroughs and underlines.

- Revise Section 1.1, Reactor Trip Functions, as follows:

  The PMS generates an automatic reactor trip for the following conditions * * *:

  14. ~~Reactor Trip on Low Water Level in any~~ Steam Generator 1 Water Level Low-2 as described in Reference 9.

  15. Steam Generator 2 Water Level Low-2 as described in Reference 9.

- Revise Section 1.2, Engineered Safety Features Actuation System Functions, as follows:
  The following is a list of the ESF system-level actuations initiated by the PMS * * *:

  21. Refueling Cavity and Spent Fuel Pool Cooling System (SFS) Isolation as described in Reference 9.

Revise UFSAR subsection 9.1.3.7, "Instrumentation Requirements," as shown below:

9.1.3.7 Instrumentation Requirements

* * *

D. Level

Safety-related instrumentation is provided to give an alarm in the main control room when the water level in the spent fuel pool reaches the ~~low-low-~~Low-2 level setpoint. This instrumentation is used for post-accident monitoring on the spent fuel pool level. (See Table 7.5-1)

Non-safety-related instrumentation is provided to give an alarm in the main control room when the water level in the spent fuel pool and the cask loading pit reaches either the ~~high~~High level or ~~low~~Low level setpoint. Instrumentation in the cask loading pit is used to alert the operator to a ~~low~~Low-2 level when injecting water from the pit into the reactor coolant system with the normal residual heat removal pumps.

* * *

Revise UFSAR Table 9A-2, "Safe Shutdown Components," as shown below:

Fire Area/ Fire Zone	System	Description	Class 1E Division			
			A	C	B	D
1000 AF 01/1100 AF 11300A	* * *	* * *	* * *	* * *	* * *	* * *
	VFS	Containment Purge Inlet Cont. Isolation Valve				V004
	PXS	IRWST Wide Range Level			LT-046	LT-048
		IRWST Gutter Isolation Valve			V130A	V130B
		Core Makeup Tank (MT-02A)				
	SGS	Steam Generator 2 Wide Range Water Level	* * *	* * *	* * *	* * *

Table 9A-2 (continued)

Fire Area/ Fire Zone	System	Description	Class 1E Division			
			A	C	B	D
1000 AF 01/ 1100 AF 11300B	* * *	* * *	* * *	* * *	* * *	* * *
	PXS	PRHR Heat Exchanger Control Valve	V108A		V108B	
		IRWST Wide Range Level	~~LT-045~~	LT-047		
		Core Makeup Tank (MT-02A)				
	* * *	* * *	* * *	* * *	* * *	* * *
	SGS	Steam Generator 1 Narrow Range Water Level	LT-001	LT-003		
		Steam Generator 2 Narrow Range Water Level	LT-005	LT-007		
		Steam Generator 2 Wide Range Water Level	LT-013	LT-017		
		Steam Generator 1 Wide Range Water Level	LT-011	LT-015		

Table 9A-2 (continued)

Fire Area/ Fire Zone	System	Description	Class 1E Division			
			A	C	B	D
1000 AF 01/ 1100 AF 11300	RCS	* * *	* * *	* * *	* * *	* * *
		Hot Leg 1 Flow			FT-101B	FT-101D
	SGS	Steam Generator 1 Wide Range Water Level			LT-012	LT-012

Fire Area/ Fire Zone	System	Description	Class 1E Division			
			A	C	B	D
1000 AF 01/ 1100 AF 11500	SGS	Steam Generator 1 Narrow Range Water Level			LT-002	LT-004
		Steam Generator 2 Narrow Range Water Level			LT-006	LT-008
	* * *	* * *	* * *	* * *	* * *	* * *

Revise Subsection 10.4.8.2.2.7, "Emergency Operation" as shown below:

Blowdown system isolation is actuated on ~~low~~Low-2 steam generator narrow range water levels. The isolation of steam generator blowdown provides for a continued availability of the steam generator as a heat sink for decay heat removal in conjunction with operation of the passive residual heat removal system and the startup feedwater system.

