## ArevaEPRDCPEm Resource

| | |
|---|---|
| **From:** | BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com] |
| **Sent:** | Monday, June 28, 2010 5:01 PM |
| **To:** | Tesfaye, Getachew |
| **Cc:** | Carneal, Jason; Hearn, Peter; KOWALSKI David (AREVA) |
| **Subject:** | FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon |
| **Attachments:** | Blank Bkgrd.gif; DRAFT RESPONSE RAI 345 Q.09.02.01-35(a,b,c,d,f).pdf; DRAFT RESPONSE RAI 345 Q.09.02.01-28(a,b,d,h).pdf; DRAFT RESPONSE RAI 345 Q.09.02.01-28(c).pdf; DRAFT RESPONSE RAI 417 Q.09.02.02-121.pdf; DRAFT RESPONSE RAI 417 Q.09.02.02-115.pdf |
| **Importance:** | High |

Draft responses to discuss tomorrow at the chapter 9 call are attached.

Thanks,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

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**From:** KOWALSKI David J (AREVA NP INC)
**Sent:** Monday, June 28, 2010 4:59 PM
**To:** BRYAN Martin (EXT)
**Cc:** GARDNER George Darrell (AREVA NP INC); BALLARD Robert W (AREVA NP INC); CONNELL Kevin J (AREVA NP INC); HUDDLESTON Stephen C (AREVA NP INC); BROUGHTON JR Ronnie T (AREVA NP INC); HARTSELL Jody M (AREVA NP INC); SLOAN Sandra M (AREVA NP INC); MCINTYRE Brian (AREVA NP INC)
**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 345 and 417 questions. These responses will be discussed at tomorrow's (6/29/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC.

Attached are the following DRAFT responses:

- Response to RAI 345 - Question 09.02.01-28 (a, b, d and h).
- Response to RAI 345 - Question 09.02.01-28 (c)
- Response to RAI 345 - Question 09.02.01-35 (a, b, c, d and f)
- Response to RAI 417 - Question 09.02.02-115
- Response to RAI 417 - Question 09.02.02-121

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.

***David J. Kowalski, P.E.***
Principal Engineer
New Plants Regulatory Affairs

**AREVA NP Inc.**
An AREVA and Siemens company

7207 IBM Drive, Mail Code CLT-2A
Charlotte, NC 28262
Phone: 704-805-2590
Mobile: 704-293-3346

Fax: 704-805-2675
Email: David.Kowalski@areva.com

**Hearing Identifier:** AREVA_EPR_DC_RAIs
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**From:** BRYAN Martin (EXTERNAL AREVA)

**Created By:** Martin.Bryan.ext@areva.com

**Recipients:**
"Carneal, Jason" <Jason.Carneal@nrc.gov>
Tracking Status: None
"Hearn, Peter" <Peter.Hearn@nrc.gov>
Tracking Status: None
"KOWALSKI David (AREVA)" <David.Kowalski@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

**Post Office:** AUSLYNCMX02.adom.ad.corp

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| DRAFT RESPONSE RAI 345 Q.09.02.01-28(a,b,d,h).pdf | 662016 | |
| DRAFT RESPONSE RAI 345 Q.09.02.01-28(c).pdf | 790674 | |
| DRAFT RESPONSE RAI 417 Q.09.02.02-121.pdf | 591986 | |
| DRAFT RESPONSE RAI 417 Q.09.02.02-115.pdf | 410437 | |

**Options**
**Priority:** High
**Return Notification:** No
**Reply Requested:** No
**Sensitivity:** Normal
**Expiration Date:**
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**Response to**

**Request for Additional Information No. 345**

**3/04/2010**

**U. S. EPR Standard Design Certification**
**AREVA NP Inc.**
**Docket No. 52-020**
**SRP Section: 09.02.01 - Station Service Water System**
**Application Section: 9.2.1**

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

**Question 09.02.01-35:**

Follow-up to RAI 119, Question 9.2.1-09

The ESWS must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. System design features, operating procedures, and surveillance testing must provide adequate assurance that the ESWS safety functions will not be compromised due to damaging water hammer events. Two of the four safety-related trains are normally in operation with the remaining two trains in standby. All valves in the main flow path of each train, including the two trains in standby, are kept open (Tier 2 FSAR Section 9.2.1.4). Since the cooling tower spray nozzles are located at an elevation that is well above the cooling tower basin water level, there is a potential for the standby loops to drain to their respective cooling tower basins and create a large air void in the piping of the ESWS standby trains. If this occurs, an automatic actuation of the standby ESWS trains could result in a water hammer.

Any loop seals in the ESWS that are caused by component design or piping configuration would tend to result in a much more severe water hammer event. The ESWS description does not adequately consider and address water hammer vulnerabilities (such as this) in the FSAR and does not explain how system design features, operating procedures, and periodic surveillance testing provide adequate assurance that the ESWS safety functions will not be compromised by water hammer events. Accordingly, the applicant needs to provide additional information in Tier 2 FSAR Section 9.2.1 to address water hammer considerations. If system valves are relied upon to prevent excessive back-leakage, the ESWS description in the FSAR needs to fully explain and justify the maximum amount of back-leakage that is allowed, and specify the leakage acceptance criteria that will be established in the in-service testing program for these valves along with the basis for this determination.

Based on the staff's review of response to RAI 119, Question 9.2.1-09 and an audit by the staff conducted on October 27, 2009, this item remains open and requires further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

The staff found the applicant's response, proposed actions and conclusions to be reasonable, but not complete. The applicant should address the following items.

a. Provide the hydraulic transient analysis or provide an Tier 1 ITAAC item in Section 2.7.11.

b. The RAI-response provided a description that the ESWS pumps will be rotated on a bi-weekly bases (or as determined by the hydraulic transient analysis) as part of the strategy for preventing water hammer events in the ESWS. The applicant should provide this information in the FSAR or provide a COL item for this activity.

c. Provide in the FSAR the mechanism for how plant operators will determine the water level in case the ESWS water column is drained sooner than the assumed 14 days. For example, more rapid draining could occur if debris was to get lodged between the seat and disc at the time of valve closure. Provide a description of instrumentation and alarms to the control room of level indication of the water column to operability determination.

d. Provide a revised markup of U.S. EPR FSAR Section 9.2.1.3.5. The proposed markup only identified pump discharge check valve leakage criteria and that a hydraulic transient analysis will be performed. The staff found this FSAR markup to be insufficient since the design features described in this response that are relied upon for water hammer mitigation (e.g. limiting check valve leakage, auto closing of pump discharge valve(s), riser air release path etc) were not addressed in the FSAR. The staff concluded that for a full understanding of this subject a description is necessary in the FSAR including the automatic valve actions that take place upon ESWS pump trip and restart and the intended design function of vacuum breaker (AA191) and air release (AA190) valves.

e. FSAR Tier 2 Section 3.9.6.3 presently indicates that both MOVs 30PEB10/20/30/40 AA005 and 30PED 10/20/30/40AA010 are listed as ASME 0M Code Category "B," for which seat leakage in the closed position is inconsequential to fulfill their required functions. The concerned that such seat leakage could create a system drain down that may lead to water hammer vulnerability. Therefore, the applicant should consider revising Tier 2 Table 3.9.6-2 "In-service Valve Testing Requirements," for pump discharge check valve 30PEB10/20/30/40 AA204 as well as for MOVs 30PEB10/20/30/40 AA005 and 30PED 10/20/30/40 AA010 by adding Leakage Testing (LT).

f. The staff has identified a potential drain path between the pump discharge check valve and the discharge MOV that could lead to increasing the potential for a water hammer event. Provide an FSAR description addressing water volume loss from the pump discharge pipe and the normally open ESWS pump room cooler path (i.e. in addition to valve leakage).

g. The staff noted that Rev 1 of the U.S. EPR FSAR revised the description in FSAR 9.2.1.4.1 from "during standby...valves in the main line are open" to "during standby...manual valves in the main line are open." The RAI-response 9.2.1-09 or the related FSAR markup did not explain this change in wording. The change to the FSAR should be explained.

**Response to Question 09.02.01-35:**

Part (a)

Refer to RAI 345, Q 09.02.01-42 (b) for testing requirements added to Chapter 14 Test #048 to specifically address that normal and emergency ESW system re-alignments occur and do not indicate evidence of a water hammer (valve realignments, pump start/stops, filter backwashes, operation of vacuum breaker valve, etc.).

Part (b)

Response to RAI 119, Question 9.2.1-09 indicated that the ESWS pumps will be rotated on a biweekly basis (or as determined by the hydraulic transient analysis) as part of the strategy for preventing and mitigating water hammer events in the ESWS. However, in order to eliminate the need to start the whole train and to minimize the operator actions, a keep-fill line is routed from the non-safety related portion of the normal makeup line that is inside the ESW pump building to the highest point in the riser pipe as indicated in Figure 9.2.5-1. A safety related manual keep-fill valve and check valve separates the non-safety related portions of the keep-fill line to maintain the pressure boundary of the safety related riser pipe. The non-safety related function of the tower keep-fill line is to replenish water in the cooling tower riser pipe of a standby train that is lost due to valve leakages thereby preventing potential water hammer effects. A level measuring instrument will provide an indication to the operator of low level in the riser pipe and the keep fill valve (30PED10 AA024) will be manually opened to replenish the riser pipe until it reaches the high level. In the event of further loss of water, at a pre-determined MIN-2 level, the operator shall start the ESW pump to replenish the riser pipe level. There is no requirement for bi-weekly rotation of the pumps due to this new design feature.

A description of the new keep-fill line will be added to the FSAR in response to Part (d). Figure 9.2.5-1 will also be revised to add this design feature.

Part (c)

In a standby train, as the water level in the riser pipe diminishes below a pre-determined MIN-1 level, the new keep-fill isolation valve will be administratively opened to supply water to the riser pipe and closed when level in the riser pipe has reached a pre-determined high level. A level sensor in the riser pipe provides level indication in the control room and locally at the keep-fill valve. In the event of further loss of water, at a pre-determined MIN-2 level, the operator shall start the ESW pump to replenish the riser pipe level.

