ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Tuesday, September 21, 2010 9:36 AM
To: Tesfaye, Getachew
Cc: KOWALSKI David (AREVA); Hearn, Peter
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 351 Q.09.02.05-30 (d).pdf; DRAFT FSAR Changes RAI 351 Q.09.02.05-30 (d).pdf; DRAFT RESPONSE RAI 390 Q.09.02.02-106 (SAHRS).pdf; DRAFT FSAR Changes RAI 390 Q.09.02.02-106 (SAHRS).pdf

Importance: High

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Subject: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Importance: High

Marty:

Please transmit to Getachew Tesfaye the attached partial set of DRAFT responses to RAI 351 and 390 questions. If the NRC reviewers have enough time to review these responses, they can be discussed at today's (9/21/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC, or can be scheduled for a future telecon.

Attached are the following DRAFT response(s):

- Response to RAI 351 - Question 09.02.05-30 (d).
- Response to RAI 390 - Question 09.02.02-106 (SAHRS).

Note that these DRAFT responses have not been through the final Licensing review/approval process; nor do they reflect technical editing.

Please call me if you have any questions. Thanks.

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DRAFT RESPONSE RAI 390 Q.09.02.02-106 (SAHRS).pdf	247318	
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Response to

Request for Additional Information No. 351(4112, 4163), Revision 1

01/15/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.05 - Ultimate Heat Sink
SRP Section: 09.05.01 - Fire Protection Program

Application Section: FSAR Chapter 9

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 09.02.05-30:

Follow-up to RAI 175, Question 9.2.5-17:

Standard Review Plan (SRP) 9.2.5 Section III, paragraph 1 requires confirmation of the overall arrangement of the ultimate heat sink (UHS). The staff reviewed the descriptive information, arrangement, design features, environmental qualification, performance requirements, and interface information provided in Tier 1 Final Safety Analysis Report (FSAR) Section 2.7.11 to confirm completeness and consistency with the plant design basis as described in Tier 2 Section 9.2.5. The staff found that the Tier 1 information is incomplete, inconsistent, inaccurate, or that clarification is needed with respect to the following considerations:

a. Although the Introduction Section in Chapter 1 of the Tier 1 FSAR states that the information in the Tier 1 portion of the FSAR is extracted from the detailed information contained in Tier 2, the staff found that much of the information provided in FSAR Tier 1 is not described in Tier 2 FSAR Section 9.2.5 (e.g., equipment locations, valve functional requirements, indication and control information, priority actuation and control system description and functions, automatic actuation and interlock details, valve failure modes, and harsh environment considerations). This Tier 1 information needs to be added to Tier 2.

b. FSAR Tier 1 does not stipulate that the ultimate heat sink (UHS) is accessible for performing periodic inspections as required by General Design Criteria (GDC) 45.

c. FSAR Tier 1 does not stipulate that the UHS design provide for flow testing of makeup water for accident and emergency conditions.

d. FSAR Tier 1 does not stipulate that the essential service water system (ESWS) pumps are protected from debris from the cooling towers.

e. FSAR Tier 1 does not stipulate that the safety related UHS outdoor piping is adequately protected from the elements and postulated hazards.

f. Tier 1, Figure 2.7.11-1, “Essential Service Water System Functional Arrangement,” does not show nominal pipe sizes for the UHS, which are necessary for design certification. This table does not show design information for the UHS fans.

g. Tier 1, Table 2.7.11-2, “Essential Service Water System Equipment I&C and Electrical Design,” does not include information pertaining to the UHS fans and corresponding power supplies.

h. The point of Note 2 for Tier 1, Table 2.7.11-2 is not clear since it does not appear to pertain to anything on the table. However, this appears to be due to an oversight whereby dedicated ESWS components are not listed in the table.

i. The discussion under Item 6 Tier 1 of Table 2.7.11-2 related to environmental qualification is inconsistent with the information provided in Table 2.7.11-2 in that no equipment is listed in the table for harsh environment considerations.

Based on the staff’s review of the applicant's response to RAI 9.2.5-17 (ID1817/6814) AREVA #175, Supplement 3, the following were determined as unresolved and needed further clarification/resolution by the applicant.

The applicant's response to Item (b) focuses on inservice inspection requirements, while the question that was asked focuses on the requirement specified by 10 CFR 50, Appendix A, General Design Criterion (GDC) 45. GDC 45 requires that “the cooling water system shall be designed to permit appropriate periodic inspections of important components, such as heat exchangers and piping, to assure the integrity and capability of the system.” Therefore, the capability to perform periodic inspections of important components needs to be described in FSAR Tier 2 and ITAAC need to be established to confirm this aspect of the design.

With regard to the response to Item (d), the staff does not agree that screens and filters that are solely for equipment protection are not safety significant. Filters and screens are relied upon to ensure that debris, aquatic organisms, and other material that find their way into the cooling tower basins do not adversely impact the capability of the essential service water system and ultimate heat sink to perform their safety functions. Without the screens and filters, pumps and valves can be damaged and rendered inoperable, heat exchanger tubes and cooling tower spray nozzles can become clogged, and heat transfer surfaces can become fouled. Therefore, ITAAC are needed to confirm the installation and proper mesh size of the filters and screens that are relied upon. Additionally, FSAR Tier 2 Sections 9.2.1 and 9.2.5 need to be revised to describe important filter and screen design specifications such as maximum allowed differential pressure and mesh size, including the bases for these specifications.

The response to Item (e) indicates that the UHS does not have any safety-significant outdoor piping within the scope of design certification. Based on this, the staff agrees that ITAAC are not needed to confirm adequate protection of exposed equipment. However, ITAAC are needed to confirm that ESWS and UHS piping and components are not exposed to the elements and postulated hazards. Additionally, based upon further review, the staff found that additional information needs to be included in the FSAR to address freeze protection considerations, especially for divisions that are in standby and for those parts of the cooling tower that are exposed and vulnerable to cold weather conditions.

The response to Item (f) refers to a response that was provided to RAI 9.2.1-22 (AREVA RAI No. 119, Supplement 1). The response indicates that line sizing details will be identified later in the design process. Consequently, this item remains open pending submittal of the information that was requested and a schedule for providing this information needs to be established.

In response to second part of Item (f), the applicant stated that design information for the UHS fans will be added to FSAR Tier 1, Table 2.7.11-2, “Essential Service Water System Equipment I&C and Electrical Design,” as part of the response to Item (g) of this RAI. The staff noted that the FSAR markup of Table 2.7.11-2 does not specify alternate power supplies for the two fans in Essential Service Water (ESW) Building 4. In this regard, additional information is needed to explain why an alternate power source is not specified for the ESW Building 4 cooling tower fans since they are necessary to support operation of the dedicated ESW train. The dedicated ESW train is provided to mitigate accidents that are beyond the design basis when normal backup power may not be available. Therefore, the applicant should specify an alternate power source for these fans similar to that shown for several other dedicated ESW train components in FSAR Tier 1 Table 2.7.11-2.

Response to Question 09.02.05-30:

Item (d)

The generation of debris within the UHS cooling tower is unlikely and wind blown debris entering the cooling tower basin is not expected to be significant; nonetheless, the UHS is furnished with additional screening equipment and a site-specific chemical treatment support system to remove potential debris which could be generated from cooling tower operation itself or due to wind blown debris entering the air inlets.

As stated in the response to RAI 175 question 9.2.5-10, the ESWS pumps are protected by screens located in the pump suction flow path. More specifically, the ESW cooling tower basin water flows to the pump intake structure through a coarse screen and a fine screen (located in series) prior to reaching the ESW pump. Both of these screens are safety related and extend across the full width of the pump bay opening and above the maximum water level to assure full control of the debris across the flow cross section.

The coarse and fine screens mesh sizes are primarily selected to protect the ESW pump operation, since the components downstream of the pump, such as the system user heat exchangers and UHS cooling tower spray nozzles, are protected by the in-line automatic backwash strainer referred to below. The coarse screen mesh is sized to prevent large debris from entering the pump intake structure and the fine screen mesh is sized to allow the debris with sizes acceptable for pump operation to pass the screen. The selected mesh openings of coarse and fine screens are 2 inches and 0.5 inch, respectively. Pump requirements based on mesh sizes will be in the specification and selection for the ESW, and ESW dedicated pumps. Both screens will be designed with include provisions for manual cleaning. Tier 1 Table 2.7.11-3 will be revised to include an ITAAC that confirms the installation and proper mesh size of the screens. Tier 2 Table 3.2.2-1 will be revised to include the debris screens.