Revise Subsection 10.4.8.2.3.5, "Blowdown Isolation Valves" as shown below:

* * *
The isolation valves provide for redundant isolation of the blowdown system upon actuation of the passive residual heat removal system, ~~low (narrow range)~~Low-2 steam generator narrow range water level, or abnormal conditions in the blowdown system. Each isolation valve receives an actuation signal from the protection and safety monitoring system (PMS) upon passive residual heat removal actuation to preserve steam generator inventory. The valves also close upon receiving a ~~low (narrow range)~~Low-2 steam generator narrow range water level signal to preserve steam generator inventory.
* * *

Revise Subsection 10.4.9.5, "Instrumentation Applications" as shown below:

* * *
The startup feedwater flow is controlled by a steam generator level demand signal modulating the startup feedwater control valve. The control valve may either be in manual or automatic control. Refer to Section 7.7. The startup feedwater flow transmitters also provide redundant indication of startup feedwater and automatic safeguards actuation input on low flow coincident with ~~low, narrow range~~Low-2 steam generator narrow range water level. See Section 7.3.

Revise Subsection 14.2.9.3.5, "Steam Generator Blowdown System Testing" as shown below:

* * *
d) The heat transfer capability of each blowdown heat exchanger is verified.
e) The automatic isolation of steam generator blowdown on ~~low~~Low-2 steam generator narrow range water level is verified.

Revise Table 14.3-2, "Design Basis Accident Analysis" as shown below:

Reference	Design Feature	Value
* * *	* * *	* * *
Section 7.3.1.2.7	The passive residual heat removal heat exchanger control valves are opened on ~~low~~Low-2 steam generator wide range water level or on a CMT actuation signal via the protection and safety monitoring system.	
* * *	* * *	* * *
Section 10.4.8.2.2.7	Blowdown system isolation is actuated on ~~low~~Low-2 steam generator narrow range water levels. The isolation of steam generator blowdown provides for a continued availability of the steam generator as a heat sink for decay heat removal in conjunction with operation of the passive residual heat removal system and the startup feedwater system.	
* * *	* * *	* * *
Section 15.2.6.2.1	Following a loss of ac power, the PRHR heat exchanger is actuated by ~~the low~~Low-2 steam generator wide range water level ~~(wide range)~~.	

Revise Table 15.0-4a, "Protection and Safety Monitoring System Setpoints and Time Delay Assumed in Accident Analyses" as shown below:

Function	Limiting Setpoint Assumed in Analyses	Time Delays (seconds)
* * *	* * *	* * *
Reactor trip on ~~low~~Low-2 steam generator narrow range water level	95,000 lbm	2.0
* * *	* * *	* * *
PRHR actuation on ~~low~~Low-2 steam generator wide range water level	55,000 lbm	2.0

Revise Table 15.0-6, "Plant Systems and Equipment Available for Transient and Accident Conditions" as shown below:

Incident	Reactor Trip Functions	ESF Actuation Functions	ESF and Other Equipment
Section 15.2			
Decrease in heat removal by the secondary system			
Loss of external load/turbine trip	High pressurizer pressure, high pressurizer water level, overtemperature ΔT, overpower ΔT, ~~Steam~~Low-2 steam generator ~~low~~ narrow range water level, low RCP speed, manual	-	Pressurizer safety valves, steam generator safety valves
Loss of nonemergency ac power to the station auxiliaries	~~Steam~~ Low-2 steam generator ~~low~~ narrow range water level, high pressurizer pressure, high pressurizer level, manual	~~Steam~~ Low-2 steam generator ~~low~~ narrow range water level coincident with low startup water flow, steam generator ~~low~~Low-2 wide range water level	PRHR, steam generator safety valves, pressurizer safety valves
Loss of normal feedwater flow	~~Steam~~ Low-2 steam generator l~~ow~~ narrow range water level, high pressurizer pressure, high pressurizer level, manual	~~Steam~~ Low-2 steam generator ~~low~~ narrow range water level coincident with low startup water flow, steam generator ~~low~~Low-2 wide range water level	PRHR, steam generator safety valves, pressurizer safety valves
Feedwater system pipe break	~~Steam~~ Low-2 steam generator ~~low~~ narrow range water level, high pressurizer pressure, high pressurizer level, manual	~~Steam~~ Low-2 steam generator ~~low~~ narrow range water level coincident with low startup feedwater flow, ~~Steam~~ Low-2 steam generator ~~low~~ wide range water level, low steam line pressure, high-2 containment pressure	PRHR, core makeup tank, MSIVs, feedline isolation, pressurizer safety valves, steam generator safety valves