Part (d)

Response to RAI 345, Q 09.02.01.42(a) provides the functions of the various automatic valves in the ESW system and proposed insertion point in the FSAR. As described in the response, the ESW pump is started against a closed discharge isolation valve 30PEB10/20/30/40 AA005. The air release valve 30PEB10/20/30/40 AA190 provides a path to remove the air in the pipe between the debris filter and the pump. In addition, following a trip of the pump, the air release valves provide a path for air to enter the ESW line to prevent vacuum formation.

The vacuum breaker valve 30PEB11 AA191 as shown in FSAR Figure 9.2.1-1 provides a path for air to fill the room cooler discharge line when the ESW pump trips. The discharge line from the room cooler is submerged in the basin. Following a trip of the pump, as the water in the vertical section of the room cooler discharge line drains to the basin, the vacuum breaker valve provides a path for the air to prevent vacuum formation.

The keep-fill line and monitoring of water level in the tower riser pipe of a standby train is administratively controlled to keep the water level in the riser above the pre-determined minimum. The pump discharge isolation valve 30PEB10/20/30/40 AA005 and the cooling tower return isolation valve 30PED10/20/30/40 AA010 both auto close on pump stop. Therefore, the leakage path from the tower riser is through the cooling tower return isolation valve, the pump discharge isolation valve and the pump discharge check valve 30PEB10/20/30/40 AA204, all in series. These three valves are part of the in-service testing program (FSAR Section 3.9.6) and will be leak tested in accordance with the requirements therein. Additionally, the discharge line from the room cooler is routed so that the highest point in the room cooler discharge line will be higher than the highest point in the cooling tower riser pipe. This also prevents draining of fluid through the pump room cooler following a trip of the ESW pump.

In summary, water hammer prevention and mitigation is accomplished through a combination of design features, surveillance, and testing measures. A description of these measures for water hammer prevention and mitigation will be added to FSAR Section 9.2.1.3.5.

Part (f)

The discharge line from the room cooler is routed so that the highest point in the room cooler discharge line will be higher than the highest point in the cooling tower riser pipe. This prevents draining of fluid through the pump room cooler following a trip of the ESW pump.

**FSAR Impact:**

U.S. EPR FSAR Tier 2, Section 9.2.1.3.5, Figure 9.2.5-1, Table 3.9.6.2, and Table 3.10-1 will be revised as described in the response and indicated on the enclosed markup.

### 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).

RAI 345
09.02.01-35

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.

INSERT A →

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. ~~One out of two logic from two~~The nuclear island drain and vent system (NIDVS) sump level instruments 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.

**INSERT for RAI 345, Q 09.02.01-35**

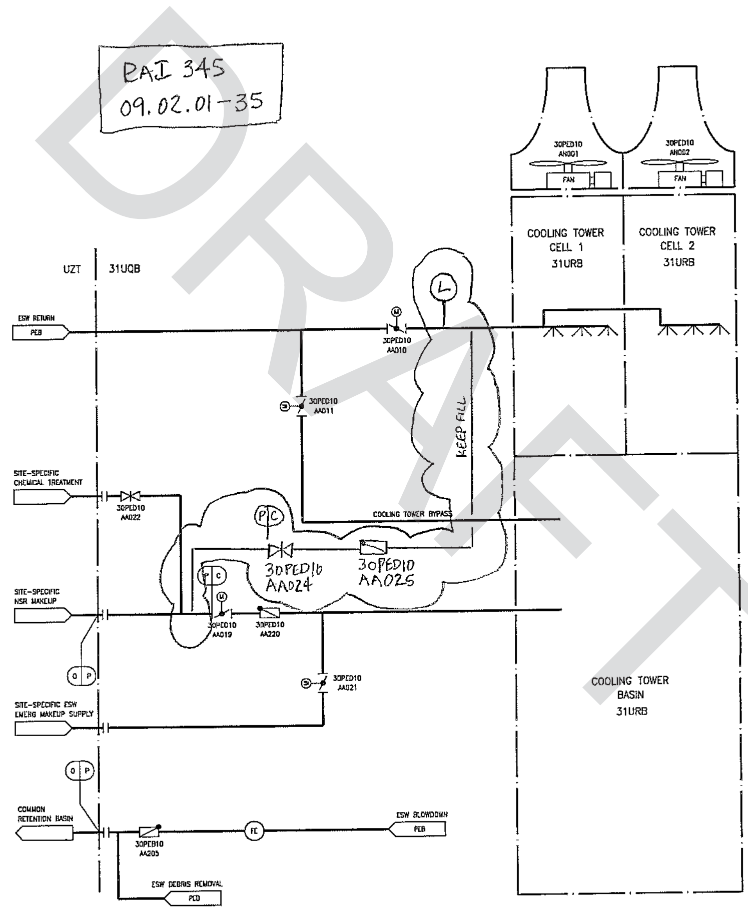
**INSERT A**

Water hammer prevention and mitigation is accomplished through a combination of design features, surveillance, and testing measures. A keep-fill line and monitoring of water level in the tower riser of a standby train is administratively controlled to keep the water level in the tower riser above the pre-determined minimum. The non-safety related function of the tower keep-fill line is to replenish water in the cooling tower riser pipe that is lost due to valve leakages thereby minimizing potential water hammer effects on an actuation of the standby train due to a large air void in the riser. The keep-fill line is routed from the non-safety related portion of the normal makeup line that is inside the ESW pump building to the highest point in the riser pipe. The safety related manual keep-fill valve and check valve separates the non-safety related portions of the keep-fill line to maintain the pressure boundary of the safety related riser pipe.

The ESW pump is started against a closed discharge isolation valve. The air release valve provides a path to remove the air in the pipe between the debris filter and the pump. In addition, following a trip of the pump, the air release valves provide a path for air to enter the ESW line to prevent vacuum formation.

The pump discharge isolation valve 30PEB10/20/30/40 AA005 and the cooling tower return isolation valve 30PED10/20/30/40 AA010 both auto close on pump stop. Therefore, the leakage path from the tower riser is through the cooling tower return isolation valve, the pump discharge isolation valve, and the pump discharge check valve 30PEB10/20/30/40 AA204, all in series. These three valves are part of the In-service Testing program (U.S. EPR FSAR Section 3.9.6) and will be leak tested in accordance with the program requirements therein. Additionally, the discharge line from the room cooler is routed so that the highest point in the room cooler discharge line will be higher than the highest point in the cooling tower riser pipe. This also prevents draining of fluid through the pump room cooler following a trip of the ESW pump. The vacuum breaker valve 30PEB11 AA191 as shown in FSAR Figure 9.2.1-1 provides a path for air to fill the room cooler discharge line when the ESW pump trips. The discharge line from the room cooler is submerged in the basin. Following a trip of the pump, as the water in the vertical section of the room cooler discharge line drains to the basin, the vacuum breaker valve provides a path for the air to prevent vacuum formation.

## Figure 9.2.5-1—Ultimate Heat Sink Piping and Instrumentation Diagram




PEB – ESSENTIAL SERVICE WATER PIPING SYSTEM
PED – ESSENTIAL SERVICE WATER RECIRCULATION COOLING SYSTEM

31UQB – ESSENTIAL SERVICE WATER PUMP BUILDING, DIVISION 1
31URB – ESSENTIAL SERVICE WATER COOLING TOWER STRUCTURE, DIVISION 1
UZT – OUTDOOR AREA

NOTE:
1. TRAIN 1 SHOWN IS REPRESENTATIVE OF TRAINS 2, 3 AND 4, WITH EXCEPTIONS AS NOTED.

| | | |
|---|---|---|
| P | E | NSC |
| O | E | NSC |
| C | C | I |
| DESIGN AREA | SSC QUALITY GROUP | SSC SEISMIC CLASS |

PED01T2



Next File

RAI 345
09.02.01-35

## Table 3.9.6-2—Inservice Valve Testing Program Requirements
Sheet 86 of 100

| Valve Identification Number[1] | Description/ Valve Function | Valve Type[2] | Valve Actuator[3] | ASME Code Class[4] | ASME OM Code Category[5] | Active / Passive[6] | Safety Position[7] | Test Required[8,10] | Test Frequency[9] | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~30PEB80AA211~~ | ~~Blowdown check PEB80~~ | ~~CK~~ | ~~SA~~ | ~~3~~ | ~~C~~ | ~~A~~ | ~~C~~ | ~~ET~~ | ~~Q~~ | |
| ~~30PEB81AA001~~ | ~~Isolation upstream SAQ40 AC001~~ | ~~PG~~ | ~~MA~~ | ~~3~~ | ~~B~~ | ~~A~~ | ~~O~~ | ~~ET~~<br>~~PI~~ | ~~5Y~~<br>~~2Y~~ | |
| 30PED10AA010 | ~~V~~ Tower Isolation | BF | MO | 3 | B | A | O | ET<br>PI | Q<br>2Y | |
| 30PED10AA011 | ~~V~~ Tower Bypass Isolation | BF | MO | 3 | B | A | C | ET<br>PI | Q<br>2Y | |
| 30PED10AA019 | ~~V~~ Makeup Water Isolation | BF | MO | 3 | B | A | C | ET<br>PI | Q<br>2Y | |
| 30PED10AA021 | ~~V~~ Emergency Makeup Water Isolation | BF | MO | 3 | B | A | O | ET<br>PI | Q<br>2Y | |
| 30PED10AA220 | ~~V~~ Makeup Water Check | CK | SA | 3 | C | A | C | ET | Q | |
| 30PED20AA010 | ~~V~~ Tower Isolation | BF | MO | 3 | B | A | O | ET<br>PI | Q<br>2Y | |
| 30PED20AA011 | ~~V~~ Tower Bypass Isolation | BF | MO | 3 | B | A | C | ET<br>PI | Q<br>2Y | |
| 30PED20AA019 | ~~V~~ Makeup Water Isolation | BF | MO | 3 | B | A | C | ET<br>PI | Q<br>2Y | |
| 30PED20AA021 | ~~V~~ Emergency Makeup Water Isolation | BF | MO | 3 | B | A | O | ET<br>PI | Q<br>2Y | |
| 30PED 10/20/30/40 AA024 | Tower Keep-Fill Isolation | PL | MA | 3 | B | A | C | ET<br>LT<br>PI | Q<br>2Y<br>2Y | |
| 30PED 10/20/30/40 AA025 | Tower Keep-Fill Check | CK | SA | 3 | C | A | C | ET | Q | |