Safety related water level indicators are installed in the UHS cooling tower basin, on the upstream side of the coarse screen, and on the downstream side of the fine screen to monitor the differential water levels across the coarse screen and the fine screen continuously through the Distributed Control System (DCS). Based on a pre-set magnitude of differential pressure between these water level indicators, operators will be alerted to inspect the screens for potential debris accumulation and cleaning. Due to the large flow area across the screens the pressure drop across these screens will be small. The maximum allowable total pressure drop across both the coarse and the fine screen is 12 inches. However, the operating procedures will include provisions for a low water level alarm responding to a differential pressure set point for the operator to initiate inspection and manual cleaning of the screens as necessary. The set pressure drop across the screens corresponds to a screen blockage that is well within the design limit of 12 inches and has no effect on the NPSH available or submergence for the pump. Such high blockage of fine screens is unlikely due to the makeup water supply to basin being free from debris and insignificant debris generated by cooling tower operation such as small concrete/ceramic particles and wear products and/or air blown debris entering the tower basin through air inlets. Tier 2 Figure 9.2.1-1 will be revised to include a level instrument in the pump bay.

As stated in Tier 2 Section 9.2.5.2, the UHS cooling tower basin is furnished with a site-specific chemical treatment support system. The purpose of the chemical treatment support system is to minimize the biofouling of heat transfer surfaces, to inhibit scale formation, to minimize the growth of legionella and other bacteria, to minimize the corrosion of internal wetted surfaces (tubing and piping internal diameters, pump and valve internals, etc.) and to minimize foaming.

As stated in Tier 2 Section 9.2.1.3, an automatic backwash debris filter is located downstream of each ESW pump and it protects the components downstream of the pump, such as the system user heat exchangers and UHS cooling tower spray nozzles.

FSAR Impact:

U.S. EPR FSAR, Tier 1, Section 2.7.11 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR, Tier 2, Section 3.2.2, 3.11, 9.2.1 and 9.2.5 will be revised as described in the response and indicated on the enclosed markup.

Insert 1 for Tier 2 Section 9.2.5.7.1

- Cooling tower basin intake structure differential water level across screens

Insert 2 for Tier 2 Section 9.2.5.7.2

- Cooling tower basin intake structure differential water level across screens high

Insert 3 for Tier 2 Section 9.2.5.2

Each safety related division also includes a cooling tower basin intake structure with removable coarse and fine screens. The screens protect the ESWS pumps and the dedicated ESWS pump against debris.

Insert 4 for Tier 2 Section 9.2.1.3.1

- Maximum allowable water level differential across the coarse and fine screens

Insert 5 for Tier 2 Section 9.2.1.3.2

- Maximum allowable water level differential across the coarse and fine screens

Insert 6 for Tier 2 Section 9.2.1.3.3

"that pass through coarse and fine screens and"

Insert 7 for Tier 2 Section 9.2.1.3.4

"that pass through coarse and fine screens and"

Insert 8 for Tier 2 Section 9.2.5.3.4(New)

9.2.5.3.4 Coarse and Fine Screens

Coarse and fine screens are provided in the ESWS cooling tower basin intake structure to protect the ESWS pumps and dedicated ESWS pump against debris. The screens are removable for manual maintenance and cleaning. The coarse screen mesh is sized to prevent large debris from entering the pump intake structure and the fine screen mesh is sized to allow the debris with sizes acceptable for pump operation to pass the screen. Differential water level set points across the coarse and fine screens are provided and continuously monitored. Inspection and maintenance at pre-set intervals are carried out. An inspection and cleaning of the screens is initiated anytime the water level differential reaches alarm level set point

The collected debris must be treated in accordance with federal and state regulations relevant to the site location.

Insert 9 for Tier 2 Section 9.2.1.4.1

"the differential water level across coarse and fine screens is within limit, and ”

Insert 10 for Tier 2 Section 9.2.1.4.1

"In addition, if the differential water level across coarse and fine screens reaches alarm level, inspection and clearing of screens is initiated."

Insert 11 for Tier 2 Section 9.2.1.4.2

"A blockage of the fine screen in a safety related division is monitored by the elevated differential level or function alarm. A blockage of the coarse or fine screens will result in an operator initiated division switchover".

Insert 12 for Tier 1 Section 7.0

7.X The inlet between the cooling tower basin and pump intake structure has a coarse and a fine debris screen for each ESW pump.

Insert 13 for Tier 1 Table 2.7.11-3

Commitment Wording		Inspection, Tests, Analyses	Acceptance Criteria
7.X	The inlet between the cooling tower basin and pump intake structure has a coarse and a fine debris screen for each ESW pump.	a. An inspection will be performed for the existence of a coarse and a fine debris screen at the inlet between the cooling tower basin and pump intake structure for each ESW pump. b. An inspection will be performed to verify the maximum mesh grid opening of the debris screens.	a. A coarse and a fine debris screen exists at the inlet between the cooling tower basin and pump intake structure for each ESW pump. b. The coarse debris screen mesh is a maximum grid opening of 2 x 2 inches. The fine debris screen mesh is a maximum grid opening of 0.5 x 0.5 inches.

Insert 14 for Tier 2 Table 3.2.2-1

KKS System or Component Code	SSC Description	Safety Classification	Quality Group Classification	Seismic Category	10 CFR 50 Appendix B Program	Location
30PED10/20/30/40 AT003	Coarse Debris Screen	S	C	I	Yes	URB
30PED10/20/30/40 AT004	Fine Debris Screen	S	C	I	Yes	URB

Insert 15 for Tier 2 Table 3.11-1

Name Tag	Tag Number	Local Area	EQ Environment	Radiation Environment	EQ Designated Function	Safety Cla
UHS Tower Basin Level Indicator	30PEB10CL002	31UQB01002	M	M	ES SI	S 1E E

Insert 16 for Tier 2 Table 3.11-1

Name Tag	Tag Number	Local Area	EQ Environment	Radiation Environment	EQ Designated Function	Safety Cla
UHS Tower Basin Level Indicator	30PEB20CL002	32UQB01002	M	M	ES SI	S 1E E

Insert 17 for Tier 2 Table 3.11-1

Name Tag	Tag Number	Local Area	EQ Environment	Radiation Environment	EQ Designated Function	Safety Cla
UHS Tower Basin Level Indicator	30PEB30CL002	33UQB01002	M	M	ES SI	S 1E E

Insert 18 for Tier 2 Table 3.11-1

Name Tag	Tag Number	Local Area	EQ Environment	Radiation Environment	EQ Designated Function	Safety Cla
UHS Tower Basin Level Indicator	30PEB40CL002	34UQB01002	M	M	ES SI	S 1E E

at least 72 hours of water inventory for the DBA, in combination with the worst ambient evaporation conditions, the UHS emergency makeup is not required to start until after 72 hours. At that point, the makeup requirements are diminished. The minimum makeup supply rate is based on the maximum evaporation rate over a 72 hour period post-DBA and considers such losses as drift, seepage and valve seat leakage.

COL applicants that reference the U.S. EPR will verify that the makeup water supply is sufficient for the ambient conditions corresponding to their plant location. Refer to Table 1.8-2, Item number 2.3-10.

9.2.5.6 Inspection and Testing Requirements

Prior to initial plant startup, a comprehensive preoperational test is performed to demonstrate the ability of the ESWS and UHS to supply cooling water as designed under normal and emergency conditions. The UHS is tested as described in Chapter 14.2, Test # 49.

The installation and design of the UHS provides accessibility for the performance of periodic inservice inspection and testing. Periodic inspection and testing of safety-related equipment verifies its structural and leaktight integrity and its availability and ability to fulfill its functions. Inservice inspection and testing requirements are in accordance with Section XI of the ASME BPV Code and the ASME OM Code.

Section 3.9 and Section 6.6 outline the inservice testing and inspection requirements. Refer to Section 16.0, Surveillance Requirements (SR) 3.7.19 for surveillance requirements that verify continued operability of the UHS.

9.2.5.7 Instrumentation Applications

Instrumentation is provided in order to control, monitor and maintain the safety-related functions of the UHS. Indications of the process variables measured by the instrumentation are provided to the operator in the main control room.

9.2.5.7.1 System Monitoring

- Cooling tower basin water level.
- Cooling tower water temperature.

9.2.5.7.2 System Alarms

- Cooling tower water temperature low.
- Cooling tower basin water level low.
- Cooling tower basin water level high.

The UHS operates for a nominal 30 days following a loss of coolant accident (LOCA) without requiring any makeup water to the source or demonstrates that replenishment or use of an alternate or additional water supply can be effected to ensure continuous capability of the sink to perform its safety-related functions.

9.2.5.2 System Description

The UHS consists of four separate, redundant, safety-related divisions. Also included is one dedicated non-safety-related division which is located in division 4. Each safety-related UHS division consists of one mechanical draft cooling tower with two fans, piping, valves, controls and instrumentation. System design parameters are listed on Table 9.2.5-2. The system is shown in Figure 9.2.5-1—Ultimate Heat Sink Piping and Instrumentation Diagram.

A COL applicant that references the U.S. EPR design certification will provide site-specific information for the UHS support systems such as makeup water, blowdown and chemical treatment (to control biofouling).

A COL applicant that references the U.S. EPR design certification will provide a description of materials that will be used for the UHS at their site location, including the basis for determining that the materials being used are appropriate for the site location and for the fluid properties that apply.