Revise Subsection 15.1.5.2.3, "Core Power and Reactor Coolant System Transient" as shown below:

* * *

The PRHR system provides a passive, long-term means of removing the core decay and stored heat by transferring the energy via the PRHR heat exchanger to the in-containment refueling water storage tank (IRWST). The PRHR heat exchanger is normally actuated automatically when the steam generator level falls below the ~~low wide range~~Low-2 steam generator wide range water level. For the main steam line rupture case analyzed, the PRHR exchanger is conservatively actuated at time zero to maximize the cooldown.

Revise Subsection 15.2.3.2.1, "Analysis of Effects and Consequences" as shown below:

* * *

Reactor Trip

Reactor trip is actuated by the first reactor trip setpoint reached, with no credit taken for the rapid power reduction on the turbine trip. Trip signals are expected due to high pressurizer pressure, overtemperature ΔT, low RCP speed, high pressurizer water level, and ~~low~~Low-2 steam generator narrow range water level.

* * *

Revise Subsection 15.2.6.2.1, "Method of Analysis" as shown below:

* * *

- A heat transfer coefficient is assumed in the steam generator associated with reactor coolant system natural circulation flow conditions following the reactor coolant pump coastdown.
- The PRHR heat exchanger is actuated by the ~~low~~Low-2 steam generator narrow range water level (~~narrow range~~ coincident with low start up feed water flow).

* * *

Revise Subsection 15.2.7.1, "Identification of Causes and Accident Description" as shown below:

* * *

The following occurs upon loss of normal feedwater (assuming main feedwater pump fails or valve malfunctions):

- The steam generator water inventory decreases as a consequence of the continuous steam supply to the turbine. The mismatch between the steam flow to the turbine and the feedwater flow leads to the reactor trip on a ~~low~~Low-2 steam generator narrow range water level signal. The same signal also actuates the startup feedwater system (see Subsection 15.2.6.1).

* * *

- If startup feedwater is not available, the PRHR heat exchanger is actuated on either a ~~low~~Low-2 steam generator narrow range water level ~~(narrow range)~~, coincident with a low startup feedwater flow rate signal or a ~~low~~Low-2 steam generator wide range water level ~~(wide range)~~ signal. The PRHR heat exchanger transfers the core decay heat and sensible heat to the IRWST so that core heat removal is uninterrupted following a loss of normal and startup feedwater (see Subsection 15.2.6).

Revise Subsection 15.2.7.2.1, "Method of Analysis" as shown below:

* * *

The assumptions used in the analysis are as follows:

- The plant is initially operating at 102 percent of the design power rating. The main feedwater flow measurement supports a 1-percent power uncertainty; use of a 2-percent power uncertainty is conservative.

- Reactor trip occurs on Low-2 steam generator ~~low (narrow range)~~ narrow range water level.

- The only safety function required is the core decay heat removal that is carried by the PRHR heat exchanger; therefore, the worst single failure is assumed to occur in the PRHR heat exchanger. The actuation of the PRHR heat exchanger requires the opening of one of the two fail-open valves arranged in parallel at the PRHR heat exchanger discharge. Because no single failure can be assumed that impairs the opening of both valves, the failure of a single valve is assumed.

  The PRHR heat exchanger is actuated by the ~~low~~Low-2 steam generator narrow range water level ~~narrow range~~ signal, coincident with low start up feedwater flow or by the ~~low~~Low-2 steam generator wide range water level ~~wide range~~ signal.

* * *

Revise Subsection 15.2.7.2.2, "Results" as shown below:

* * *

Figures 15.2.7-1 through 15.2.7-13 show the significant plant parameters following a loss of normal feedwater. The loss of main feedwater results in an increase in the pressurizer water volume until reactor trip on ~~low~~Low-2 steam generator narrow range water level ~~(narrow range)~~.

* * *

Revise Subsection 15.2.8.1, "Identification of Causes and Accident Description" as shown below:

* * *

At the beginning of the transient, the main feedwater control system is assumed to malfunction due to an adverse environment. Interactions between the break and the main feedwater control system result in no feedwater flow being injected or lost through the steam generator feedwater nozzles. This assumption causes the water levels in both steam generators to decrease equally until the ~~low~~Low-2 steam generator narrow range water level ~~(narrow range)~~ reactor trip setpoint is reached. After reactor trip, a full double-ended rupture of the feedwater line is assumed such that the faulted steam generator blows down through the break and no main feedwater is delivered to the intact steam generator.