INSERT AS 4 INDIVIDUAL VALVES
8 TOTAL

## Table 3.10-1—List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment
## Sheet 89 of 206

| 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) |
|---|---|---|---|---|---|---|---|
| D-V Ret Com2B C | 30KAB70AA404 | 30UJA11016 | H | H | ES SI | S C/NM | Y (4) Y (5) |
| D-V Retn Com1B Orb | 30KAB70AA405 | 34UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| D-V40 Sup Com1B C | 30KAB70AA406 | 34UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V-V40 Retn Com1B C | 30KAB70AA501 | 34UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V-V40 Retn Com1B IC | 30KAB70AA502 | 34UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| F Dnstr CVCS HP Cl2 | 30KAB70CF050 | 30UJA11016 | H | H | SI | S C/NM | Y (4) Y (5) |
| F Class Com2B | 30KAB70CF081 | 34UJH10004 | M | H | SI | S C/NM | Y (3) Y (5) |
| G Acty CCWS Inlet | 30KAB70CR001 | 30UJA11016 | H | H | SI | S C/NM | Y (4) Y (5) |
| G Acty CCWS Outlet | 30KAB70CR002 | 30UJA11016 | H | H | SI | S C/NM | Y (4) Y (5) |
| T Dnstr CVCS HP Cl2 | 30KAB70CT082 | 30UJA11016 | H | H | SI | S C/NM | Y (4) Y (5) |
| V 1 Upstr *QN* Users | 30KAB80AA015 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V 2 Upstr *QN* Users | 30KAB80AA016 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V Dnstr *QN* Users | 30KAB80AA019 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| CK-V Rten Com 1B NC | 30KAB80AA020 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V F KAB80 CF060 | 30KAB80AA314 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V F KAB80 CF060 | 30KAB80AA315 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V F KAB80 CF061 | 30KAB80AA316 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V F KAB80 CF061 | 30KAB80AA317 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| D-V Sup Com1B NC | 30KAB80AA403 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| D-V Retn Com1B NC | 30KAB80AA406 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| D-V Retn Com1B NC | 30KAB80AA407 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V-V Sup Com1B NC | 30KAB80AA501 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| V-V Retn Com1B NC | 30KAB80AA504 | 31UJH10004 | M | H | ES SI | S C/NM | Y (3) Y (5) |
| F Upstr QNA21 AC002 | 30KAB80CF060 | 31UJH10004 | M | H | SI | S C/NM | Y (3) Y (5) |
| F Dnstr KAB80 Chil | 30KAB80CF061 | 31UJH10004 | M | H | SI | S C/NM | Y (3) Y (5) |
| **Essential Service Water System (ESWS)** | | | | | | | |
| CCW HX Inlet Isolation Vlv | 30PEB10AA007 | 31UJH05026 | M | H | SI | S C/NM | Y (3) Y (5) |
| CCW HX Outlet Isolation Vlv | 30PEB10AA009 | 31UJH05026 | M | H | SI | S C/NM | Y (3) Y (5) |
| CCW HX Tube Side Thermal Relief Vlv | 30PEB10AA192 | 31UJH05026 | M | H | SI | S C/NM | Y (3) Y (5) |
| CCW HX Inlet Side DP Root Vlv | 30PEB10AA306 | 31UJH10026 | M | H | SI | S C/NM | Y (3) Y (5) |
| CCW HX Outlet Side DP Root Vlv | 30PEB10AA307 | 31UJH10026 | M | H | SI | S C/NM | Y (3) Y (5) |
| ESW Drain Isolation Vlv | 30PEB10AA401 | 31UJH01026 | M | H | SI | S C/NM | Y (3) Y (5) |
| ESW Drain Isolation Vlv | 30PEB10AA402 | 31UJH10026 | M | H | SI | S C/NM | Y (3) Y (5) |



INSERT

RAI 345 09.02.01-35

INSERT FOR RAI 345 Q 09.02.01-35

| Name Tag (Equipment Description) | Tag Number | Local Area KKS ID (Room Location) | EQ Environment | Radiation Environment (Zone) | EQ Designated Function | EQ Post-Accident Period of Operability | Safety Class | EQ Program Designation |
|---|---|---|---|---|---|---|---|---|
| UHS Tower Keep-Fill Isolation Valve | 30PED10AA024 | 31UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |
| UHS Tower Keep-Fill Isolation Valve | 30PED20AA024 | 32UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |
| UHS Tower Keep-Fill Isolation Valve | 30PED30AA024 | 33UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |
| UHS Tower Keep-Fill Isolation Valve | 30PED40AA024 | 34UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |
| UHS Tower Keep-Fill Check Valve | 30PED10AA025 | 31UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |
| UHS Tower Keep-Fill Check Valve | 30PED20AA025 | 32UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |
| UHS Tower Keep-Fill Check Valve | 30PED30AA025 | 33UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |
| UHS Tower Keep-Fill Check Valve | 30PED40AA025 | 34UQB02001 | M | M | ES SI | MEDIUM TERM | S SI C/NM | Y (5) |



RAI 345
09.02.01-35

Response to

Request for Additional Information No. 345

3/04/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.01 - Station Service Water System
Application Section: 9.2.1

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

**Question 09.02.01-28:**

Follow-up to RAI 119, Question 9.2.1-04

The ESWS must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. The ESWS description and P&ID were reviewed to assess the design adequacy of the ESWS for performing its heat removal functions. While the P&ID shows the ESWS components and identifies the boundaries between safety-related and non-safety-related parts of the system, some of the information is incomplete, inaccurate, or inconsistent. Consequently, the applicant needs to revise the FSAR to address the following considerations in this regard:

Part (a)- Pipe sizes are not shown on the P&ID, and the system description does not explain the criteria that were used in establishing the appropriate pipe sizes (such as limiting flow velocities).

Part (b)- The system description does not provide design details such as system operating temperatures, pressures, and flow rates for all operating modes and alignments.

Part (c)- The P&ID does not show where indications are displayed (e.g., local, remote panel, control room), and what instruments provide input to a process computer and/or have alarm and automatic actuation functions.

Part (d)- The P&ID does not show what the normal valve positions are, what valves are locked in position, and what valves have automatic functions; and these design features are not described.

Part (h)- The P&ID does not show specific set point for alarms, relief valves, vacuum breakers, air release valves, automatic functions such as filter backwash, etc., and the bases for these set points are not explained in the system description.

Based on the staff's review of response to RAI 119, Question 9.2.1-04 and an audit by the staff conducted on October 27, 2009, Parts a, b, c, d and h remain open and require further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the remaining open items.

With regard to items a, b, c, d and h of RAI-response 9.2.1-04 above, the staff found that in general, the applicant stated that details would be developed later in the design process. The staff noted that the applicant provided some new information for parts (a) and (c) including: (1) criteria that will be used for determination of pipe sizes, and (2) a description of the normal functions for system valves. However, the requested details would be developed later in the design process. While the staff found the partial response to part (c) an improvement over the descriptions currently included in U.S.EPR FSAR Tier 2 Section 9.2.1, the applicant stated that the FSAR will not be updated as a result of this question. The applicant should include the requested information in the FSAR when the design is completed.

The applicant should identify what the maximum return temperatures are coming out of the heat exchangers and going to the cooling tower.

The applicant should identify the continuation of the dedicated blowdown line from Figure 9.2.1-1, Sheet 4 of 4.

**Response to Question 09.02.01-28:**

Part (a)

Pipe diameters for all branches of the ESWS are based on limiting the flow velocity to 10 ft/sec for normal modes of operation that are expected to occur frequently. ESW piping in each train is sized to provide sufficient flow in that train to remove design heat loads from system user heat exchangers under normal operating, shutdown/cooldown, design basis accident, and (for ESW Train 4 only) severe accident conditions with flow velocities less than 10 feet per second.



Part (b)

The ESWS system is bounded by the following design parameters:

| Component | Max Heat Load MBTU/hr | Total Required ESW Flow ($10^6$ lbm/hr) | Required ESW Temp $^0$F | ESW System Design Temp $^0$F | ESW System Design Pressure PSIG | Comments |
|---|---|---|---|---|---|---|
| CCWS heat exchanger | 128.1 | 7.540 min | ≤92 | 135 | 190 | Normal Operation |
| | 120.1 | 7.540 min | ≤90 | 135 | 190 | Spring/Fall Outage Cooldown |
| | 291.3 | 7.540 min | ≤95 | 135 | 190 | DBA |
| Dedicated CCWS heat exchanger | 48.64 | 1.205 min | ≤95 | 150 | 100 | Severe Accident |
| EDG heat exchanger | 22.0 | 1.06 | ≤95 | 135 | 190 | |
| ESW Pump Room Cooler for 31/32/33/34 UQB | 0.619 | 0.0685 | ≤95 | 135 | 190 | Normal Operations Shutdown/ Cooldown and DBA |

| | | | | | | |
|---|---|---|---|---|---|---|
| ESW Pump Room Cooler for 34 UQB | 0.314 | 0.0347 | ≤95 | 135 | 190 | Severe Accident-ESW flow supplied by the Dedicated ESW pump |

The system design temperatures and pressures will be added to U.S. EPR FSAR Tables 9.2.1-1 and 9.2.1-2. For the total required minimum ESW flow rates and required ESW temperatures for the different operating conditions refer to U.S. EPR FSAR Table 9.2.5-1.

Part (d)

Refer to RAI Response 09.02.01-42(a) for details related to normal operations and automatic valve actions.

Part (h)

Set points descriptions have been provided in the Table 9.2.1-3 Alarm Summary. Refer to RAI Response 09.02.01-42(c). Pressure relief device set points for the ESWS are in accordance with ASME Section III. Refer to RAI Response 09.02.01-42(a) for details related to the functional descriptions of system valves.

Additional Response Clarifications

The maximum return temperature to the cooling towers from the heat exchangers is 135°F. Section 9.2.5, Table 9.2.5-2, will be revised to include this value as the Design Hot (Inlet) Water Temperature. The Winter Design Cold (Outlet) Water Temperature has also been added for the different operating modes.

The dedicated blowdown line continues to the site-specific Common Retention Basin. FSAR Figure 9.2.1-1, Sheet 4 of 4 will be revised to indicate this destination.