The UHS contains isolation valves at the cooling towers to isolate the safety related portions of the system from the non-safety-related basin support systems provided by the COL applicant. The site-specific UHS systems are shown in Figure 9.2.5-2—[[Conceptual Site-Specific UHS Systems]].

9.2.5.3 Component Description

9.2.5.3.1 Mechanical Draft Cooling Towers

The cooling towers are rectangular mechanical-induced draft-type towers. Each tower consists of two cells in a back-to-back arrangement. The two cells of the cooling tower in a particular division share a single cooling tower basin and each cell is capable of transferring fifty percent of the design basis heat loads for one division from the ESWS to the environment under worst-case ambient conditions. The division four cooling tower shares use with the dedicated ESW train and can transfer severe accident (SA) heat loads to the environment under worst-case ambient conditions.

The cooling tower fill design and arrangement maximize contact time between water droplets and air inside the tower. The tower fill spacing is chosen to minimize the buildup of biofilm and provide for ease of cleaning, maintenance, and inspection.

ESWS are powered by Class 1E electrical buses and are emergency powered by the EDGs.

The non-safety-related dedicated division contains a dedicated ESWS pump, debris filter, piping, valves, controls, and instrumentation. The non-safety related ESWS pumps cooling water from the division four UHS cooling tower basin to the dedicated CCWS HX and back to the division four UHS cooling tower during severe accidents (SA). The dedicated ESWS ~~pump~~train is powered by Class 1E electrical ~~buses~~Division 4 and is capable of being supplied by an EDG or a station blackout diesel generator (SBODG).

Refer to Section 12.3.6.5.7 for essential service water system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.2.1.3 Component Description

9.2.1.3.1 Safety-Related Essential Service Water Pumps

Each of the four safety-related cooling divisions contains one 100 percent capacity pump. During normal operating conditions, two of the four divisions are operating. The required flow rate of each ESWS pump is defined by the heat to be removed from the system loads. Design parameters are listed in Table 9.2.1-1. The pumps are designed to fulfill the corresponding minimal required design mass flow rate under the following conditions:

- Minimal water level without cavitation.
- Head losses in the cooling water inlet piping according to full power plant operation.
- Fluctuations in the supplied electrical frequency.
- Increased pipe roughness due to aging and fouling.
- Fouled debris filters.
- Maximum pressure drop through the system HXs.
- Minimum water level in cooling tower basin considers minimum submergence requirements to prevent vortex effects, and net positive suction head to prevent cavitation of the ESWS pump.

Determination of the discharge head of the pumps is based on the dynamic pressure losses, the minimum/maximum water levels of the water source, and the head losses of the mechanical equipment of the associated ESWS at full load operation.

The pump motors are air cooled. To remove heat losses, an air recirculation system is installed for each division. In addition, anti-condensation heaters on the motors are switched on as soon as the pumps cease operation.

9.2.1.3.2 Dedicated Essential Service Water Pump

The 100 percent capacity dedicated ESW pump is normally in standby mode.

This non-safety-related pump is manually started only in response to certain postulated SA conditions; it is not credited for response to any DBA.

The required flow rate of the dedicated ESWS pump is defined by the heat to be removed from the dedicated CCWS HX. Design parameters are listed in Table 9.2.1-2. The pump is designed to fulfill the corresponding minimal required design mass flow rate under the following conditions:

- Minimal water level.
- Fluctuations in the supplied electrical frequency.
- Increased pipe roughness due to aging and fouling.
- Fouled debris filter.
- Minimum water level in cooling tower basin considers minimum submergence requirements to prevent vortex effects, and net positive suction head to prevent cavitation of the dedicated ESWS pump.

The pump motor is air cooled. In addition, an anti-condensation heater on the motor is switched on as soon as the pump ceases operation.

9.2.1.3.3 Debris Filters -Safety Divisions

The debris filters remove all debris particles from the cooling water that would obstruct the system user HXs.

The debris filters are designed as an automatic backwash type. With increasing fouling, the differential pressure across the filter segments increases until reaching a preset operational point. The pressure relief backwash process of the filter is initiated by either the signal of the differential pressure measuring system, a timer after the start of the ESW pump or via a manual operator initiation.

The discharge and disposal of the collected debris must be treated in accordance with federal and state regulations relevant to site location.

9.2.1.3.4 Debris Filter -Dedicated Division

The debris filter removes all debris particles from the cooling water that would obstruct the dedicated CCWS HX.

The debris filter is designed as an automatic backwash type. With increasing fouling, the differential pressure across the filter segments increases until reaching a preset operational point. The pressure relief backwash process of the filter is initiated by either the signal of the differential pressure measuring system, a timer after the start of the dedicated ESW pump or via a manual operator initiation.

The discharge and disposal of the collected debris must be treated in accordance with federal and state regulations relevant to the site location.

9.2.1.3.5 Piping, Valves, and Fittings

System materials must be selected that are suitable to the site location, ESW fluid properties and site installation. System materials that come into contact with one another must be chosen so as to minimize galvanic corrosion. All safety-related piping, valves, and fittings are in accordance with ASME Code Section III, Class 3 (Reference 1).

A COL applicant that references the U.S. EPR design certification will provide a description of materials that will be used for the essential service water system (ESWS) at their site location, including the basis for determining that the materials being used are appropriate for the site location and for the fluid properties that apply.

The general protection concept in case of pipe failures in the ESWS with regard to flooding is based on the principle of restricting the consequences to the affected division. In case of significant leakage from an ESWS train in a Safeguard Building (SB), the associated motor-driven ESWS pump discharge isolation valve is automatically closed and the ESWS pump is tripped. Another ESWS train is also put into operation. The detection and isolation signaling is done by safety-related means. The nuclear island drain and vent system (NIDVS) sump level instrument in the non-controlled areas of the SBs provides a MAX alarm in the MCR and isolates the affected ESWS train. No operator action is required to isolate the ESWS in a large flooding event.

Primary overpressure protection on the ESWS side of the CCWS HXs is provided by thermal relief valves.

Secondary overpressure protection on the ESWS side of the CCWS HXs is provided by manual opening of the valve (located upstream of the relief valve) before isolation of the particular HX.

conditions, and with the highest essential service water (ESW) heat load for a 72-hour period, without incurring pump damage during operation.

UHS tower blowdown is automatically secured during the initial 72-hour post-accident period through system instrumentation and control design features, so the only significant system water inventory losses are due to evaporation, tower drift, and valve seat leakage and seepage.

Meteorological conditions resulting in the maximum evaporative and drift loss of water for the UHS over a 72-hour period are presented in Table 9.2.5-3—Design Values for Maximum Evaporation and Drift Loss of Water from the UHS[1].

Meteorological conditions for the U.S. EPR that result in minimum cooling tower cooling that are the worst combination of controlling parameters (wet bulb and dry bulb), including diurnal variations for the first 24 hours of a DBA LOCA, are presented in Table 9.2.5-4 and do not result in a maximum ESWS supply temperature from the UHS basin exceeding 95°F.

9.2.5.4 System Operation

The safety related ESWS pumps cooling water from the cooling tower basin to supply ESWS loads and back to the mechanical draft cooling tower. The four safety-related divisions of the UHS are powered by Class 1E electrical buses and are emergency powered by the emergency diesel generators (EDG).

The non-safety-related dedicated ESWS pumps cooling water from the division four cooling tower basin to the dedicated system heat load and back to the division four mechanical draft cooling tower during SA and beyond DBAs.

The cooling tower fans are driven with multi-speed drives that are capable of fan operation in the reverse direction. Consistent with vendor recommendations, the fan may be operated in the reverse direction for short periods to minimize ice buildup at the air inlets. Cooling tower fans operating in the reverse direction during normal operation are considered operable at the onset of a design basis accident (DBA). Upon receipt of a safety injection (SI) signal, any fans operating in the reverse direction are secured and brought to a complete stop before re-energizing to operate at full speed in the forward direction. Upon receipt of an SI signal, fans in the operating and standby trains are automatically set to full fan speed to dissipate the maximum heat load to the environment. The cooling tower bypass piping provides a means for diverting ESW return flow directly to the tower basin under low load/low ambient temperature conditions to maintain ESW cold water temperature within established limits and to protect against freezing.

To make sure the performance of the safety-related functions, all manually operated valves in the main lines of the safety-related ESWS divisions are mechanically locked in the proper position.

In-service testing of valves shall be performed as described in Section 3.9.6.3. Leakage rates for boundary isolation valves that require testing are based on ASME OM Code, Subsection ISTC (Reference 3).

A maximum valve leakage criterion will be specified for the safety-related check valves which will be no less stringent than the API-598 metal seated check valve criterion. A hydraulic transient analysis will be performed to confirm the integrity of ESW piping to withstand the effects of water hammer.

In general, butterfly valves are used in the ESWS for isolation (open or closed) service and not for throttling. In those applications where a butterfly valve is used in the ESWS and is subject to substantial throttling service for extended periods of time, design provisions are considered to prevent consequential pipe wall thinning immediately downstream of these valves. Such design provisions include the use of erosion resistant materials, the use of thick wall pipe and installing straight pipe lengths immediately downstream of the affected valves.