* * *

- A reactor trip on any of the following four conditions:
  - High pressurizer pressure
  - Overtemperature ΔT
  - High-3 pressurizer water level
  - ~~Low~~Low-2 steam generator narrow range water level in either steam generator

* * *

Revise Subsection 15.2.8.2.1, "Method of Analysis" as shown below:

* * *

- Reactor trip is assumed to be initiated when the ~~low~~Low-2 steam generator narrow range water level setpoint is reached on the ruptured steam generator.

* * *

- The PRHR heat exchanger is actuated by the ~~low~~Low-2 steam generator wide range water level ~~(wide range)~~ signal. A 15-second delay is assumed following the low level signal to allow time for the alignment of PRHR heat exchanger valves.

* * *

The PRHR heat exchanger is initiated if the steam generator water level drops to the ~~low~~Low-2 steam generator wide range water level~~(wide range)~~. Similarly, receipt of a low steam line pressure signal in at least one steam line initiates a steam line isolation signal that closes all main steam line and feed line isolation valves.

* * *

Revise Subsection 15.2.8.2.2, "Results" as shown below:

* * *

The results presented in Figures 15.2.8-5 and 15.2.8-7 show that pressures in the reactor coolant system and main steam system remain below 110 percent of the respective design pressure. Pressurizer pressure decreases after reactor trip on the ~~low~~Low-2 steam generator narrow range water level (70.3 seconds) due to the loss of heat input.

* * *

After the trip, the core makeup tanks are actuated (95 seconds) on low steam line pressure in the ruptured loop while the PRHR heat exchanger is actuated on a ~~low~~Low-2 steam generator wide range water level ~~wide range~~ (90.1 seconds).

* * *

Revise Table 15.2-1 (Sheet 5), "Time Sequence of Events for Incidents Which Result in a Decrease in Heat Removal By the Secondary System" as shown below:

Accident	Event	Time (seconds)
II.A. Loss of ac power to the plant auxiliaries	Feedwater is lost	10.0
	~~Low~~Low-2 steam generator narrow range water level reactor trip set point is reached	70.4
	* * *	* * *
	PRHR heat exchanger actuation on ~~low~~Low-2 steam generator narrow range water level (~~narrow range~~ coincident with low start up flow rate)	132.4
	* * *	* * *

Revise Table 15.2-1 (Sheet 6), "Time Sequence of Events for Incidents Which Result in a Decrease in Heat Removal by the Secondary System" as shown below:

Accident	Event	Time (seconds)
II.A. Loss of normal feedwater flow	Feedwater is lost	10.0
	~~Low~~Low-2 steam generator narrow range water level reactor trip set point is reached	70.4
	* * *	* * *
	PRHR heat exchanger actuation on ~~low~~Low-2 steam generator narrow range water level (~~narrow range~~ coincident with low start up flow rate)	132.4
	* * *	* * *

Revise Table 15.2-1 (Sheet 7), "Time Sequence of Events for Incidents Which Result in a Decrease in Heat Removal by the Secondary System" as shown below:

Accident	Event	Time (seconds)
III.B. Loss of normal feedwater flow with a consequential loss of ac power	Feedwater is lost	10.0
	~~Low~~Low-2 steam generator narrow range water level reactor trip set point is reached	58.2
	* * *	* * *
	PRHR heat exchanger actuation on ~~low~~Low-2 steam generator narrow range water level (~~narrow range~~ coincident with low start up flow rate)	120.2
	* * *	* * *

Revise Table 15.2-1 (Sheet 8), "Time Sequence of Events for Incidents Which Result in a Decrease in Heat Removal By the Secondary System" as shown below:

Accident	Event	Time (seconds)
IV. Feedwater system pipe break	Main feedwater flow to both steam generators stops due to interaction between the break and the main feedwater control system	10.0
	~~Low~~Low-2 steam generator narrow range water level reactor trip set point is reached	58.2
	* * *	* * *
	~~Low~~Low-2 steam generator wide range water level ~~(wide range)~~ set point reached	73.1
	* * *	* * *
	PRHR heat exchanger actuation on ~~low~~Low-2 steam generator wide range water level ~~(wide range)~~	90.1
	* * *	* * *