**FSAR Impact:**

U.S. EPR FSAR Section 9.2.1.3.5 and Tables 9.2.1-1 and 9.2.1-2 will be revised as described in the response and indicated on the enclosed markup.

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

### 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

RAI 345 09.02.01-28

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.

INSERT A

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. ~~One out of two logic from two~~The nuclear island drain and vent system (NIDVS) sump level instruments 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.

INSERT B

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.

## Table 9.2.1-1—Essential Service Water Design Parameters

| Essential Service Water Pump 30PEB10/20/30/40 AP001 | |
|---|---|
| Description | Technical Data |
| Number | 4 |
| Type | Wet Pit Vertical Turbine |
| Normal Flow Rate | 19,340 gpm |
| Required Pump Head at Normal Flow Rate | 185 ft/$H_2O$ |
| I Required Minimum Water Level in the Basin | 95 inches (from suction inlet) |
| System Design Pressure | 190 psig |
| System Design Temperature | 135 °F |

## Table 9.2.1-2—Dedicated Essential Service Water Design Parameters

| Dedicated Essential Service Water Pump 30PEB80 AP001 | |
|---|---|
| Description | Technical Data |
| Number | 1 |
| Type | Wet Pit Vertical Turbine |
| Normal Flow Rate | 2737 gpm |
| Required Pump Head at Normal Flow Rate | 150 ft/$H_2O$ |
| I Required Minimum Water Level in the Basin | 46 inches (from suction inlet) |
| System Design Pressure | 100 psig |
| System Design Temperature | 150 °F |

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09.02.01-28(b)

Next File

## Table 9.2.5-2—Ultimate Heat Sink Design Parameters

| Cooling Tower Cells 31/32/33/34 URB | |
|---|---|
| **Description** | **Technical Data** |
| Cooling Tower Type | Mechanical Induced Draft |
| Design Water Flow (total both cells) | 19,200 gpm |
| Design Cold (Outlet) Water Temperature | ≤95°F (max, DBA) |
| ~~Ambient Wet Bulb/Summer/~~Design Inlet ~~WBT~~Wet Bulb Temperature | 81°F (~~includes 1°F correction for interference~~non-coincident, 0% exceedance value)[1] |
| Maximum Drift Loss (Percent of Water Flow) | < 0.005% |
| Maximum Evaporation Loss at Design Conditions (total both cells) | 571 gpm |
| Number of Cells | 2 Cell/Tower |
| Basin Water Volume (Min) | ~~337,987~~ ≥295,120 $ft^3$ |
| Basin Water Level (Min) | ~~27.2~~23.75 ft |
| Required Cooling Tower Emergency Makeup Flow, 72 hours, post-DBA | 300 gpm |

Note:

1. COL applicant to determine wet bulb temperature correction factor to account for potential interference and recirculation effects. (Refer to COL Item 2.0-1 in Table 1.8-2).

| | |
|---|---|
| Design Hot (Inlet) Water Temperature | 135°F |

| | |
|---|---|
| Winter Design Cold (Outlet) Water Temperature @ 50°F Inlet WB | 71°F Normal Ops / 72°F Cooldown 78.5°F DBA |

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09.02.01-28

DRAFT

**<u>INSERT for RAI 345, Question 09.02.01-28 Parts (a) and (h)</u>**

**INSERT A**

Pipe diameters for all branches of the ESWS are based on limiting the flow velocity to 10 ft/sec for normal modes of operation that are expected to occur frequently. ESW piping in each train is sized to provide sufficient flow in that train to remove design heat loads from system user heat exchangers under normal operating, shutdown/cooldown, design basis accident, and (for ESW Train 4 only) severe accident conditions with flow velocities less than 10 feet per second. Refer to U.S. EPR FSAR Table 9.2.5-1 for the total required minimum ESW flow rates and required ESW temperatures for the different operating conditions.

**INSERT B**

Pressure relief device set points for the ESWS are in accordance with ASME Section III.

**Response to**

**Request for Additional Information No. 345**

**3/04/2010**

**U. S. EPR Standard Design Certification**
**AREVA NP Inc.**
**Docket No. 52-020**
**SRP Section: 09.02.01 - Station Service Water System**
**Application Section: 9.2.1**

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

**Question 09.02.01-28:**

Follow-up to RAI 119, Question 9.2.1-04

The ESWS must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. The ESWS description and P&ID were reviewed to assess the design adequacy of the ESWS for performing its heat removal functions. While the P&ID shows the ESWS components and identifies the boundaries between safety-related and non-safety-related parts of the system, some of the information is incomplete, inaccurate, or inconsistent. Consequently, the applicant needs to revise the FSAR to address the following considerations in this regard:

Part (a)- Pipe sizes are not shown on the P&ID, and the system description does not explain the criteria that were used in establishing the appropriate pipe sizes (such as limiting flow velocities).

Part (b)- The system description does not provide design details such as system operating temperatures, pressures, and flow rates for all operating modes and alignments.

Part (c)- The P&ID does not show where indications are displayed (e.g., local, remote panel, control room), and what instruments provide input to a process computer and/or have alarm and automatic actuation functions.

Part (d)- The P&ID does not show what the normal valve positions are, what valves are locked in position, and what valves have automatic functions; and these design features are not described.

Part (h)- The P&ID does not show specific set point for alarms, relief valves, vacuum breakers, air release valves, automatic functions such as filter backwash, etc., and the bases for these set points are not explained in the system description.

Based on the staff's review of response to RAI 119, Question 9.2.1-04 and an audit by the staff conducted on October 27, 2009, Parts a, b, c, d and h remain open and require further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the remaining open items.

With regard to items a, b, c, d and h of RAI-response 9.2.1-04 above, the staff found that in general, the applicant stated that details would be developed later in the design process. The staff noted that the applicant provided some new information for parts (a) and (c) including: (1) criteria that will be used for determination of pipe sizes, and (2) a description of the normal functions for system valves. However, the requested details would be developed later in the design process. While the staff found the partial response to part (c) an improvement over the descriptions currently included in U.S.EPR FSAR Tier 2 Section 9.2.1, the applicant stated that the FSAR will not be updated as a result of this question. The applicant should include the requested information in the FSAR when the design is completed.

The applicant should identify what the maximum return temperatures are coming out of the heat exchangers and going to the cooling tower.

The applicant should identify the continuation of the dedicated blowdown line from Figure 9.2.1-1, Sheet 4 of 4.

**Response to Question 09.02.01-28:**

Part (c)

Cooling tower basin water level and temperature, ESW pump discharge pressure, ESW cooling water supply temperature, debris filter differential pressure, valve position status (open/closed), and pump operating status (energized/de-energized) are provided in the MCR for operation of the system.

U.S. EPR FSAR Table 9.2.1-3 Alarm Summary will be revised to indicate which alarms will be provided in the MCR/RSS. The associated instruments provide input to a process computer and/or have alarm and automatic actuation functions. U.S. EPR FSAR Figure 9.2.1-1 will be revised to show which valves are monitored for valve position. U.S. EPR FSAR Section 9.2.1.7.1 will be revised to include valve position status as a monitored parameter.

The system automatic actions will be added to the U.S. EPR FSAR Section 9.2.1.7.

A new ITACC item will be added to U.S. EPR Tier 1, Table 2.7.11-3, stating the pumps can perform the function listed in U.S. EPR Tier 1, Table 2.7.11-1 under system operating conditions. System operating conditions include safety injection.

**FSAR Impact:**

U.S. EPR FSAR Tier 2, Section 9.2.1, Table 9.2.1-3 and Figure 9.2.1-1 will be revised as described in the response and indicated on the enclosed markup.

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

RAI 345 09.02.01-28(c)

U.S. EPR FSAR Tier 2, Section 3.9 and Section 6.6 outline the inservice testing and inspection requirements. Refer to U.S. EPR FSAR Tier 2, Section 16.0, Surveillance Requirement (SR) 3.7.8 for surveillance requirements that verify continued operability of the ESWS.

Pursuant to the recommendations included in Generic Letter 89-13 (Reference 2), the design of safety-related portions of the ESWS considers the potential for capability and performance degradation and subsequent system failure due to siltation, erosion, corrosion, protective coating failure, and the presence of organisms that subject the system to microbiological influenced corrosion, as well as macro-fouling. A combination of design means, such as chemical treatment to reduce biological challenges; provisions to permit regular, periodic inspections, preventative maintenance, testing and performance trending; the use of best design practices for piping material selection and layout to minimize erosion and corrosion; and administrative controls in the form of operating, maintenance and emergency procedures, provide a level of assurance that the ESWS is able to perform its safety function when required.

Consistent with GL 89-13, design provisions of the ESWS accommodate performing the following:

- Identify and reduce the incidence of flow blockage problems caused from biofouling.
- Verify the heat transfer capability of safety-related heat exchangers connected to or cooled by the ESWS.
- Conduct routine inspection and maintenance activities of ESWS piping and components to provide assurance that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of safety-related systems supplied by ESW.

## 9.2.1.7 Instrumentation Requirements

Instrumentation is provided in order to control, monitor and maintain the safety-related and non-safety-related functions of the ESWS.

INSERT A

### 9.2.1.7.1 System Monitoring

The ESWS system is monitored for the following parameters:

- Fluid flow rate and pressure downstream of the ESWS pumps and the dedicated ESWS pump.
- Differential pressure at the ESWS and the dedicated ESWS debris filters, CCWS HXs, and Essential Service Water Pump Building Ventilation System (SAQ) room cooler.

- Fluid flow from the CCWS and EDG HXs.
- Temperature of the ESWS and the dedicated ESWS pump discharge.
- Temperature at the outlet of the HXs.

### 9.2.1.7.2 System Alarms

- MOV position status
- High temperature ESW and dedicated ESW.
- ESW and dedicated ESW pump abnormal.
- Low flow across the CCWS and dedicated CCWS HX.
- High ΔP across the CCWS, dedicated CCWS HX, and SAQ room cooler.
- Low temperature ESW.
- Table 9.2.1-3—Alarm Summary provides additional information.

### 9.2.1.8 References


1. ASME Boiler and Pressure Vessel Code, Section III: "Rules for Construction of Nuclear Facility Components," Class 3 Components, The American Society of Mechanical Engineers, 2004.
2. Generic Letter 89-13, NRC Letter to All Holders of Operating Licenses or Construction Permits for Nuclear Power Plants, "Service Water System Problems Affecting Safety-Related Equipment," U.S. Nuclear Regulatory Commission, July 18, 1989.