9.2.1.4 Operation

9.2.1.4.1 Normal Operating Conditions

Safety-Related Divisions

The ESWS supply is vital for all phases of plant operation and is designed to provide cooling water both during power operation and shutdown of the plant. During normal plant operation, two of four pumps are in operation with the remaining divisions in standby. The pumps are switched over periodically, thus changing the operational divisions.

The four divisions are filled and vented prior to operation. Under normal system operating conditions on a per division basis, the ESWS pump is in operation, the debris filter is functioning and all the valves in the main line are open. If the differential pressure across the debris filter reaches the predefined setpoint, automatic filter cleaning is initiated.

During standby, the divisions not in operation are aligned for normal operation (manual valves in the main line are open) and the system is filled and vented. The debris filter is in standby and ready to start. The system can be started manually from the main control room or automatically. In all cases, only the start signal needs to be actuated; preparatory measures are not necessary. The stopping of a particular division is performed manually.

A failure of the cleaning function of the debris filter in a safety-related division is monitored by the elevated differential pressure or function alarm. In this case, the operator initiates a division switchover.

9.2.1.5 Safety Evaluation

The ESWS pump buildings are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other natural phenomena. Section 3.3, Section 3.4, Section 3.5, Section 3.7 and Section 3.8 provide the basis for the adequacy of the structural design of these structures.

The ESWS is designed to remain functional after a safe shutdown earthquake (SSE). Section 3.7 and Section 3.9 provide the design loading conditions that are considered. Section 3.5, Section 3.6 and Section 9.5.1 provide the hazards analyses to verify that a safe shutdown, as outlined in Section 7.4, can be achieved and maintained.

The four division design of the ESWS provides complete redundancy; therefore a single failure will not compromise the ESWS system safety-related functions. Each division of ESWS is independent of any other division and does not share components with other divisions or with other nuclear power plant units.

Considering a single failure and preventative maintenance, two ESW divisions may be lost, but the ability to achieve the safe shutdown state under DBA conditions can be reached by the remaining two ESWS divisions. In case of LOOP the four ESW pumps have power supplied by their respective division EDGs.

During SAs, containment heat is removed by the dedicated cooling chain consisting of the severe accident heat removal system (SAHRS), dedicated CCWS, and dedicated ESWS. This cooling chain is manually actuated. In case of loss of the dedicated ESWS division, the SAHRS cooling chain is lost. This condition is outside the DBA.

In the event of an LOCA during power operations, the engineered safety features system (ESFS) (refer to Section 7.3) initiates a safety injection and containment isolation phase 1 signal. The ESWS divisions previously not in operation are automatically started by the PS.

9.2.1.6 Inspection and Testing Requirements

The ESWS is initially tested with the program given in Section 14.2, Test # 48.

The installation and design of the ESWS provides accessibility for the performance of periodic inservice inspection and testing. Periodic inspection and testing of all safety-related equipment verifies its structural and leak tight integrity and its availability and ability to fulfill its functions. Inservice inspection and testing requirements are in accordance with Section XI of the ASME BPV Code and the ASME OM Code.

6.0 Environmental Qualifications

6.1 Deleted.

7.0 Equipment and System Performance

7.1 The ESWS UHS as listed in Table 2.7.11-1 has the capacity to remove the design heat load from the CCWS.

7.2 The pumps listed in Table 2.7.11-1 have net positive suction head available (NPSHA) that is greater than net positive suction head required (NPSHR) at system run-out flow.

7.3 Class 1E valves listed in Table 2.7.11-2 can perform the function listed in Table 2.7.11-1 under system operating conditions.

7.4 The ESWS provides for flow testing of the ESWS pumps during plant operation.

7.5 Deleted.

7.6 The ESWS delivers water to the CCWS and EDG heat exchangers and the ESWPBVS room coolers.

8.0 Interface Requirements

8.1 The site specific emergency makeup water system provides 300 gpm makeup water to each ESW cooling tower basin to maintain the minimum basin water level.

9.0 Inspections, Tests, Analyses, and Acceptance Criteria

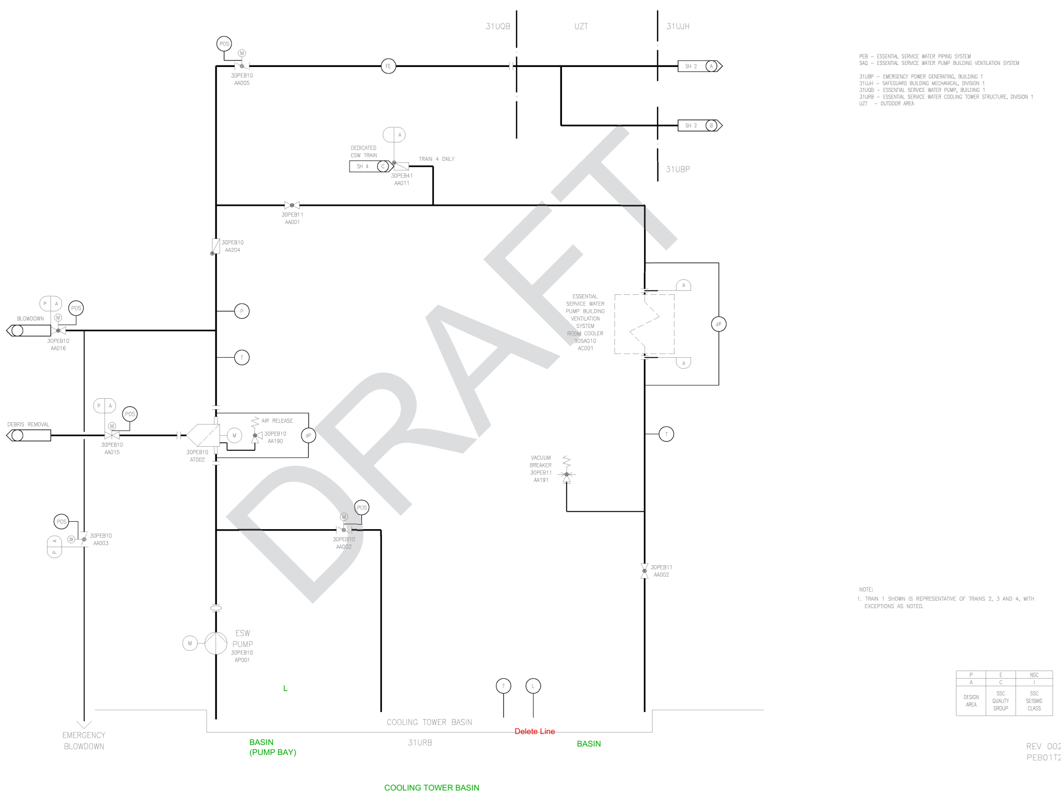
Table 2.7.11-3 lists the ESWS ITAAC.

Table 2.7.11-3—Essential Service Water System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.4	The ESWS has provisions to allow flow testing of the ESWS pumps during plant operation.	Testing for flow of the ESWS pumps back to the ESW cooling tower basin will be performed.	The closed loop allows ESWS pump flow back to the ESW cooling tower basin.
7.5	Deleted.	Deleted.	Deleted.
7.6	The ESWS delivers water to the CCWS and EDG heat exchangers and the ESWPBVS room coolers.	Tests and analyses will be performed to verify the ESWS delivery rate under operating conditions.	A report exists and concludes that the ESWS system delivers a combined total flowrate of at least 19,340 gpm.

Next File

Figure 9.2.1-1—Essential Service Water System Piping & Instrumentation Diagram
Sheet 1 of 4



RAI 351 09.02.05-30(d)

Table 3.2.2-1—Classification Summary
Sheet 96 of 182

KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
PEB10/20/30/40	ESW Piping/ Components (Trains PEB10/20/30/40)	S	C	I	Yes	UQB, UZT[22], UJH, UBP	ASME Class 3[3]
30PEB10/20/30/40 AP001	ESW Pumps	S	C	I	Yes	UQB	ASME Class 3[3]
30PEB21/22/23/24	ESW to/from EDG Coolers	S	C	I	Yes	UQB	ASME Class 3[3]
30PEB11/12/13/14	ESW to/from UQB Ventilation System Room Cooler	S	C	I	Yes	UQB	ASME Class 3[3]
30PEB10/20/30/40	ESW Valves (Trains PEB10/20/30/40)	S	C	I	Yes	UQB, UJH, UBP	ASME Class 3[3]
30PED10/20/30/40 AN001/002	UHS Cooling Tower Fans	S	C	I	Yes	URB	
QKA	**Safety Chilled Water System**						
30QKA10/20/30/40 AP107	Running Pumps	S	C	I	Yes	UJK	ASME Class 3[3]
30QKA10/20/30/40 AP108	Standby Pumps	S	C	I	Yes	UJK	ASME Class 3[3]
30QKA10/40 AH112	Air Cooled Chillers	S	C	I	Yes	UJK	ASME Class 3[3]
30QKA20/30 AH112	Water Cooled Chillers	S	C	I	Yes	UJK	ASME Class 3[3]
30QKA10/20/30/40 BB101	Expansion Tanks	S	C	I	Yes	UJK	ASME Class 3[3]

Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment (Sheet 52 of 130)

Name Tag (Equipment Description)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)			
G CLS *KAB70AA019*	30KAB70CG019B	34UJH10004	M	H	ES	SI	S	1E	EMC		Y (2)	Y (5)	Y (6)
G Meas *KAB70AA116*	30KAB70CG116	30UJA11016	H	H		SI	S	1E	EMC	Y (1)		Y (5)	
G Opng *70AA191*	30KAB70CG191A	30UJA11016	H	H		SI	S	1E	EMC	Y (1)		Y (5)	
G Acty CCWS Inlet	30KAB70CR001	30UJA11016	H	H		SI	S	1E	EMC	Y (1)		Y (5)	
G Acty CCWS Outlet	30KAB70CR002	30UJA11016	H	H		SI	S	1E	EMC	Y (1)		Y (5)	
T Dnstr CVCS HP Cl2	30KAB70CT082	30UJA11016	H	H		SI	S	1E	EMC	Y (1)		Y (5)	
F Upstr QNA21 AC002	30KAB80CF060	31UJH10004	M	H		SI	S	1E	EMC		Y (2)	Y (5)	Y (6)
F Dnstr KAB80 Chil	30KAB80CF061	31UJH10004	M	H		SI	S	1E	EMC		Y (2)	Y (5)	Y (6)
G Opng *KAB80AA015*	30KAB80CG015A	31UJH10004	M	H		SI	S	1E	EMC		Y (2)	Y (5)	Y (6)
G Cls *KAB80AA015*	30KAB80CG015B	31UJH10004	M	H		SI	S	1E	EMC		Y (2)	Y (5)	Y (6)
G Opng *KAB80AA016*	30KAB80CG016A	31UJH10004	M	H		SI	S	1E	EMC		Y (2)	Y (5)	Y (6)
G Cls *KAB80AA016*	30KAB80CG016B	31UJH10004	M	H		SI	S	1E	EMC		Y (2)	Y (5)	Y (6)
Essential Service Water System (ESWS)													
30PEB10 AA002 Valve Motor Actuator	30PEB10AA002	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB10 AA003 Valve Motor Actuator	30PEB10AA003	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB10 AA005 Valve Motor Actuator	30PEB10AA005	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB10 AA015 Valve Motor Actuator	30PEB10AA015	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB10 AA016 Valve Motor Actuator	30PEB10AA016	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
ESW Pump Motor Heater, Train 1	30PEB10AH500	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
ESW Pump Motor, Train 1	30PEB10AP001	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB10 AT002 Filter Motor Actuator	30PEB10AT002	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
ESW Pump Discharge Flow Indicator	30PEB10CF001	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
CCW HX Outlet Flow Measurement	30PEB10CF002	31UJH05026	M	H	ES	SI	S	1E			Y (2)	Y (5)	
UHS Tower Basin Level Indicator	30PEB10CL001	31URB01003	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
ESW Pump Discharge Pressure Indicator	30PEB10CP002	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
ESW Pump Filter Diff Pressure Indicator	30PEB10CP003	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
ESW Pump Discharge Thermocouple	30PEB10CT001	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
SAQ HX DP Measurement	30PEB11CP001	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
SW Pump Bldg Cooler Pressure Indicator	30PEB11CP501	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
SAQ HX Outlet Temp Measurement	30PEB11CT001	31UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB20 AA002 Valve Motor Actuator	30PEB20AA002	32UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB20 AA003 Valve Motor Actuator	30PEB20AA003	32UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)
30PEB20 AA005 Valve Motor Actuator	30PEB20AA005	32UQB02001	M	M	ES	SI	S	1E	EMC			Y (5)	Y (6)

Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment (Sheet 53 of 130)

Name Tag (Equipment Description)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)		
30PEB20 AA015 Valve Motor Actuator	30PEB20AA015	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB20 AA016 Valve Motor Actuator	30PEB20AA016	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Motor Heater, Train 2	30PEB20AH500	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Motor, Train 2	30PEB20AP001	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB20 AT002 Filter Motor Actuator	30PEB20AT002	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Flow Indicator	30PEB20CF001	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
CCW HX Outlet Flow Measurement	30PEB20CF002	32UJH05020	M	H	ES	SI	S	1E		Y (2)	Y (5)	
UHS Tower Basin Level Indicator	30PEB20CL001	32URB01003	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Pressure Indicator	30PEB20CP002	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Filter Diff Pressure Indicator	30PEB20CP003	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Thermocouple	30PEB20CT001	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SAQ HX DP Measurement	30PEB21CP001	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SW Pump Bldg Cooler Pressure Indicator	30PEB21CP501	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SAQ HX Outlet Temp Measurement	30PEB21CT001	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB30 AA002 Valve Motor Actuator	30PEB30AA002	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB30 AA003 Valve Motor Actuator	30PEB30AA003	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB30 AA005 Valve Motor Actuator	30PEB30AA005	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB30 AA015 Valve Motor Actuator	30PEB30AA015	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB30 AA016 Valve Motor Actuator	30PEB30AA016	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Motor Heater, Train 3	30PEB30AH500	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Motor, Train 3	30PEB30AP001	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB30 AT002 Filter Motor Actuator	30PEB30AT002	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Flow Indicator	30PEB30CF001	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
CCW HX Outlet Flow Measurement	30PEB30CF002	33UJH05020	M	H	ES	SI	S	1E		Y (2)	Y (5)	
UHS Tower Basin Level Indicator	30PEB30CL001	33URB01003	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Pressure Indicator	30PEB30CP002	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Filter Diff Pressure Indicator	30PEB30CP003	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Thermocouple	30PEB30CT001	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SAQ HX DP Measurement	30PEB31CP001	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SW Pump Bldg Cooler Pressure Indicator	30PEB31CP501	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SAQ HX Outlet Temp Measurement	30PEB31CT001	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB40 AA002 Valve Motor Actuator	30PEB40AA002	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB40 AA003 Valve Motor Actuator	30PEB40AA003	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)

Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment (Sheet 54 of 130)

Name Tag (Equipment Description)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)		Safety Class (Note 4)			EQ Program Designation (Note 5)		
30PEB40 AA005 Valve Motor Actuator	30PEB40AA005	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB40 AA015 Valve Motor Actuator	30PEB40AA015	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB40 AA016 Valve Motor Actuator	30PEB40AA016	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Motor Heater, Train 4	30PEB40AH500	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Motor, Train 4	30PEB40AP001	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PEB40 AT002 Filter Motor Actuator	30PEB40AT002	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Flow Indicator	30PEB40CF001	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
CCW HX Outlet Flow Measurement	30PEB40CF002	34UJH05026	M	H	ES	SI	S	1E		Y (2)	Y (5)	
UHS Tower Basin Level Indicator	30PEB40CL001	34URB01003	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Pressure Indicator	30PEB40CP002	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Filter Diff Pressure Indicator	30PEB40CP003	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
ESW Pump Discharge Thermocouple	30PEB40CT001	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SAQ HX DP Measurement	30PEB41CP001	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SW Pump Bldg Cooler Pressure Indicator	30PEB41CP501	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
SAQ HX Outlet Temp Measurement	30PEB41CT001	34UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED10 AA010 Valve Motor Actuator	30PED10AA010	31UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED10 AA011 Valve Motor Actuator	30PED10AA011	31UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED10 AA019 Valve Motor Actuator	30PED10AA019	31UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED10 AA021 Valve Motor Actuator	30PED10AA021	31UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED10 AN001 Fan Motor	30PED10AN001	31URB03001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED10 AN002 Fan Motor	30PED10AN002	31URB03002	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED20 AA010 Valve Motor Actuator	30PED20AA010	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED20 AA011 Valve Motor Actuator	30PED20AA011	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED20 AA019 Valve Motor Actuator	30PED20AA019	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED20 AA021 Valve Motor Actuator	30PED20AA021	32UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED20 AN001 Fan Motor	30PED20AN001	32URB03001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED20 AN002 Fan Motor	30PED20AN002	32URB03002	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED30 AA010 Valve Motor Actuator	30PED30AA010	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED30 AA011 Valve Motor Actuator	30PED30AA011	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED30 AA019 Valve Motor Actuator	30PED30AA019	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED30 AA021 Valve Motor Actuator	30PED30AA021	33UQB02001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED30 AN001 Fan Motor	30PED30AN001	33URB03001	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)
30PED30 AN002 Fan Motor	30PED30AN002	33URB03002	M	M	ES	SI	S	1E	EMC		Y (5)	Y (6)

Response to

Request for Additional Information No. 390

4/27/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.02 - New and Spent Fuel Storage
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
SRP Section: 09.05.04 - Emergency Diesel Engine Fuel Oil Storage and Transfer System
Application Section: 9.5.4

QUESTIONS for Balance of Plant Branch 1 (SBPA)
QUESTIONS for Health Physics Branch (CHPB)

Question 09.02.02-106:

Follow-up to RAI No. 337, Supplement 2 responses addressing the seal water system (SEWSS), FSAR Section 9.2.7.