Revise UFSAR Table 17.4-1, "Risk-Significant SSCs Within the Scope of D-RAP," as shown below:

System, Structure, or Component (SSC)[1]	Rationale[2]	Insights and Assumptions
* * *		
System: General I&C[4]		
Low Pressure/DP Sensors – IRWST Wide Range Levellevel sensors (PXS-045,046, -047, -048) – IRWST Lower Narrow Range Level (PXS-066, -067, -068, -069)	RAW/CCF	TheThese in-containment refueling water storage tank (IRWST) level sensors support PMS functions. They are used in automatic actuation of refueling cavity and SFS isolation, and IRWST recirculation actions, and they provide indications to the operator. IRWST level supports IRWST recirculation actions.
* * *		

Revise UFSAR Subsection 19E.2.2.2.2, "Safety-Related Actuation in Shutdown Modes," as shown below:

19E.2.2.2.2 Safety-Related Actuation in Shutdown Modes

The AP1000 has safety-related actuations associated with the SGS that are operable during shutdown modes. These include the PRHR HX actuation on lowLow-2 steam generator wide range water level during shutdown modes, and this is discussed in Subsection 19E.2.3 of this appendix.
* * *

Revise UFSAR Subsection 19E.4.3.2, "Loss of ac Power," as shown below:

19E.4.3.2 Loss of ac Power

* * *
The reactor may be automatically tripped on low RCP speed, low RCS flow, lowLow-2 steam generator narrow range water level, or several other primary side heatup signals. Also reactor trip may occur due to the loss of power to the control rod drive mechanisms.

Following reactor trip, the PRHR HX is activated for decay heat removal. Automatic PRHR HX actuation on lowLow-2 steam generator wide range water level is available in Modes 1 through 3 and in Mode 4 when the RCS is not being cooled by the RNS.
* * *

Revise UFSAR Subsection 19E.4.3.3, "Loss of Normal Feedwater," as shown below:

19E.4.3.3 Loss of Normal Feedwater

* * *
The loss of normal feedwater flow results in a heatup and pressurization of the RCS. If the reactor is at-power, the event is mitigated by tripping the reactor on ~~low~~Low-2 steam generator narrow range water level.

Following reactor trip, the PRHR HX is activated for decay heat removal. Automatic PRHR HX actuation on ~~low~~Low-2 steam generator wide range water level is available in Modes 1 through 3 and in Mode 4 when the RCS is not being cooled by the RNS.
* * *

Revise UFSAR Subsection 19E.4.3.4, "Feedwater System Pipe Break," as shown below:

19E.4.3.4 Feedwater System Pipe Break

* * *
If the reactor is at-power, the event is mitigated by tripping the reactor on ~~low~~Low-2 steam generator narrow range water level.

Following reactor trip, the PRHR HX is activated for decay heat removal. Automatic PRHR HX actuation on ~~low~~Low-2 steam generator wide range water level is available in Modes 1 through 3 and in Mode 4 when the RCS is not being cooled by the RNS.
* * *

Revise UFSAR Subsection 19E.4.10.2, "Shutdown Temperature Evaluation," as shown below:

19E.4.10.2 Shutdown Temperature Evaluation

* * *
Summarizing this transient, the loss of normal ac power occurs, followed by the reactor trip. The PRHR heat exchanger is actuated on the ~~low~~Low-2 steam generator narrow range water level coincident with low startup feed water flow rate signal.
* * *

Revise UFSAR Table 19E.4.10-1, "Sequence of Events Following a Loss of ac Power Flow with Condensate from the Containment Shell Being Returned to the IRWST," as shown below:

Event	Time (seconds)
Feedwater is Lost	10.0
~~Low~~Low-2 Steam Generator Narrow Range Water Level ~~(Narrow Range)~~ Reactor Trip Setpoint Reached	72.4
Rods Begin to Drop	74.4
PRHR HX Actuation on ~~Low~~Low-2 Steam Generator Wide Range Water Level ~~(Wide Range)~~	129.4
* * *	* * *