RAI 345
09.02.01-28(c)

Table 9.2.1-3—Alarm Summary

| Alarm Name | Division | Setpoint Name |
|---|---|---|
| CCW Hx differential pressure Hi | 1/2/3/4 | Max 1 |
| CCW Hx Lo flow | 1/2/3/4 | Min 1 |
| EDG coolers Lo flow | 1/2/3/4 | Min 1 |
| SAQ room cooler differential pressure ESW side | 1/2/3/4 | Max 1 |
| ESW temperature Hi | 1/2/3/4 | Max 1 |
| ESW temperature Hi – Hi | 1/2/3/4 | Max 2 |
| ESW temperature Low | 1/2/3/4 | Min 1 |
| ESW debris filter differential pressure Hi | 1/2/3/4 | Max 1 |
| ESW debris filter differential pressure Hi - Hi | 1/2/3/4 | Max 2 |
| ESW pump abnormal | 1/2/3/4 | Min1 / Max 1 |
| Dedicated CCW Hx differential pressure Hi | Dedicated | Max 1 |
| Dedicated CCW Hx Lo flow | Dedicated | Min 1 |
| Dedicated ESW temperature Hi | Dedicated | Max 1 |
| Dedicated ESW temperature Hi - Hi | Dedicated | Max 2 |
| Dedicated ESW pump abnormal | Dedicated | Min 1 / Max 1 |
| Cooling tower basin water level Hi - Hi | 1/2/3/4 | Max 2 |
| Cooling tower basin water level Hi | 1/2/3/4 | Max 1 |
| Cooling tower basin water level Lo | 1/2/3/4 | Min 1 |
| Cooling tower basin water level Lo - Lo | 1/2/3/4 | Min 2 |

DELETE & INSERT "INSERT B"

RAI 345
09.02.01-28(c)

## INSERT for RAI 345, Question 09.02.01-28(c) Response

## INSERT A

**ESWS Safety Related I&C Functions**

**ESW Actuation from SIS**

Upon receipt of a safety injection signal, the four ESWS trains are started to supply the CCWS and EDG heat exchangers.

For this function, the following ESW actuations are automatically initiated by the PS:

- The ESWS pumps 30PEB10/20/30/40 AP001 are started.
- The ESW pump discharge isolation valves 30PEB10/20/30/40 AA005 are opened.
- The ESWS cooling tower return isolation valves 30PED10/20/30/40 AA010 are opened.
- UHS fans are automatically operated at full speed.

**Automatic ESW Actuation from CCWS**

To ensure cooling of the safety related users of the NI cooling chain, the ESWS is automatically actuated when the associated CCWS train is started. The following actions occur:

- The ESW pump 30PEB10/20/30/40 AP001 is started. If one ESWS pump fails during normal operation, a switchover to the other ESWS train is carried out. This switchover is done automatically for the entire cooling train and is initiated by the CCWS Switchover sequence.
- The ESW pump discharge isolation valve 30PEB10/20/30/40 AA005 is opened.
- The ESWS cooling tower return isolation valve 30PED10/20/30/40 AA010 is opened.
- UHS fans are started.

**Automatic ESW Actuation from LOOP**

To ensure cooling of the safety related EDG (30XJA10/20/30/40), the ESWS is automatically actuated by a LOOP signal. The ESW system is started according to the EDG load sequence. The following actions occur:

- The ESW pump 30PEB10/20/30/40 AP001 is started.
- The ESW pump discharge isolation valve 30PEB10/20/30/40 AA005 is opened.
- The ESWS cooling tower return isolation valve 30PED10/20/30/40 AA010 is opened.
- UHS fans are started.

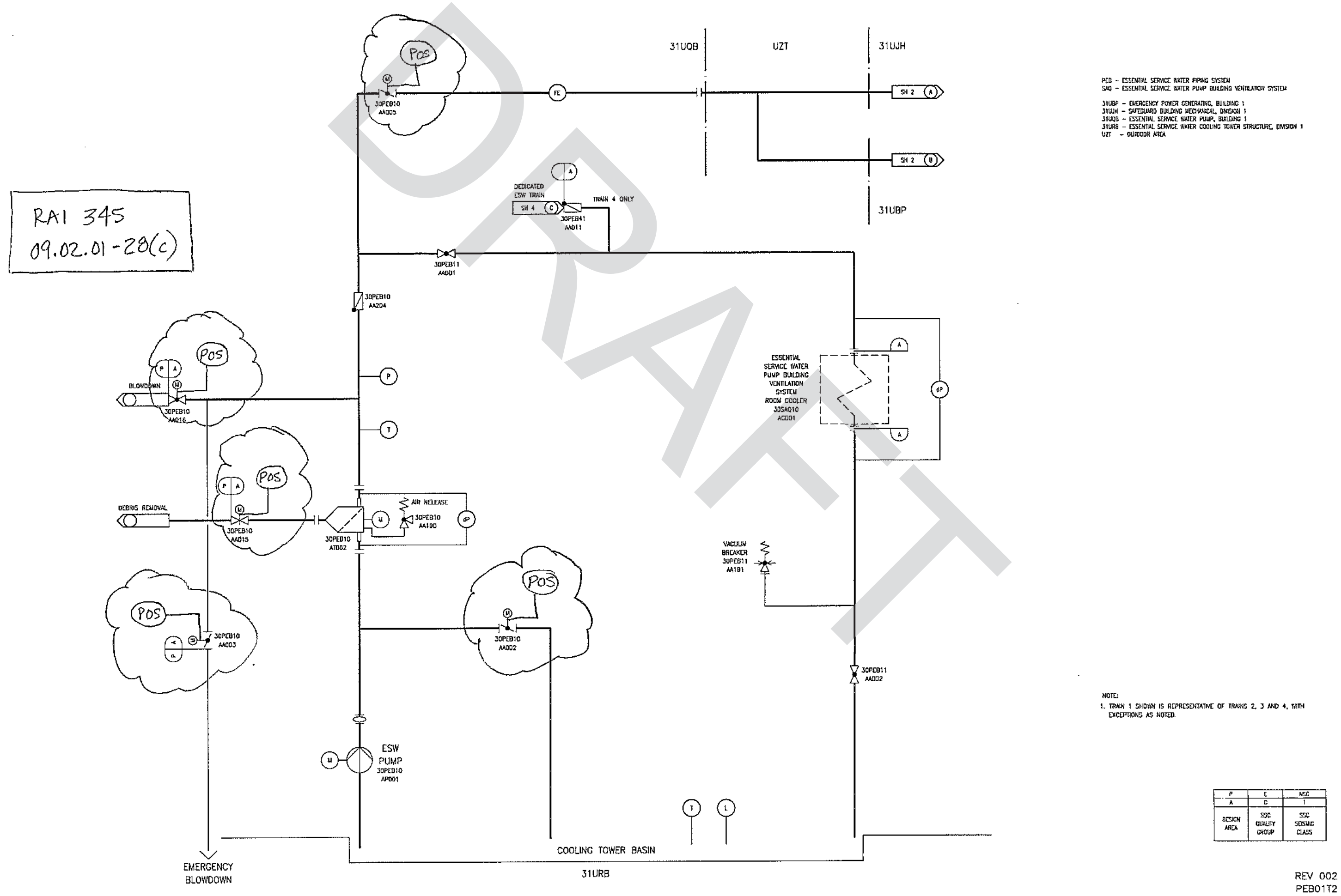
**Manual ESW Actuation**

The ESWS pumps 30PEB10/20/30/40 AP001 can be started manually from the MCR and/or RSS and the ESWS pump discharge isolation valves 30PEB10/20/30/40 AA005 and ESWS cooling tower return isolation valves 30PED10/20/30/40 AA010 can be opened manually from the MCR and/or RSS to cool the plant to cold shutdown conditions following a DBA. This functionality is a backup to the automatic actuation.