Question 9.2.2-79: In the applicant’s response to item B.1, it was noted that check valves are installed on the upstream piping of each SEWSS user. Based on the staff’s review of Figure 9.2.7-1, “Seal Water Supply System,” all the users do not have check valves. Provide clarification in the RAI response that the check valves are located on the continuations of the FSAR figures and provide information on the figure numbers in the FSAR or add the required check valves to Figure 9.2.7-1 and associated FSAR tables.

Question 9.2.2-79: In the applicant’s markup of Table 3.2.2-1, “Classification Summary,” on sheet 110, valve 30GHW44 AA006 was added. The staff could not find this valve on any FSAR figures. Provide this valve on the FSAR figure.

Question 9.2.2-80: In the applicant’s response to item B.2, it was noted that a relief valve is provided for each buffer tank. Since these relief valves are for the nitrogen side of the buffer tanks, describe the vent path for the nitrogen and explain in the RAI if this release path affects the occupations of the main control room or affects plant operators from performing any duties related to safe shutdown.

Question 9.2.2-81: In the applicant’s response to item B.1, it was noted that the severe accident heat removal system (SAHRS) did not have a statement added to the FSAR related to the SAHRS pump trip on low seal water pressure similar to the text added for the charging pump (Section 9.3.4.5). Provide clarification in the RAI response and add this information to the appropriate sections in the FSAR for the SAHRS.

The staff noted that SAHRS is described in FSAR Tier 1, Section 2.3.3, “Severe Accident Heat Removal System;” however, it is not described in detail in Tier 2. The information in Section 19.2.3.3.3.2, “Severe Accident Heat Removal System,” does not include the design information to support Tier 1. The support systems for SAHRS (dedicated component cooling and dedicated essential cooling) are described in detail in Sections 9.2. Since SAHRS is described in Tier 1, and the design descriptions, interface requirements, and site parameters are derived from Tier 2 information, the applicant should provide this information in Tier 2. In addition, Tier 1 FSAR Section 1.0, “Introduction,” states that the “information in the Tier 1 portion of the FSAR is extracted from the detailed information contained in Tier 2”.

This information is needed in Tier 2 in order for the staff to complete its review as noted below;

- SAHRS as it relates to the GDC 2. Tier 1, Table 2.3.3-1 indicates that all of the SAHRS components are not built to either seismic category I or II.
- SAHRS as it related to 10 CRF20.1406 which needs to be evaluated for the minimization of the spread of contamination during system testing.

Question 9.2.2-81: In the applicant’s response to item B.2, it was noted there was no basis for the 40 gallon buffer tanks. Provide the basis for the 40 gallon in the RAI response and add information to the FSAR as required.

Response to Question 09.02.02-106:

Follow-up to Question 09.02.02-81 (Related to severe accident heat removal system (SAHRS):

The Severe Accident Heat Removal System (SAHRS) is used to mitigate beyond design basis events (BDBEs). Therefore, the system has been classified as non-safety, except for safety-related functions performed regarding containment and IRWST boundary isolation and protection.

With regards to the initial questions asked,

This information is needed in Tier 2 in order for the staff to complete its review as noted below;

- SAHRS as it relates to the GDC 2. Tier 1, Table 2.3.3-1 indicates that all of the SAHRS components are not built to either seismic category I or II.
- SAHRS as it related to 10 CRF20.1406 which needs to be evaluated for the minimization of the spread of contamination during system testing.

As related to GDC 2, SAHRS component seismic classifications are provided in FSAR Tier 1 Table 2.3.3-1, FSAR Tier 1 Figure 2.3.3-1, and FSAR Tier 2 Table 3.2.2-1. Inconsistencies exist between these tables. Markups of FSAR Tier 1 Figure 2.3.3-1 and FSAR Tier 2, Table 3.2.2-1 are included in this RAI response to show necessary FSAR changes. Future FSAR Tier 2 Figure 19.2-22 is also included as Attachment 1 to show the simplified Piping and Instrumentation Diagram (P&ID) for SAHRS.

With respect to the seismic classification assignments, the criteria for seismic classification is predicated on conformance with GDC 2 as described in RG 1.29, “Seismic Design Classification” and NUREG-0800, Chapter 3, Section 3.2.1, “Seismic Classification”.

As noted in SRP Section 3.2.1, “Compliance with GDC 2 requires that nuclear power plant SSCs important to safety be designed to withstand the effects of natural phenomena, including earthquakes, without loss of capability to perform their safety functions. Also, compliance with 10 CFR Part 100, Appendix A and 10 CFR Part 50, Appendix S, requires that certain SSCs be designed to withstand the SSE and remain functional. The SSCs are those necessary to ensure: (1) the integrity of the reactor coolant pressure boundary; (2) the capability to shut down the reactor and maintain it in a safe shutdown condition; or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100. RG 1.29 describes an acceptable method of identification and classification of those SSCs that should be designed to withstand the SSE.”

The introduction of RG 1.29 notes, “In addition, Appendix S, “Earthquake Engineering Criteria for Nuclear Power Plants,” to 10 CFR Part 50, requires that all nuclear power plants must be designed so that certain SSCs remain functional if the safe-shutdown earthquake ground motion (SSE) occurs. These plant features are those necessary to ensure (1) the integrity of the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of 10 CFR 50.34(a)(1) or 10 CFR 100.11.2.”

The SAHRS equipment that is not non-seismic does not satisfy the above NRC criteria since their purpose is to mitigate a beyond design basis accident and are not required to ensure: (1) the integrity of the reactor coolant pressure boundary; (2) the capability to shut down the reactor and maintain it in a safe shutdown condition; or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100. Furthermore, this equipment is not identified in RG 1.29 as the type of equipment to be designed to withstand an SSE. The SAHRS equipment that is seismic and safety related relates to the containment isolation system and IRWST boundary isolation and protection. These items function to confine radioactivity that may be released into the containment following a postulated design basis accident as part of the containment isolation system and/or provide IRWST inventory protection.

The U.S. EPR containment isolation system is discussed in FSAR Tier 2 Section 6.2.4. The IRWST is discussed with the Emergency Core Cooling System (ECCS) in FSAR Tier 2 Section 6.3. SAHRS safety related components are discussed in response to RAI 249, Question 03.11-12 as related to the Environmental Qualification (EQ) program. Refer to the response of RAI Set 212, Supplement 1, Questions 06.02.02-23 and 06.02.02-27 for details regarding the SAHRS passive flood line isolation valves (30JMQ42AA004 and 30JMQ42AA006) inside containment that support IRWST inventory protection.

As related to 10CFR20.1406, contamination control for systems is addressed in FSAR Tier 2 Section 12, Section 12.3.6.5. Primary systems (e.g., dedicated CCW) supporting SAHRS are addressed. The SAHRS components are located in dedicated radiological compartments; refer to FSAR Tier 2 Figure 12.3-27 and FSAR Tier 2 Figure 12.3-28. Spread of contamination during testing is minimized by supporting system designs, cross contamination prevention and compartmentalization.

With respect to follow-on requests, the presentation of SAHRS information differs between the FSAR Tier 1 and FSAR Tier 2. The FSAR Tier 1 content for SAHRS is presented in one consolidated section (Section 2.3.3, Severe Accident Heat Removal System). FSAR Tier 1, Section 2.3.3 specifically addresses the following SAHRS sections:

- Description
- Arrangement
- Mechanical Design Features
- I&C Design Features, Displays, and Controls
- Electrical Power Design Features
- Environmental Qualifications
- Equipment and System Performance
- Inspections, Tests, Analysis, and Acceptance Criteria

SAHRS content in FSAR Tier 2 is not captured in one specific section, rather spread out throughout the FSAR. This response correlates the FSAR Tier 1 content to the FSAR Tier 2 content. FSAR changes resulting from reviews performed and comments received are identified.

- Description

  For SAHRS description, FSAR Tier 1 Section 1.0 corresponds to FSAR Tier 2 Section 1.2.3.3.5 and FSAR Tier 2, Section 19.2.3.3.2.

- Arrangement

  FSAR Tier 1, Section 2.0 includes text, which refers to FSAR Tier 1 Figure 2.3.3-1 – SAHRS Functional Arrangement and FSAR Tier 1 Table 2.3.3-1 – SAHRS Equipment Mechanical Design.

  A Figure similar to FSAR Tier 1 Figure 2.3.3-1 does not exist in FSAR Tier 2. Currently, a general illustration is provided in FSAR Tier 2 Figure 19.2.2. A more detailed SAHRS Functional Arrangement drawing will be included in FSAR Tier 2, Chapter 19, as Figure 19.2.22. The Figure addition is shown in Attachment 1 of this response.