Southern Nuclear Operating Company

ND-17-0271

Enclosure 4

Vogtle Electric Generating Plant (VEGP) Units 3 and 4

Conforming Technical Specification Bases Changes

(LAR-16-032)

(For Information Only)

Note:
Added text is shown as Blue Underline
Deleted text is shown as ~~**Red Strikethrough**~~
Omitted text is shown as three asterisks (* * *)

(Enclosure 4 consists of 8 pages, including this cover page)

ND-17-0271
Enclosure 4
Technical Specification Bases (Provide for Information Only)

Revise Technical Specifications Bases Section 3.3.1 as shown below:

* * *

(3) On increasing power, the P-6 interlock provides a backup block signal to the source range neutron flux doubling circuit. Normally, this Function is manually blocked by the main control room operator during the reactor startup.

Reactor Coolant Average Temperature (T_{avg}), P-9

With T_{avg} channels less than the P-9 setpoint, the operator can manually block the Steam Generator Narrow Range Water Level – Low 2 Reactor Trip. This allows rod testing during routine maintenance. With T_{avg} channels greater than P-9 setpoint, the Steam Generator Narrow Range Water Level - Low 2 Reactor Trip is automatically unblocked.

Power Range Neutron Flux, P-10

The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power as determined by the respective power-range detector.

* * *

10. Steam Generator Narrow Range Water Level – Low 2

The Steam Generator (SG) Narrow Range Water Level – Low 2 trip Function ensures that protection is provided against a loss of heat sink. The SGs are the heat sink for the reactor. In order to act as a heat sink, the SGs must contain a minimum amount of water. A narrow range ~~low~~Low 2 water level in any steam generator is indicative of a loss of heat sink for the reactor. The Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties as the detectors provide primary protection for an event that results in a harsh environment. This Function also contributes to the coincidence logic for the ESFAS Function of opening the Passive Residual Heat Removal (PRHR) discharge valves.

The LCO requires four channels of SG Narrow Range Water Level – Low 2 per SG to be OPERABLE in MODES 1 and 2. Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

In MODE 1 or 2, when the reactor requires a heat sink, the SG Narrow Range Water Level – Low 2 trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater System (non-safety related). The Main Feedwater System is normally in operation in MODES 1 and 2. PRHR is the safety related backup heat sink for the reactor. During normal startups and shutdowns, the Main and Startup Feedwater Systems (non-safety related) can provide feedwater to maintain SG level. In MODE 3, 4, 5, or 6, the SG Narrow Range Water Level – Low 2 Function does not have to be OPERABLE because the reactor is not operating or even critical. The P-9 interlock is provided on this Function to permit bypass of the trip Function when T_{avg} is below P-9.
* * *

Revise COL Appendix A Technical Specifications Bases Section 3.3.8 as shown below:

* * *

Intermediate Range Neutron Flux, P-6

The Intermediate Range Neutron Flux, P-6 interlock is actuated when the respective NIS intermediate range channel increases to approximately one decade above the channel lower range limit. Below the setpoint, the P-6 interlock automatically unblocks the flux doubling function, permitting the block of boron dilution. Normally, this Function is blocked by the main control room operator during reactor startup.

Reactor Coolant Average Temperature (T_{avg}), P-9

The P-9 interlock permits routine maintenance without PRHR heat exchanger actuation and SG blowdown isolation. With T_{avg} channels less than the P-9 setpoint, the operator can manually block the Steam Generator Wide Range Water Level – Low 2 and Steam Generator Narrow Range Water Level – Low 2 signals. With T_{avg} channels greater than the P-9 setpoint, the Steam Generator Wide Range Water Level – Low 2 and Steam Generator Narrow Range Water – Low 2 signals are automatically unblocked.

* * *

Steam Generator Blowdown Isolation

The primary Function of the steam generator blowdown isolation is to preserve water inventory in the steam generators to support removing the excess heat being generated until the decay heat has decreased to within the PRHR HX capability.

Steam Generator Blowdown Isolation is actuated on the following signals:

- PRHR HX Actuation; and
- SG Narrow Range Water Level – Low 2.

Steam generator blowdown isolation from SG Narrow Range Water Level – Low 2 can be manually blocked by the main control room operator when below the P-9 setpoint (T_{avg} interlock) and is automatically unblocked when above the P-9 setpoint. This block is necessary to permit routine maintenance without this ESFAS actuation.