RAI 345 09.02.01-28(c) INSERT B

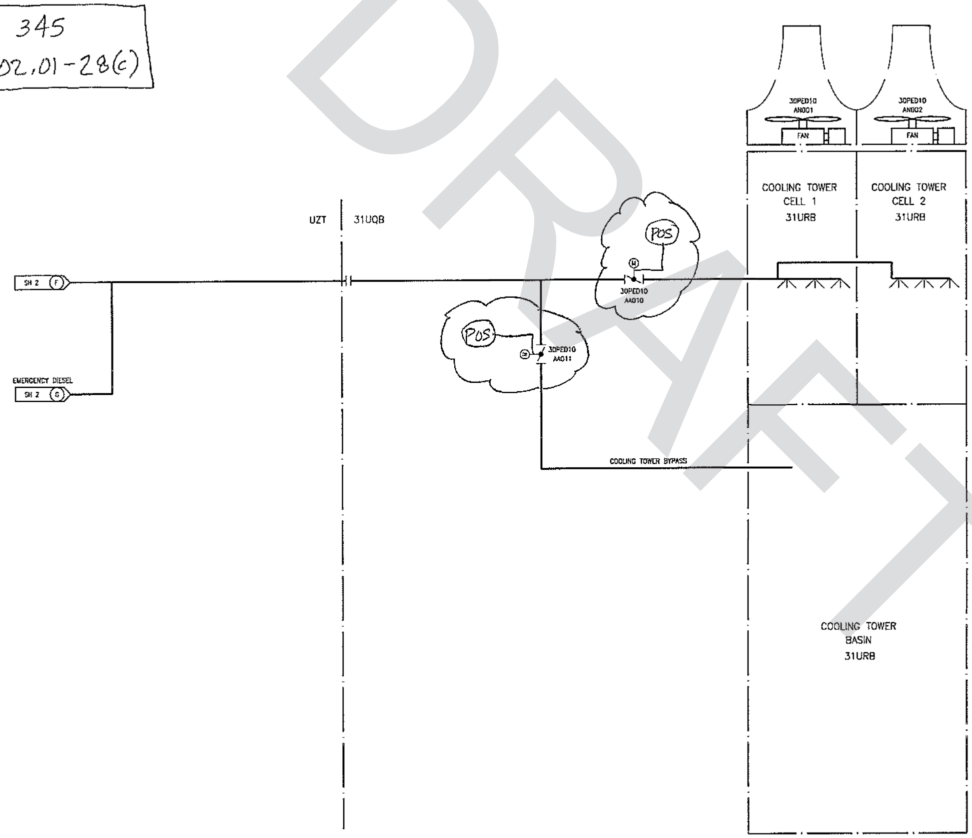
| MCR / RSS | Division | Setpoint Name | Function |
|---|---|---|---|
| CCW Hx differential pressure Hi | 1/2/3/4 | Max 1 | Alarm |
| CCW Hx Lo flow | 1/2/3/4 | Min 1 | Alarm |
| EDG coolers Lo flow | 1/2/3/4 | Min 1 | Alarm |
| CCW Hx Lo flow + EDG coolers Lo flow = Pump Discharge Flow | 1/2/3/4 | Min 1<br>Min 2 | Min 1: Alarm (Pump discharge Flow Low)<br>Min 2: Alarm (Pump discharge Flow Low-Low) and Pump Trip |
| SAQ room cooler differential pressure ESW side | 1/2/3/4 | Max 1 | Indication in MCR |
| ESW temperature | 1/2/3/4 | N/A | Indication in MCR |
| ESW debris filter differential pressure Hi | 1/2/3/4 | Max 4<br>Max 3<br>Max 2<br>Max 1 | Max 4: Alarm and Pump Trip<br>Max 3: Alarm<br>Max 2: Auto-Start Strainer Motor<br>Max 1: Status display in MCR |
| ESW pump abnormal (bearing temperature Hi) | 1/2/3/4 | Max 2<br>Max 1 | Max 2: Alarm and Pump Trip<br>Max 1: Alarm |
| ESW pump discharge pressure Hi/Lo | 1/2/3/4 | Max 2<br>Max 1<br>Min 1<br>Min 2 | Max 2: Alarm and Pump Trip<br>Max 1: Alarm<br>Min 1: Alarm (if Pump is Running)<br>Min 2: Alarm and initiates Train Switchover Sequence (if Pump is Running) |
| Dedicated CCW Hx differential pressure Hi | Dedicated | Max 4<br>Max 3<br>Max 2<br>Max 1 | Max 4: Alarm and Pump Trip<br>Max 3: Alarm<br>Max 2: Auto-Start Strainer Motor<br>Max 1: Status display in MCR |
| Dedicated CCW Hx Lo flow | Dedicated | Min 1<br>Min 2 | Min 1: Alarm<br>Min 2: Alarm and Pump Trip |
| Dedicated ESW temperature | Dedicated | N/A | Indication in MCR |
| Dedicated ESW pump abnormal (bearing temperature Hi) | Dedicated | Max 2<br>Max 1 | Max 2: Alarm and Pump Trip<br>Max 1: Alarm |
| Dedicated ESW pump discharge pressure Hi/Lo | Dedicated | Max 2<br>Max 1 | Max 2: Alarm and Pump Trip<br>Max 1: Alarm |
| ESW basin temperature Hi-Hi | 1/2/3/4 | Max 2 | Alarm and Part of the System Start Permissive (if below Max 2) |
| ESW basin temperature Hi | 1/2/3/4 | Max 1 | Alarm |
| ESW basin temperature Lo | 1/2/3/4 | Min 1 | Alarm |
| ESW basin temperature Lo-Lo | 1/2/3/4 | Min 2 | Alarm |
| Cooling tower basin water level Hi-Hi | 1/2/3/4 | Max 2 | Alarm |
| Cooling tower basin water level Hi | 1/2/3/4 | Max 1 | Auto-Close Normal Makeup Isolation Valve |
| Cooling tower basin water level Lo | 1/2/3/4 | Min 1 | Auto-Open Normal Makeup Isolation Valve |
| Cooling tower basin water level Lo-Lo | 1/2/3/4 | Min 2 | Alarm |
| Cooling tower basin water level Lo–Lo-Lo | 1/2/3/4 | Min 3 | Alarm and:<br>-Part of the System Start Permissive (if > Min2)<br>-Pump Start Permissive (if > Min2) |
| Cooling tower basin water level Lo–Lo–Lo-Lo | 1/2/3/4 | Min 4 | Alarm and Pump Trip |
| Cooling tower riser level | 1/2/3/4 | Min 1<br>Min 2 | Alarm<br>Alarm |

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



## Figure 9.2.1-1—Essential Service Water System Piping & Instrumentation Diagram Sheet 3 of 4

RAI 345
09.02.01-28(c)




PEB – ESSENTIAL SERVICE WATER PIPING SYSTEM
PED – ESSENTIAL SERVICE WATER RECIRCULATION COOLING SYSTEM

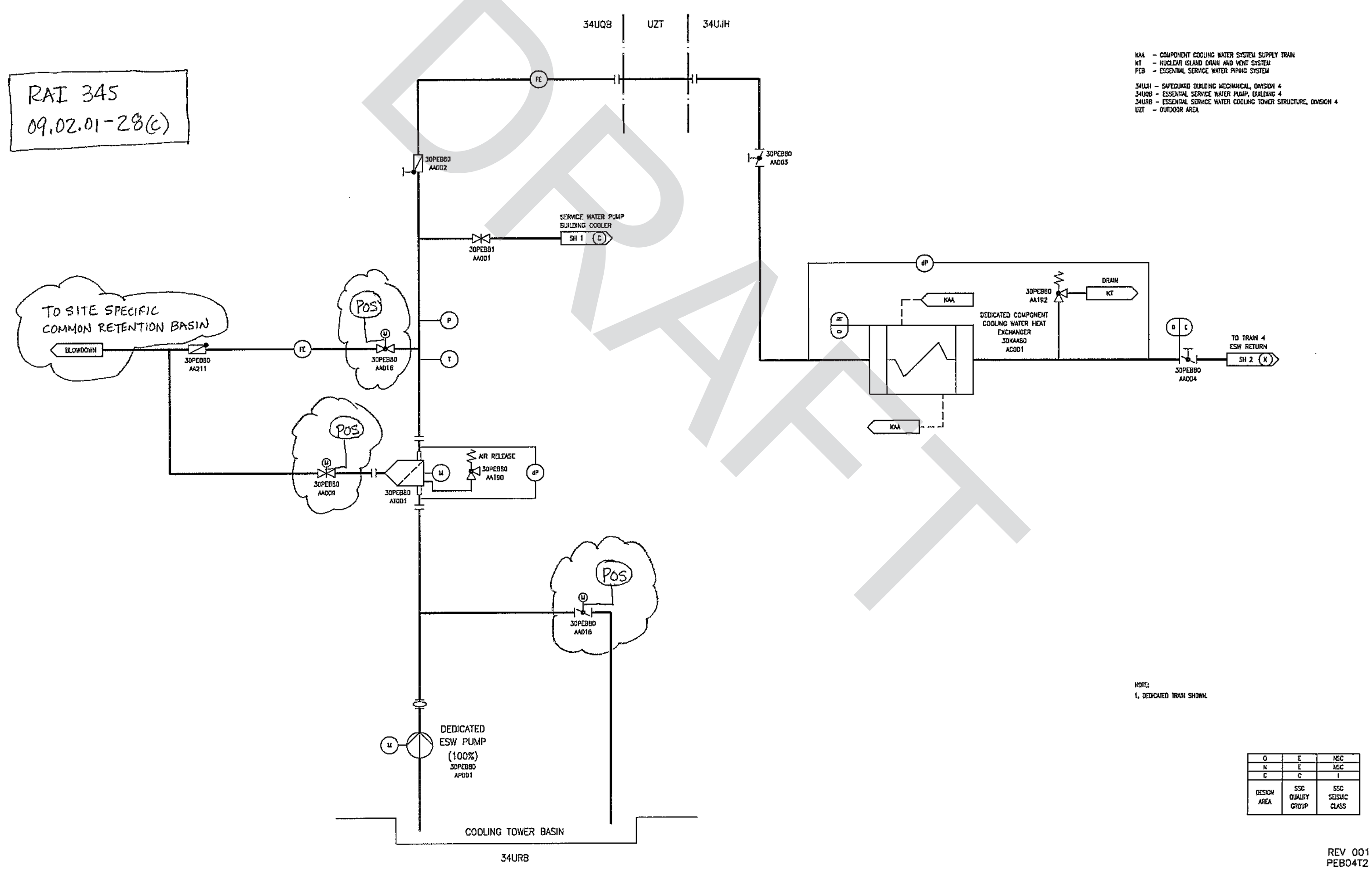
31UQB – ESSENTIAL SERVICE WATER PUMP BUILDING, DIVISION 1
31URB – ESSENTIAL SERVICE WATER COOLING TOWER STRUCTURE, DIVISION 1
UZT – OUTDOOR AREA

NOTE:
1. TRAIN 1 SHOWN IS REPRESENTATIVE OF TRAINS 2, 3 AND 4, WITH EXCEPTIONS AS NOTED.

| | | |
|---|---|---|
| P | E | NSC |
| O | E | NSC |
| C | C | I |
| DESIGN AREA | SSC QUALITY GROUP | SSC SEISMIC CLASS |

REV 002
PEB03T2

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




Next File

**INSERT for RAI 345, Question 09.02.01-28 Response**

**Add to Tier 1 Section 2.7.11, Subsection 7.0:**

**INSERT C**

7.New The pumps listed in Table 2.7.11-2 perform the function listed in Table 2.7.11-1 under system operating conditions.