  With regards to arrangement, the FSAR Tier 1, Table 2.3.3-1 includes detail regarding equipment description, equipment tag number, and equipment location. The comparable FSAR Tier 2 information is found in FSAR Tier 2, Chapter 3, Table 3.2.2-1.

  While more unique to Mechanical Design Features, it is noted here that inconsistencies with regards to Quality Groups and Seismic Classifications are also being corrected based on the review of Sections performed. For these items, corrective actions were initiated. FSAR Change Form 10-188 was initiated to address needed FSAR changes. The markups from this FSAR Change Form are attached (Attachments 2 and 3).

- Mechanical Design Features

  FSAR Tier 1, Section 3.0 content includes text, which makes reference to Table 2.3.3-1 – SAHRS Equipment Mechanical Design. FSAR Tier 1 Table 2.3.3-1 includes detail regarding equipment description, equipment tag number, equipment location, ASME Code Section III, Function, and Seismic Category.

  With the exception of a “Function” column, the content captured in FSAR Tier 1, Section 3.0 and Table 2.3.3-1, is included with FSAR Tier 2 Table 3.2.2-1 for the safety related valves identified (CIVs - 30JMQ40 AA001, 30JMQ41 AA001, 30JMQ42 AA001, 30JMQ43 AA001 and Chk Valves – 30JMQ41 AA002, 30JMQ42 AA002, and 30JMQ43 AA002). The “Function” as related to the safety related valves in the SAHRS is provided in Table 6.2.4-1, Containment Penetration, Isolation Valve, and Actuator Data.

  The spring-loaded non-safety passive flooding valves (30JMQ42 AA003 and 30JMQ42 AA005) are addressed at the end of FSAR Tier 1 Table 2.3.3-1. With respect to FSAR Tier 2, Table 3.2.2-1, these components are captured with component code 30JMQ42, description “Piping and associated equipment inside Containment (except Passive Flooding Line).” They are also shown in future FSAR Tier 2 Figure 19.2-22 (Attachment 1 of this RAI response). Operating function is discussed with the Spreading Area and Cooling Structure discussion in Section 19.2.3.3.3.1, Core Melt Stabilization System.

- I&C Design Features, Displays, and Controls

  FSAR Tier 1, Section 4.0 content includes text, which makes reference to Table 2.3.3-2, SAHRS Equipment I&C and Electrical Design. Specifically,

  - "4.1 The SAHRS equipment controls are provided in the MCR as listed in Table 2.3.3-2— SAHRS Equipment I&C and Electrical Design."

  - "4.2 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.3.3-2 responds to the state requested by a test signal."

  FSAR Tier 1, Table 2.3.3-2 addresses equipment description, equipment tag number, equipment location, IEEE Class 1E, EQ Harsh Environment, PACS, MCR Displays, and MCR controls for the SAHRS pump and motor operated containment isolation valves. The SAHRS pump information as related to EQ harsh environment in FSAR Tier 1 Table 2.3.3-2 is being changed as discussed with the Environmental Qualification bullet.

  Containment Isolation I&C design features are discussed in FSAR Tier 2 Section 7.3.1.2.9 of the FSAR. FSAR Tier 2 Figure 7.1-2 shows the U.S. EPR I&C Architecture. FSAR Section 7.3.1.1 addresses that actuation orders are sent from the protection system (PS) to the priority and actuator control system (PACS). Other details associated with IEEE Class 1E, EQ, and equipment are covered via different bulleted items in this response.

- Electrical Power Design Features

  The U.S. EPR Project electrical power supply and design features are captured in Tier 2, Section 8. The safety related SAHRS electrical components and non-safety related SAHRS electrical components considered critical for mitigation of a BDBE (e.g., SAHRS pump) are powered by the Class 1E electrical distribution system and can receive power supplied from the offsite power source, emergency diesel generator or the SBO diesel generator. In addition, safety related motorized isolation valves are backed by battery power (12UPS) during a severe accident and a loss of offsite power and all emergency diesel generators. U.S. EPR FSAR Figure 8.3-2 — Emergency Power Supply System Single Line Drawing Sheet 3 of 3, illustrates the connection to the 6.9 kV SAHRS pump to the Class 1E electrical distribution system. The safety-related SAHRS motor operated valves are supplied by 480 V motor control centers 31/34BNB03. As shown in the Chapter 8 single line drawings, the BNB03 MCCs are capable of being supplied from offsite power, the respective division EDG, an SBO diesel generator, and are also capable of connection with the 12UPS system. Identification of the SAHRS safety-related motor-operated valve power supply was provided in the response to RAI 11, Supplement 2, Question 08.03.01-2.

- Environmental Qualifications

  FSAR Tier 1, Section 6.0 content includes text, which makes reference to Table 2.3.3-2, SAHRS Equipment I&C and Electrical Design. FSAR Tier 1, Table 2.3.3-2 includes the containment isolation valves, which are classified safety related and seismic class I. Other equipment within the SAHRS that fall within the EQ program are as detailed in FSAR Tier 2 Tables 3.10-1 and 3.11-1. As addressed in response to RAI 249, Question 03.11-12, "as noted in 10 CFR 50.49, environmental qualification (EQ) applies to equipment relied upon to remain functional during and following a design basis event (DBE)." As previously indicated in response to RAI 249, Question 03.11-12, SAHRS as a system is dedicated to support mitigation of BDBEs and is classified as a non-safety system. As such, SAHRS is not required to be environmentally qualified per 10 CFR 50.49. Also refer to FSAR Tier 2, Section 3.11.5.1, which was revised in response to RAI 249 Question 03.11-12.

Note that FSAR Tier 1, Table 2.3.3-2 requires change to note the SAHRS pump as N/A in the harsh environmental column. The SAHRS pump does not fall within the EQ program. A markup of this change to Table 2.3.3-2 is included in Attachment 4 of this RAI response.

- Equipment and System Performance

FSAR Tier 1, Section 7.0 content includes text, which makes reference to FSAR Tier 1 Table 2.3.3-1. The following other bullets are included:

- "7.1 The SAHRS heat exchanger as listed in Table 2.3.3-1 has the capacity to transfer the design heat load to the component cooling water system (CCWS)."
- "7.2 Class 1E valves listed in Table 2.3.3-2 perform the functions listed in Table 2.3.3-1 under system design conditions."
- "7.3 Containment isolation valves listed in Table 2.3.3-1 close within the containment isolation response time following initiation of a containment isolation signal."

Links associated with FSAR Tier 1 Table 2.3.3-1 were previously addressed in the section responses described above. EQ relationships, functions, and containment isolation valve links were also addressed in previous responses. For the first bullet, supporting SAHRS discussion illustrating the ability of SAHRS to provide post BDBE support is provided in FSAR Tier 2 Section 19.2.

Note the new SAHRS Tier 2 Figure 19.2-22 shows two tagged heat exchangers. FSAR Change Form 10-188 is incorporating changes to identify the two heat exchanger tag numbers in appropriate locations throughout the FSAR. The two heat exchangers in series make up the SAHRS heat exchanger. The two heat exchanger identification resulted from a corrective action.

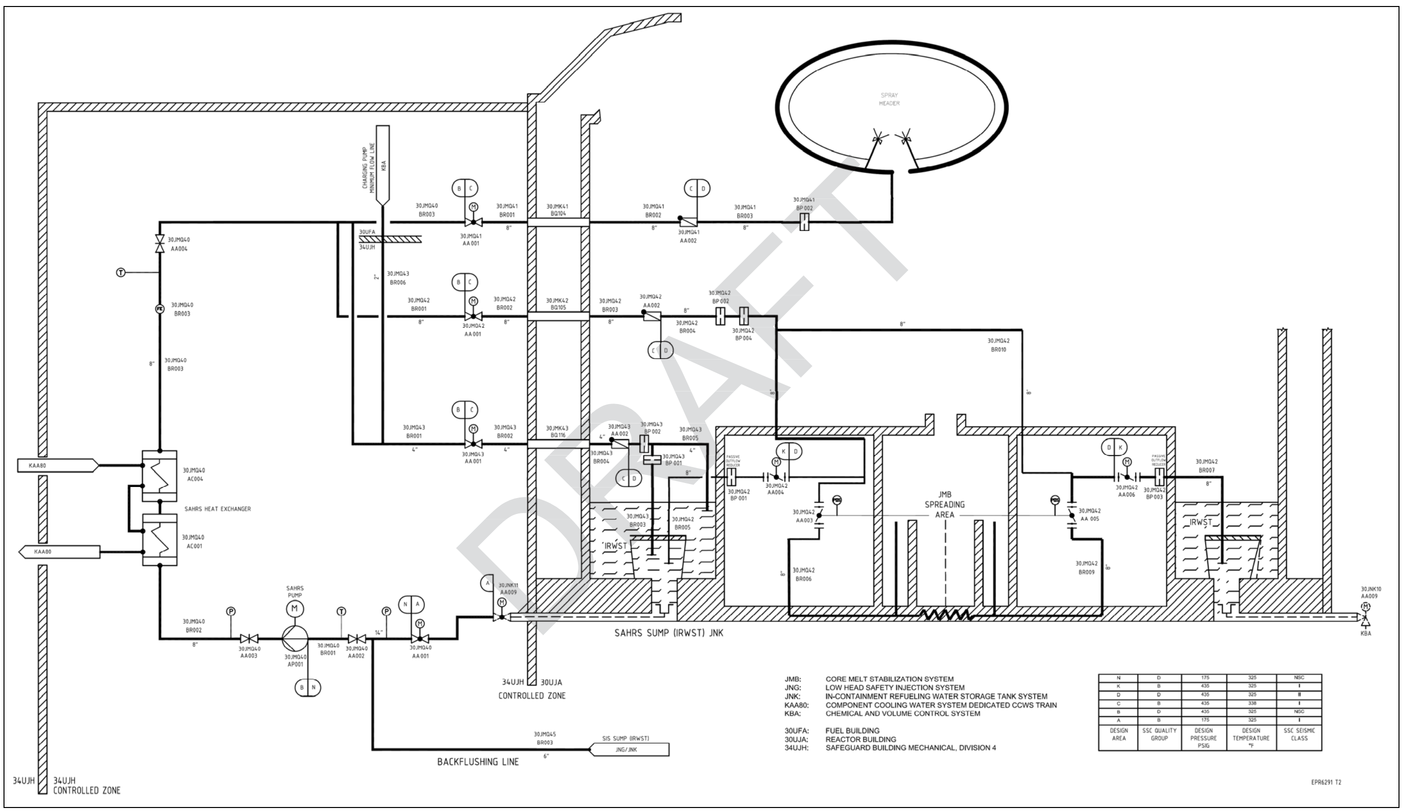
- Inspections, Tests, Analysis, and Acceptance Criteria

FSAR Tier 1, Section 8.0 content includes text, which makes reference to FSAR Tier 1 Table 2.3.3-3. For FSAR Tier 2, ITAACs associated with the SAHRS are listed in FSAR Section 14.2.12.2.6.

FSAR Impact:

Refer to separate file of FSAR changes.

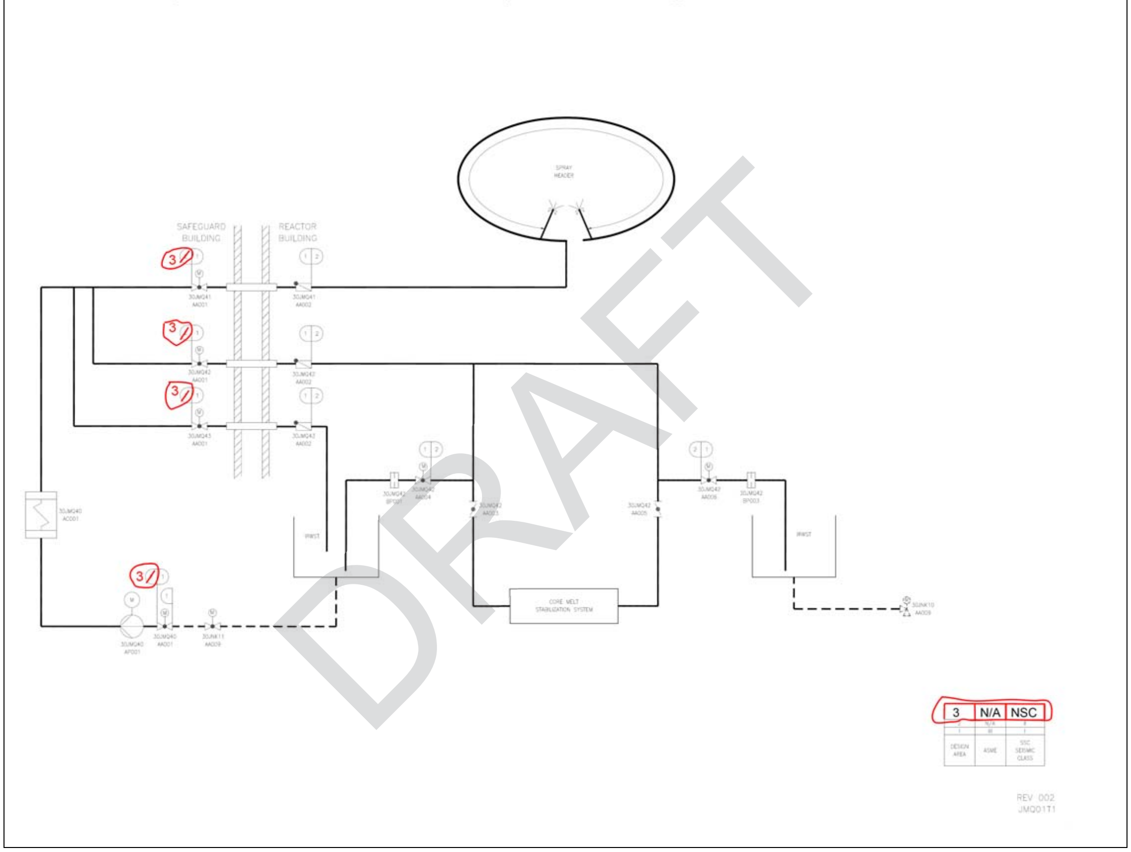
Attachment 1 – New FSAR Tier 2 Figure 19.2-22 for Severe Accident Heat Removal System



DESIGN AREA	SSC QUALITY GROUP	DESIGN PRESSURE PSIG	DESIGN TEMPERATURE °F	SSC SEISMIC CLASS
N	D	175	325	NSC
K	B	435	325	I
D	D	435	325	II
C	B	435	338	I
B	D	435	325	NSC
A	B	175	325	I

Attachment 2 – FSAR Change Form 10-188, Tier 1, Figure 2.3.3-1 Markups

Figure 2.3.3-1—Severe Accident Heat Removal System Functional Arrangement



Attachment 3 – FSAR Change Form 10-188, Tier 2, Table 3.2.2-1 Markups

(including penetrations and associated piping)

30JMQ40AA001 and

Table 3.2.2-1—Classification Summary
Sheet 47 of 185

KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
JMQ	**Severe Accident Heat Removal System**						
30JMQ~~40~~/41/42/43 AA001/002	Containment Isolation Valves	S	B	I	Yes	UJH	ASME Class 2[2]
30JMQ42 BR005/007	Passive Flooding line up to and including MOV (JMQ42 AA00~~7~~4/00~~9~~6)	S	B	I	Yes	UJA	ASME Class 2[2]
30JMQ41 BR004	Piping - Spray Header and Nozzles	NS-AQ	D	II	Yes	UJA	ANSI/ASME B31.1[6]; Located above safety-related piping and equipment
30JMQ40	Piping and associated equipment in Safeguards Building	NS	D	NSC	No	UJH	ANSI/ASME B31.1[6]
30JMQ41/43	Piping and associated equipment inside Containment	NS-AQ	D	II	Yes	UJA	ANSI/ASME B31.1[6]; Located in close proximity to safety-related piping and equipment

41/42/43

(excluding piping leading from containment isolation valve to penetration)

Attachment 3 cont. – FSAR Change Form 10-188, Tier 2, Table 3.2.2-1 Markups

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Table 3.2.2-1—Classification Summary
Sheet 48 of 185

KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
30JMQ42	Piping and associated equipment inside Containment (except Passive Flooding Line)	NS-AQ	D	II	Yes	UJA	ANSI/ASME B31.1[6]; Located in close proximity to safety-related piping and equipment
~~30JMQ41/42/43~~	~~Piping in Safeguards Building~~	~~NS-AQ~~	~~D~~	~~II~~	~~Yes~~	~~UJH~~	~~ANSI/ASME B31.1[6]; Located in close proximity to safety-related piping and equipment~~
30JMQ40 AC001	SAHRS Heat Exchanger	NS	D	NSC	No	UJH	ASME VIII[8]
30JMQ40 AP001	SAHRS Pump	NS	D	NSC	No	UJH	Manufacturer Standards

Delete, this is not correct.

Table 2.3.3-2—SAHRS Equipment I&C and Electrical Design

Description	Tag Number (1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR Displays	MCR Controls
SAHRS Suction Side Containment Isolation Valve	30JMQ40AA001	Safeguard Building 4	$1^{N},2^{A}$	Yes	Yes	Yes	Open-Close
SAHRS Pump	30JMQ40AP001	Safeguard Building 4	4^{N}	~~No~~ N/A	Yes	N/A	Start-Stop
Spray Function Outside Containment Isolation Valve	30JMQ41AA001	Safeguard Building 4	$4^{N},3^{A}$	Yes	Yes	Yes	Open-Close
Active Cooling Function Outside Containment Isolation Valve	30JMQ42AA001	Safeguard Building 4	$4^{N},3^{A}$	Yes	Yes	Yes	Open-Close
IRWST Backflush Function Outside Containment Isolation Valve	30JMQ43AA001	Safeguard Building 4	$4^{N},3^{A}$	Yes	Yes	Yes	Open-Close

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

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