*** * ***

Passive Residual Heat Removal (PRHR) Heat Exchanger Actuation

The PRHR Heat Exchanger (HX) provides emergency core decay heat removal when the Startup Feedwater System is not available to provide a heat sink.

PRHR is actuated on the following signals:

- SG Narrow Range Water Level – Low 2 coincident with Startup Feedwater Flow – Low;
- SG Wide Range Water Level – Low 2;
- ADS Stages 1, 2, & 3 Actuation;
- CMT Actuation;
- Pressurizer Water Level – High 3; and
- PRHR Heat Exchanger Actuation – Manual Initiation.

PRHR heat exchanger actuation from SG Narrow Range Water Level – Low 2 and from SG Wide Range Water Level – Low 2 can be manually blocked by the main control room operator when below the P-9 setpoint (T_{avg} interlock) and is automatically unblocked when above the P-9 setpoint. This block is necessary to permit routine maintenance without these ESFAS actuations.

* * *

IRWST Containment Recirculation Valve Actuation

The PXS provides core cooling by gravity injection and recirculation for decay heat removal following an accident. The PXS has two containment recirculation flow paths. Each path contains two parallel flow paths, one path is isolated by a motor operated valve in series with a squib valve and one path is isolated by a check valve in series with a squib valve.

IRWST Containment Recirculation Valve Actuation is actuated on the following signals:

- ADS Stage 4 Actuation coincident with IRWST Lower Narrow Range Level – Low 3 level; and

* * *

Refueling Cavity Isolation

The containment isolation valves in the lines between the refueling cavity and the Spent Fuel Pool Cooling System are isolated on Spent Fuel Pool Level – ~~Low~~Low 2 signal.

* * *

18. IRWST Lower Narrow Range Level – Low 3

A low IRWST level coincident with a ADS Stage 4 Actuation signal will open the containment recirculation valves. Four channels of IRWST Lower Narrow Range Level – Low 3 instrumentation are provided to permit one channel to be in trip or bypass indefinitely and still ensure that no single random failure will disable the trip Function.

The IRWST Containment Recirculation Valve Actuation ESFAS protective function is actuated by IRWST Lower Narrow Range Level – Low 3.

Four channels of IRWST Lower Narrow Range Level – Low 3 are required to be OPERABLE in MODES 1, 2, 3, 4, and 5, and MODE 6 with the upper internals in place.

20. SG Narrow Range Water Level – Low 2

PRHR is actuated when the SG Narrow Range Water Level reaches its ~~low~~Low 2 setpoint coincident with an indication of low Startup Feedwater Flow. The LCO requires four channels per steam generator to be OPERABLE to satisfy the requirements with a two-out-of-four logic. Four channels are provided to permit one channel to be in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. The Setpoint reflects both steady state and adverse environmental instrument uncertainties as the detectors provide protection for an event that results in a harsh environment.

The ESFAS protective functions actuated by SG Narrow Range Water Level – Low 2 are:

- PRHR Heat Exchanger Actuation; and
- SG Blowdown Isolation

The SG Narrow Range Water Level – Low 2 Function is required to be OPERABLE in MODES 1, 2, and 3 and in MODE 4 when the RCS is not being cooled by the Normal Residual Heat Removal System (RNS). This ensures that PRHR can be actuated in the event of a loss of the normal heat removal systems. In MODE 4 when the RCS is being cooled by the RNS, and in MODES 5 and 6, the SGs are not required to provide the normal RCS heat sink. Therefore, startup feedwater flow is not required, and PRHR actuation on ~~low~~Low 2 steam generator narrow range water level is not required. This ESFAS function can be manually blocked by the main control room operator when below the P-9 setpoint (T_{avg} interlock) and is automatically unblocked when above the P-9 setpoint. This block is necessary to permit routine maintenance without PRHR heat exchanger actuation or SG blowdown isolation.

* * *

21. SG Wide Range Water Level – Low 2

PRHR is also actuated when the SG Wide Range Water Level reaches its Low 2 Setpoint. There are four wide range level channels for each steam generator and a two-out-of-four

logic is used. Four channels are provided to permit one channel to be in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function.