**INSERT D**

**Item 7.New in Table 2.7.11.-3:**

| | | | |
|---|---|---|---|
| 7.New | The pumps listed in Table 2.7.11-2 perform the function listed in Table 2.7.11-1 under system operating conditions. | Tests and analyses or a combination of tests and analyses will be performed to demonstrate the ability of the pumps listed in Table 2.7.11-2 to perform the function listed in Table 2.7.11-1 under system operating conditions. | The pumps perform the function as listed in Table 2.7.11-1 under system operating conditions. |

Request for Additional Information No. 417(4741), Revision 0

6/8/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
Application Section: 9.2.2

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

09.02.02-121

Follow-up to RAI 334, Question 9.2.2-76 and RAI 174, Question 9.2.2-31:

Part (i)2 and Part i(3)- In Parts (i)2 and (i)3 of follow-up RAI 9.2.2-76 the staff asked the applicant to resolve discrepancies with the alternate power source for ESWS and CCWS Dedicated Train Components identified in U.S. EPR FSAR Tier 1 Tables 2.7.1-2 (CCWS) and 2.7.11-2 (ESWS). In Part (i)2 the staff noted that the FSAR markup provided by the applicant in the response to RAI 174, Supplement 3 of Table 2.7.1-2 identified normal power for the Dedicated Train was provided by Class 1E Division 4 with alternate power from Division 3 for some components but not for others. In Part (i)3 the staff asked the applicant to resolve differences in the power source identified in dedicated train components between CCWS Tier 1 Table 2.7.1-2 (markup for RAI 174, Supplement 3) and ESWS Tier 1 Table 2.7.11-2 (From FSAR Rev. 1). For some Dedicated Train components ESWS Table 2.7.11-2 identified Division 4 normal power with alternate power from the SBO EDG while the markup of CCWS Table 2.7.1-2 identified alternate power from division 3.

The response provided by the applicant in RAI 334, Supplement 1 included markups of Tier 1 Tables 2.7.1-2 and Table 2.7.11-2 as well as Tier 2 Sections 9.2.1 (ESWS) and 9.2.2 (CCWS). The staff's review of the applicant's response and markup of Tier 1 Tables 3.7.1-2 and 2.7.11-2 found them acceptable since only normal power was identified from Class 1E Division 4 and the conflicting alternate power sources were deleted. However, the staff review of the markups provided for FSAR Tier 2 Sections 9.2.1 and 9.2.2 noted a difference in the description of the power source for the Dedicated ESWS Train when compared to the markup for CCWS. The staff believes the FSAR description for the power source for the Dedicated ESWS and CCWS trains should be consistent. Accordingly, the applicant is requested to revise the markup provided for FSAR Tier 2, Section 9.2.1 and 9.2.2 to provide consistency. The subject descriptions from the markup are provided below followed by a list of items that require clarification.

From the markup of ESWS Tier 2 Section 9.2.1, Page 9.2-3

> The dedicated ESWS pump is powered by Class 1E electrical buses and is capable of being supplied by an EDG or a station blackout diesel generators (SBODG).

From the markup of CCWS Tier 2 Section 9.2.2, Page 9.2-20

The dedicated CCWS train … is normally fed from offsite power and is capable of being supplied by the onsite electrical power supplies that are backed by an EDG or SBO diesel generator.

The applicant should provide clarifications as shown below:

1. The FSAR description should state that the identified power sources are applicable to the entire dedicated train (pump, valves, components etc.) not just the pump as stated in the ESWS markup.

2. The FSAR description should be corrected since Tier 1 Table 2.7.1-2 and Table 2.7.11-2 which identified normal power for the dedicated train is from Class 1E Division 4, conflicts with the CCWS markup of Section 9.2.2 states that the normal source is off-site power.

3. The FSAR description should state the dedicated trains are also capable of being powered by the Division 4 EDG or the SBO DG.

Part (i)5- In Part (i)5 the applicant was asked to describe the basis for CCWS equipment that is provided with alternate power supplies in Tier 2, Section 9.2.2 In RAI 334 Supplement 1 the applicant responded by including new Table 9.2.2-4 "Power Supplies for CCWS Valves" in the markup of U.S. EPR FSAR Tier 2 Section 9.2.2 which is consistent with Tier 1. The Table identifies CCWS motor operated valves that are provided with normal and alternate Class 1E power supplies. The staff noted that Tier 2 Section 8.3.1.1.1, "Emergency Power Supply System," describes the alternate feed alignments which addressed the basis for alternate power in the EPR design for added power flexibility. However, the staff noted that the markup of Tier 1 Table 2.7.1-2 should identify a Class 1E power source for hydraulic fluid pumps that are associated with each hydraulic valve and associated pilot valves. This information should be added to the FSAR.

Part (m)- In Part (m) the staff requested that the applicant define the ESWS/CCWS design heat load in Tier 1 and cited examples of comparable FSAR Tier 1 Sections where this information was provided. In RAI 334 Supplement 1 the applicant responded by referring to the response to RAI 9.2.2-77 for revised CCWS ITAAC. However, the staff's review of the response to RAI 9.2.2-77 found no information was provided in regard to the addition of ITAAC for ESWS/ CCWS Hx heat load. The applicant should provide this information in Tier 1.

**Response to Question 09.02.02-121:**

Part (i)2 and (i)3:

1. A review of the CCWS and ESWS confirmed the identified power sources are applicable to the entire dedicated train for each system. U.S. EPR FSAR Section 9.2.1 will be revised to include this information.
2. A review of the CCWS and ESWS confirmed normal power for the dedicated train of each system is from Class 1E Division 4. U.S. EPR FSAR Section 9.2.2 will be revised to include this information.
3. Refer to the Response to 1 and 2 above for the Tier 2 Sections 9.2.1 and 9.2.2 addition of the description related to alternate power from an EDG or SBODG. Refer to the Response to RAI 345 Question 9.2.1-26 for the addition of this information in Tier 1 Section 2.7.11. U.S. EPR FSAR Tier 1 Table 2.7.1-3 will be revised to include this information.

Part (i)5:

Refer to the Response to RAI 397 Question 9.2.2-107 for details related to power supplies for hydraulic valve pilot circuits.

Part (m):

A review of the CCWS confirmed the design heat load for the CCWS heat exchanger of 124.9 E+06 BTU/hr. U.S. EPR FSAR Tier 1 Table 2.7.1-3 will be revised to include this information.

**FSAR Impact:**

U.S. EPR FSAR Tier 1, Section 2.7.1 and Tier 2 Sections 9.2.1 and 9.2.2 will be revised as described in the response and indicated on the enclosed markup.

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 is powered by Class 1E electrical buses and is capable of being supplied ~~emergency powered~~ by an EDG or a ~~the~~ station blackout diesel generator~~s~~ (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.

which performs a containment isolation function is classified Seismic Category I. This equipment is located in buildings designed to Seismic Category I requirements.

~~CCWS equipment that does not serve safety-related functions but is routed proximate to other safety-related structures, systems and components (SSC) is classified Seismic Category II to prevent loss of function of safety-related SSC.~~

CCWS users, which are not classified Seismic Category I, can be isolated by Seismic Category I fast-acting isolation valves in case of external hazards.

The Seismic Category I fast-acting isolation valves for non-safety-related CCWS users are hydraulically operated and designed to close in less than 10 seconds. The CCWS common header switchover valves are also fast-acting hydraulically operated valves with a closure time of less than 10 seconds. These switchover valves can be used to isolate the common headers to conserve the system capacity to cool the safety-related SIS users directly associated with the CCWS train.

The four separate, independently powered safety cooling trains of the CCWS, combined with high standards for system design, installation and maintenance, provides assurance that the system will fulfill its safety-related function under the most demanding postulated conditions in spite of its most limiting credible single failure.

During severe accidents, containment heat is removed by the dedicated cooling chain, consisting of the SAHRS, dedicated CCWS, and dedicated ESWS. This dedicated CCWS train is normally in standby operation and is manually started if needed. In case of loss of the dedicated CCWS or ESWS division, the SAHRS cooling chain is lost. This condition is outside the DBA. The dedicated CCWS train supports beyond design basis accident mitigation and is normally fed from offsite power and is capable of being supplied by the onsite electrical power supplies that are backed by an EDG or SBO diesel generator.

Each physically separated CCWS safety-related train includes:

- A main system pump fitted with a recirculation line and pump motor cooling line.
- An HX, cooled by ESWS, with a parallel flow bypass line with control valve to maintain CCW minimum temperature during cold weather and low-load operation.
- A concrete, steel lined surge tank connected to the pump suction line with sufficient capacity to compensate for CCWS normal leaks or component draining.
- A sampling line with continuous radiation monitor.
- A chemical additive supply line.

**Table 2.7.1-2—Component Cooling Water System Equipment I&C and Electrical Design (7 Sheets)**

| Description | Tag Number (1) | Location | IEEE Class 1E (2) | EQ – Harsh Env. | PACS | MCR/RSS Displays | MCR/RSS Controls |
|---|---|---|---|---|---|---|---|
| Common Header 1b Safety Related Loads CVCS HP Cooler 1 Downstream Control Valve | KAB60AA116 | Reactor Building | NA | N/A | Yes | Pos | Open-Close |
| Common Header 2b Safety Related Loads CVCS HP Cooler 2 Downstream Control Valve | KAB70AA116 | Reactor Building | NA | N/A | Yes | Pos | Open-Close |
| Dedicated CCWS Surge Tank Isolation Valve | KAA80AA020 | Safeguards Building 4 | 4 | N/A | Yes | Pos | Open-Close |
| Dedicated CCWS Surge Tank Nitrogen Supply Valve | KAA80AA021 | Safeguards Building 4 | 4 | N/A | Yes | Pos | Open-Close |
| Dedicated CCWS Demin Water Makeup Water Supply Valve | KAA80AA202 | Safeguards Building 4 | 4 | N/A | Yes | Pos | Open-Close |
| Dedicated CCWS Pump | KAA80AP001 | Safeguards Building 4 | 4 | N/A | Yes | On-Off / NA | Start-Stop / NA |
| Dedicated CCWS Demin Water Makeup Pump | KAA80AP201 | Safeguards Building 4 | 4 | N/A | Yes | On-Off / NA | Start-Stop / NA |

**Table 2.7.1-2—Component Cooling Water System Equipment I&C and Electrical Design (7 Sheets)**

| Description | Tag Number [1] | Location | IEEE Class 1E [2] | EQ – Harsh Env. | PACS | MCR/RSS Displays | MCR/RSS Controls |
|---|---|---|---|---|---|---|---|
| Safety Chilled Water Chiller CCWS Flow Control Valve | KAA22AA101 | Safeguards Building 2 | $2^N$<br>$1^A$ | N/A | Yes | NA / NA | NA / NA |
| Safety Chilled Water Chiller CCWS Flow Control Valve | KAA32AA101 | Safeguards Building 3 | $3^N$<br>$4^A$ | N/A | Yes | NA / NA | NA / NA |

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; $^A$ denotes the division the component is powered from when alternate feed is implemented.