The PRHR Heat Exchanger Actuation ESFAS protective function is actuated by SG Narrow Range Water Level – Low 2.

* * *

In MODE 4 when the RCS is being cooled by the RNS, and in MODES 5 and 6, the SGs are not required to provide the normal RCS heat sink. Therefore, SG Wide Range Water Level is not required, and PRHR actuation on ~~low wide range~~ SG ~~level~~Wide Range Water Level – Low 2 is not required. This ESFAS function can be manually blocked by the main control room operator when below the P-9 setpoint (T_{avg} interlock) and is automatically unblocked when above the P-9 setpoint. This block is necessary to permit routine maintenance without PRHR heat exchanger actuation.

Revise COL Appendix A Technical Specifications Bases Section 3.3.11 as shown below:

B 3.3 INSTRUMENTATION

* * *

APPLICABLE SAFETY ANALYSES, LCOs, and APPLICABILITY	The required channels of ESFAS instrumentation provide plant protection in the event of any of the analyzed accidents. ESFAS protective functions include PRHR Heat Exchanger Actuation. PRHR is actuated when the Steam Generator Narrow Range Water Level reaches its ~~low~~Low 2 setpoint coincident with an indication of low Startup Feedwater Flow. * * *

Revise COL Appendix A Technical Specifications Bases Section 3.3.14 as shown below:

B 3.3.14 Engineered Safety Feature Actuation System (ESFAS) Spent Fuel Pool Level Instrumentation

* * *

APPLICABLE SAFETY ANALYSES, LCOs, and APPLICABILITY	The required channels of ESFAS instrumentation provide plant protection in the event of any of the analyzed accidents. ESFAS protective functions include the Refueling Cavity Isolation. The instrument Function required by this LCO is the Spent Fuel Pool Level – ~~Low~~Low 2. In the event of a leak in the non-safety Spent Fuel Pool Cooling System, closure of the containment isolation valves on low spent fuel pool level in two of three channels will terminate draining of the refueling cavity. Since the transfer canal is open in MODE 6, the spent fuel pool level is the same as the refueling cavity. Draining of the spent fuel pool, directly, through a leaking Spent Fuel Pool Cooling System is limited by the location of the suction piping, which is near the top of the pool. Therefore, closure of the containment isolation valves between the refueling cavity and the Spent Fuel Pool Cooling System is sufficient to terminate refueling cavity and spent fuel pool leakage through the Spent Fuel Pool Cooling System. Three channels of ESFAS Spent Fuel Pool Level - ~~Low~~Low 2 Function are required to be OPERABLE in MODE 6 to maintain water inventory in the refueling cavity.

* * *

Revise COL Appendix A Technical Specifications Bases Section 3.3.17 as shown below:

11. In-Containment Refueling Water Storage Tank (IRWST) Wide Range Water Level

    The IRWST provides a long term heat sink for non-LOCA events and is a source of injection flow for LOCA events. When the IRWST is a heat sink, the level will change due to increased volume associated with the temperature increase.

Revise COL Appendix A Technical Specifications Bases Section 3.7.10 as shown below:

B 3.7 PLANT SYSTEMS

B 3.7.10 Steam Generator (SG) Isolation Valves

BASES

BACKGROUND

* * *

The blowdown line from each steam generator is provided with two series isolation valves, both located outside, but close to, containment. The blowdown valves receive a PMS isolation signal on ~~low~~ SG ~~level~~Narrow Range Water Level – Low 2 and on Passive Residual Heat Removal (PRHR) actuation. The first blowdown isolation valve outside of containment is also a containment isolation valve.

* * *

APPLICABLE SAFETY ANALYSES (continued)

* * *

The blowdown flow path on each SG must be isolated following Loss of Feedwater and Feedwater Line Break events to retain the steam generator water inventory for use in Reactor Coolant System (RCS) heat removal via the SGs. RCS heat removal for these events is primarily, provided by the Passive Residual Heat Removal Heat Exchanger (PRHR HX); however, the SG heat removal is assumed. The SG blowdown isolation valves receive an isolation signal on ~~low~~ SG ~~level~~Narrow Range Water Level – Low 2 or PRHR actuation. These events take credit for steam generator heat removal using the water inventory retained after blowdown isolation. If the blowdown line were not isolated, much of the inventory would drain from the SG rather than cool the RCS.