3) Each hydraulically operated valve has multiple solenoid-operated pilot valves. Pilot valves for KAA10AA006/010/032/033 are powered from Division 1. Pilot valves for KAA20AA006/010/032/033 are powered from Division 2. Pilot valves for KAA30AA006/010/032/033 are powered from Division 3. Pilot valves for KAA40AA006/010/032/033 are powered from Division 4.

## Table 2.7.1-3—Component Cooling Water System ITAAC (7 Sheets)

| | Commitment Wording | Inspections, Tests, Analyses | Acceptance Criteria |
|---|---|---|---|
| | | b. Components listed as harsh environment in Table 2.7.1-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.b. For equipment listed for harsh environment in Table 2.7.1-2, an inspection will be performed of the as-installed Class 1E equipment and the associated wiring, cables and terminations. | b. Inspection reports exists and conclude that the components listed in Table 2.7.1-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.b. Inspection concludes the as-installed Class 1E equipment and associated wiring, cables, and terminations as listed in Table 2.7.1-2 for harsh environment conform to the design. |
| 7.1 | The CCWS heat exchanger as listed in Table 2.7.1-1 has the capacity to transfer the design heat load to the ESWS system. | Tests and analyses will be performed to demonstrate the capability of the CCWS heat exchanger as listed in Table 2.7.1-1 to transfer the heat load to the ESWS. | A report exists and concludes that the ESWS has the capacity to remove the design heat load via the heat exchanger listed in Table 2.7.1-1.The CCW heat exchanger satisfies the required heat transfer of an equivalent combined product of the heat exchanger area of 39963 $ft^2$ and the overall heat transfer coefficient of 360 BTU/hr*$ft^2$*°F. |
| 7.2 | The pumps listed in Table 2.7.1-1 have sufficient NPSHA. | Testing and analyses will be performed to verify NPSHA for pumps listed in Table 2.7.1-1. | A report exists and concludes that tThe pumps listed in Table 2.7.1-1 have NPSHA that is greater than net positive suction head required (NPSHR) at system run-out flow with consideration for minimum allowable surge tank water level (as corrected to account for actual temperature and atmospheric conditions). |

Request for Additional Information No. 417(4741), Revision 0

6/8/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
Application Section: 9.2.2

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

09.02.02-115

Follow-up to RAI 334, Question 9.2.2-57 and RAI 174, Question 9.2.2-8:

From RAI 9.2.2-8: The component cooling water system (CCWS) must be able to withstand natural phenomena without the loss of function in accordance with General Design Criteria (GDC) 2 requirements. As specified in Standard Review Plan (SRP) Tier 2 Section 9.2.2, staff acceptance is based upon compliance with GDC 2, "Design Basis for Protection Against Natural Phenomena." The staff considers the CCWS to be acceptable with respect to GDC 2 if it satisfies Position C1 and C.2 of Regulatory Guide 1.29, "Seismic Design Classification." Position C1 specifies that safety-related SSCs should satisfy Seismic Category I specifications and Position C2 indicates that the design on non-safety-related SSCs is acceptable if failures do not adversely affect the control room or safety-related SSCs, or result in excessive radiological releases to the environment. Consequently, the applicant needs to include additional information in Tier 2 Section 9.2.2 of the Final Safety Analysis Report (FSAR) to fully describe and address the impact of failures of the non-safety-related parts of the CCWS on the control room and radiological release considerations.

In response to follow-up RAI 9.2.2-57 the applicant provided a detailed markup of FSAR Tier 2 Section 9.2.2 that identified areas of the plant where non-safety, non-seismic CCWS piping was routed and a discussion of the isolation valves that the system design provided for isolation of these areas from the safety related portions of the CCWS system. Since several of the areas identified also contain other safety-related SSCs (e.g. Safeguards Buildings 1 to 4, Reactor Building Annulus etc.) the staff requests that the applicant revise the markup to include a description of the means used to assure that failure of the non-seismic CCWS piping will not adversely impact other safety-related SSCs located in these buildings. For example, the non-safety related headers are as large as 20" diameter. This part of the original RAI (RAI 9.2.2-8) has not been previously addressed; that is, the design of non-safety-related SSCs is acceptable if failures do not adversely affect the control room <u>or safety-related SSCs,</u> or result in excessive radiological releases to the environment". This guidance is found in RG1.29, C.2 which states:

> Those portions of SSCs of which continued function is not required but of which failure could reduce the functioning of any plant feature included in items 1.a through 1.q above to an unacceptable safety level or could result in incapacitating injury to

occupants of the control room should be designed and constructed so that the SSE would not cause such failure.

In summary the applicant should address the following:

a. The failure of non-seismic CCWS related to safety-related SSCs as addressed in RG 1.29, C.2 should be addressed in the FSAR. The applicant should considered for example, Seismic Category II, geographical separation, impact evaluation, etc. (see FSAR 3.7.3.8, “Interaction of Other Systems with Seismic Category I Systems”), for any portions of the non-safety CCWS that could possible affect safety-related SSCs. This information should be added to the FSAR.

b. The information that was added as part of RAI 9.2.2-57 FSAR mark-up related to the details of the non-seismic CCWS piping, locations and failure consequences should be removed and more of a high level summary added in its place.

**Response to Question 09.02.02-115:**

a. A review of the CCWS confirmed the location of non-seismic piping and components in the CCWS and the failure of those components related to safety-related SSCs.

   Non-Seismic portions of the CCWS are isolated from safety-related SSCs by either geographical separation or by the use of physical barriers. U.S. EPR FSAR Tier 2, Section 9.2.2 will be revised to include this information.

b. Refer to the Response to part (a) above.

**FSAR Impact:**

U.S. EPR FSAR, Tier 2 Section 9.2.2 will be revised as described in the response and indicated on the enclosed markup.

are of a suitable corrosion resistant metal. Table 9.2.2-4—Power Supplies for CCWS Valves identifies the CCWS valves that are provided with normal and alternate power supplies per Section 8.3.1.1.1.

The CCWS has non-seismic piping and components in the following locations:

- Safeguards Buildings (SB) 1, 2, 3 and 4.
- Nuclear Auxiliary Building (NAB).
- Reactor Building Annulus.
- Fuel Building (FB).
- Radioactive Waste Processing Building (RWPB).

The demineralized water distribution system (DWDS) supply to each of the CCWS surge tanks located in SBs 1, 2, 3 and 4 is non-seismic from the DWDS tank up to the Seismic I motor-operated valve (MOV) of the CCWS. A failure in this portion of the CCWS non-seismic piping does not result in excessive radiological release because these portions of the system only carry demineralized quality water. The control room is not adversely affected by a failure of these potions of the CCWS. The nuclear island drain and vent system (NIDVS) floor drains direct demineralized water leakage to the NIDVS sump, which shuts off the demineralized water supply. At the entrance of the FB, the demineralized water MOVs 30GHC73 AA001/002 are protectively closed if the level limit value of the NIDVS sumps is initiated for SBs 1, 2 or the FB. At the entrance of SB 4, the demineralized water MOVs 30GHC78 AA001/002 are protectively closed if the level limit value of the NIDVS sumps is initiated for SB 3 or 4.

Operational chilled water system (OCWS) users on the CCWS common 1 header in the NAB are supplied by piping and components that are non-seismic. This portion of the CCWS is routed from SB 1 through the Reactor Building Annulus and FB. The non-seismic portion of piping is isolated from the Seismic I piping on the supply to the OCWS users by two Seismic I isolation valves, and one Seismic I isolation valve and one Seismic I check valve on the return from the OCWS users. A failure of this non-seismic portion of the CCWS does not result in excessive radiological release because there is no potential for radioactive in-leakage to the CCWS from the OCWS. The control room is not adversely affected by a failure of the non-seismic CCWS piping in SB 1, Reactor Building Annulus, FB or the NAB because the control room is located in the Seismic I SB 2.

OCWS, coolant treatment system, coolant degasification system, steam generator blowdown system, liquid waste processing system and solid waste system users on the CCWS common 2 header in the NAB and RWPB are supplied by non-seismic piping and components. This portion of the CCWS is routed from SB 4 into the NAB and the

RWPB. This non-seismic portion of piping is isolated from the Seismic I piping on the supply to the users by two Seismic I isolation valves, and one Seismic I isolation valve and one Seismic I check valve on the return from the users. A failure of this non-seismic portion of the CCWS does not result in excessive radiological release because there is no potential for radioactive in-leakage to the CCWS from these users. The CCWS is at a higher pressure than each of these systems, so the only potential for in-leakage is from CCWS into these systems. The control room is not adversely affected by a failure of the non-seismic CCWS piping in the NAB or the RWPB because the control room is located in the Seismic I SB 2.

The dedicated CCWS is a non-safety-related system located in SB 4 whose piping and components are non-seismic. This system is used in beyond design basis accidents to transfer heat from the severe accident heat removal system (SAHRS). A failure of this non-seismic portion of the CCWS does not result in excessive radiological release since the pressurized tank in the dedicated CCWS keeps the system at a higher pressure than that of the SAHRS to prevent possible in-leakage of contaminated fluids in the SAHRS. The control room is not adversely affected by a failure of the non-seismic dedicated CCWS piping located in SB 4 because the control room is located in the Seismic I SB 2.

A fault in CCWS piping is recognized by redundant level indications on each CCWS surge tank. In the event that tank levels drop to MIN 2, the non-safety-related branches automatically isolate if there is a flow mismatch in inlet and outlet of the supply and return lines for the users. The CCWS is a closed-loop cooling water system with the only potential for radioactive in-leakage coming from the high pressure CVCS and RCS.



### 9.2.2.2.2 Component Description

Refer to Section 3.2 for details of the seismic and system quality group classification of the CCWS, CCW structures, and CCW components.

*CCWS Pumps*

CCWS pumps are sized to provide the capacity to support system flow requirements during penalizing conditions. To accomplish this, design margins are added to the limiting flow requirements (volumetric flow and head). The required design margins of the CCWS pumps are given in Table 9.2.2-5—Design Margins of CCWS Pumps.

Margin is combined using the square root of the sum of the squares method to prevent system over design which challenges system operation during normal operation. Considering that margin must be available for system flow balancing, the margin provided for this purpose is added using a straight summation to that combined using the square root of the sum of the squares (e.g., wear, testing uncertainty, grid frequency deviations). The margin (penalties) to be applied to the pump design conditions are as follows: