ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Thursday, August 16, 2012 5:31 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); LENTZ Tony (EXTERNAL AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 543 (6323), FSAR Ch. 14 - NEW PHASE 4 RAI, Supplement 2
Attachments: RAI 543 Supplement 2 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to the 2 questions in RAI No. 543 on May 18, 2012. Supplement 1 response was sent on July 18, 2012 to provide a revised schedule for Question 14.03.08-5.

The attached file, “RAI 543 Supplement 2 Response US EPR DC.pdf” provides a technically correct and complete final response to Question 14.03.08-5. Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 543 Question 14.03.08-5.

The following table indicates the respective pages in the response document, “RAI 543 Supplement 2 Response US EPR DC.pdf,” that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 543 — 14.03.08-5	2	5

The schedule for providing a technically correct and complete response to the remaining question in RAI 543 is unchanged as provided below.

Question #	Response Date
RAI 543 — 14.03.08-4	September 13, 2012

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Wednesday, July 18, 2012 4:36 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)

Subject: Response to U.S. EPR Design Certification Application RAI No. 543 (6323), FSAR Ch. 14 - NEW PHASE 4 RAI, Supplement 1

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to the 2 questions in RAI No. 543 on May 18, 2012.

The schedule for a technically correct and complete response to Question 14.03.08-5 has been changed as provided below.

Question #	Response Date
RAI 543 — 14.03.08-4	September 13, 2012
RAI 543 — 14.03.08-5	**August 16, 2012**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
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From: WILLIFORD Dennis (RS/NB)
Sent: Friday, May 18, 2012 9:46 AM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 543 (6323), FSAR Ch. 14 - NEW PHASE 4 RAI

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 543 Response US EPR DC.pdf," provides a schedule since a technically correct and complete response to the two questions cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 543 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 543 — 14.03.08-4	2	2
RAI 543 — 14.03.08-5	3	4

A complete answer is not provided for the two questions. The schedule for a technically correct and complete final response to these questions is provided below.

Question #	Response Date
RAI 543 — 14.03.08-4	**September 13, 2012**
RAI 543 — 14.03.08-5	**July 18, 2012**

Sincerely,

Dennis Williford, P.E.
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, April 19, 2012 11:27 AM
To: ZZ-DL-A-USEPR-DL
Cc: Stutzcage, Edward; Schaaf, Robert; Jaffe, David; Segala, John; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 543 (6323), FSAR Ch. 14 - NEW PHASE 4 RAI

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on April 5, 2012, and discussed with your staff on April 18, 2012. Draft RAI Question 14.03.08-5 (e) was modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/LB1
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 3990

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D4DB6CA6)

Subject: Response to U.S. EPR Design Certification Application RAI No. 543 (6323), FSAR Ch. 14 - NEW PHASE 4 RAI, Supplement 2
Sent Date: 8/16/2012 5:31:09 PM
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MESSAGE	5070	8/16/2012 5:31:38 PM
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Response to

Request for Additional Information No. 543, Supplement 2

4/19/2012

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 14.03.08 - Radiation Protection Inspections, Tests, Analyses, and Acceptance Criteria
Application Section: Tier 1, Section 2.2.8

QUESTIONS for Health Physics Branch (CHPB)

Question 14.03.08-5:

OPEN ITEM

Follow up to RAI 386, Question Nos. 14.03.08-2 and 14.03.08-3.

Based on staff's review of Revision 3 of the U.S. EPR FSAR and the responses to RAI 386 and associated FSAR markups, the staff has the following items to be addressed related to the radiation monitors provided in Tier 1, Section 2.4-22:

a) In the response to Question 14.03.08-3 the applicant provided an FSAR markup showing proposed changes to Table 2.4.22-2 in FSAR Revision 3. However, upon reviewing FSAR Revision 3 staff found that Table 2.4.22-2, "Radiation Monitoring System Equipment," provided different information than what was provided in the proposed FSAR markup. Specifically, it still lists the Containment High Range Dose Rate Monitors as being located in the "Reactor Building," instead of the "Containment Building," as was proposed in the response to Question 14.03.08-3. In order to more accurately describe the location of the monitors, please update the FSAR Tier 1, "Radiation Monitoring System Equipment" table, as described above.

b) In response to Question 14.03.08-2 the applicant stated that information would be added to the U.S. EPR Tier 1 radiation monitoring ITAAC in the response to RAI 273, Question 11.05-02 and RAI 450, Question 14.03.07-37. However, these responses did not propose that any additional monitors will be added to Section 2.4.22 ITAAC. 10 CFR 52.47(b) requires that, the application must contain, "The proposed inspections, tests, analyses, and acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a facility that incorporates the design certification has been constructed and will be operated in conformity with the design certification, the provisions of the Act, and the Commission's rules and regulations." In addition, SRP Section 14.3 Appendix A, Section IV.4.B states that "The purpose of the ITAAC is to verify that an as-built facility conforms to the approved plant design and applicable regulations." Staff does not believe that all of the monitors necessary to ensure that a U.S. EPR facility will be constructed and operated in conformity with the design certification and with the Commission's rules and regulations are included in DCD Tier 1, Section 2.4.22. Specifically, Tier 1 Section 2.4.22 (including Table 2.4.22-3), does not include the spent fuel pool area radiation monitors, which are required by 10 CFR 50.68(b)(6), or the main control room air intake duct activity monitors, which are relied upon to initiate the engineered safety feature (ESF) of isolating and filtering the main control room air conditioning system upon detecting high activity.

   Accordingly, the applicant is requested to include information and ITAACs for the U.S. EPR spent fuel radiation monitoring system in FSAR Tier 1 Section 2.4.22.

c) FSAR Tier 1, Sections 2.4.1 and 2.4.22, contains ITAAC which will require licensee's to test parts of the RMS and the ESF associated with the RMS. However, staff cannot identify any information in Tier 1 indicating that the containment high range monitors will record and provide a readout of containment radiation levels in the main control room. 10 CFR 50.34(f)(xvii), requires that the containment high range monitors display this information in the MCR. Please update FSAR Tier 1, Section 2.4.1 or 2.4.22 to include information demonstrating that these monitors will provide containment radiation level information to the control room, as described above.

d) FSAR Tier 1, Section 2.4.22, Table 2.4.22-3, Section 4.1, contains ITAAC indicating that tests will be performed on the RMS system to verify output signals. It is not clear whether these “tests” will include functional tests of the radiation detector, which is the essential component of the radiation monitoring channel. In the context of completing the ITAAC, the commitment described in FSAR Tier 1, Section 2.4.22, Item 4.2, should use the same type of radioactive calibration source’s as are called for in FASR Tier 2, Rev. 1, Section 14.2.12.11.19 (Test #143) in demonstrating the operational function of the channel (while ensuring that the source does not present a hazard and doses are kept ALARA during testing). This approach would confirm that the radiation monitoring channel operates in accordance with design commitments. Please update Section 2.4.22 ITAAC to include information ensuring that the radiation monitors listed within Tier 1 will be tested to verify the appropriate response to high radiation levels after installation.

e) FSAR Tier 1, Sections 2.4.1 lists the ESF actions, including those that occur as a result of high activity levels in containment, the main steam lines, and the main control room air intake duct. This section also contains ITAAC ensuring that input signals to the protection system (PS) result in an reactor trip (RT) or ESF signal, as appropriate. However, it is not clear whether this test confirms the function of the radiation monitoring system (RMS) and PS as a whole. Revise FSAR Tier 1 to include ITAAC to verify that a test signal at the detectors (high activity levels, main steam lines and main control room air intake duct) results in the PS generating the correct ESF signal. The test should be performed on the system in its entirety, as opposed to in parts. This is particularly important since Section 14.2, Test #143 does not test that a signal at the RMS detectors results in an ESF signal, but instead only requires that the input to the PS is provided by the appropriate RMS radiation monitors. Revise Tier 1, of the FSAR such that the ITAAC provide assurance that activity levels at the containment monitors, main steam line monitors and the main control room air intake duct, result in the appropriate ESF signal.

Response to Question 14.03.08-5:

Item a:

U.S. EPR FSAR Tier 1, Table 2.4.22-1, will be updated to change "Reactor Building" to "Containment Building," as requested.

Item b:

Main control room vent duct gamma activity monitors (30KLK65CR001/002 and 30KLK66CR001/002) will be added to U.S. EPR FSAR Tier 1, Table 2.4.22-1. In addition, U.S. EPR FSAR Tier 1, Table 2.4.22-2 will be updated to add the main control room air conditioning system (CRACS) supply gamma activity to the list of RMS output signals.

The FBVS radiation monitors (KLK38CR001/002) are non-safety radiation monitors with a non-safety automatic control function to close the FBVS isolation dampers to divert flow to the Safeguards Building Ventilation System (SBVS) iodine filtration units on high activity. The FBVS radiation monitors provide for defense in depth but are not credited for 10 CFR 50.68(b)(6) compliance. Specifically, the fuel handling accident dose consequence analysis described in U.S. EPR FSAR Tier 2, Section 15.0.3.10.2 does not credit the iodine filtration via the SBVS. U.S. EPR FSAR Tier 2, Section 9.4.2.2.3 will be revised to state that no credit is

taken for iodine filtration for a fuel handling accident in the Reactor Building or the Fuel Handling hall.

Area radiation monitors are provided at the Containment Building refueling bridge (JYK15CR003), at the setdown area near the equipment hatch in the Fuel Building (JYK28CR004), and on the Fuel Building spent fuel mast bridge (JYK28CR002). The area radiation monitor at the Fuel Building equipment hatch (JYK28CR004) monitors the general dose rate level within the vicinity of the Fuel Building equipment hatch. Area radiation monitors on Containment Building refueling bridge (JYK15CR003) and on the Fuel Building spent fuel mast bridge (JYK28CR002) monitor radiation levels during fuel assembly handling and alarm upon detection of high radiation. All these area radiation monitors are non-safety related. Thus, these area radiation monitors are not credited for 10 CFR 50.68(b)(6) compliance.

Conforming changes will be made to U.S. EPR FSAR Tier 1, Sections 2.4.4, 2.6.4 and 2.4.25, and U.S. EPR FSAR Tier 2, Sections 7.1, 7.3, 9.4.2.3, and 11.5.1.1.

Item c:

U.S. EPR FSAR Tier 1, Section 2.4.22, will be revised to add inspections, tests, analyses, and acceptance criteria (ITAAC), Item 4.5, which states that the radiation monitors listed in Table 2.4.22-1 will record and provide an indication in the main control room (MCR) of the radiation level.

Item d:

The inspections, tests, and analyses in U.S. EPR FSAR Tier 1, Table 2.4.22-3, will be revised to indicate that tests will be performed using an internal check source or a calibration check source with strengths at the lower level of monitor sensitivity to verify the appropriate response to high radiation levels. This is consistent with the description of the testing of the RMS provided in U.S. EPR FSAR Tier 2, Section 14.12.11.19 (Test #143).

Item e:

U.S. EPR FSAR Tier 1, Section 2.4.22 Item 4.1 provides the ITAAC to verify the functionality of safety-related radiation monitors and their signals to the Signal Conditioning and Distribution System (SCDS). U.S. EPR FSAR Tier 1, Section 2.4.25, Item 4.1 and Item 4.2 provide the ITAAC to verify the functionality of SCDS to receive the radiation monitor signals and provide signal outputs to the Protection System (PS). U.S. EPR FSAR Tier 1, Section 2.4.22, will be revised to add ITAAC, Item 4.6, which states that the RMS output signals identified in U.S. EPR FSAR Tier 1, Table 2.4.22-2, are sent to the PS for generation of automatic ESF signals. This ITAAC will provide the verification of logic within the PS to produce an ESF signal to the Priority and Actuator Control System (PACS) when the radiation monitor signal reaches the trip setpoint. The ITAAC to verify the PACS module functions properly upon receipt of a PS signal are provided in the corresponding process system's ITAAC section (e.g., for the Main Control Room Air Conditioning System, see U.S. EPR FSAR Tier 1, Section 2.6.1 Item 4.3). These different ITAAC items, when combined, provide a series of overlapping tests that provide verification of the functionality of the instrumentation loop for the radiation monitor from sensor to actuator.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.4.22, Table 2.4.4-2, Table 2.4.22-1, Table 2.4.22-2, Table 2.4.22-3, Table 2.4.25-2, Table 2.4.25-3, and Section 2.6.4 and U.S. EPR FSAR Tier 2, Table 7.1-5, Table 7.1-7, Figure 7.3-63, Figure 7.3-64, Section 7.3.1.4.4, Section 9.4.2.2.3, Section 9.4.2.3, and Section 11.5.1.1 will be revised as described in the response and indicated in the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

Table System	Function Name	Input Variable
	Interlock	Common 1b Supply Outer Valve Position
		Common 2b Return Outer Valve Position
		Common 2b Supply Outer Valve Position
		Common 1b Return Inner Valve Position
		Common 1b Supply Inner Valve Position
		Common 2b Return Inner Valve Position
		Common 2b Supply Inner Valve Position
	SCWS Condenser Supply Water Flow Control	Condenser Refrigerant Pressure
Emergency Feedwater System (EFWS)	SG Closed Loop Level Control	SG Level
	Pump Flow Protection	Pump Flow Signal
Essential Service Water Pump Building Ventilation System (ESWPBVS)	ESWPBVS ESWS Pump Rooms Temperature Control	Outside Air Temperature
Fuel Building Ventilation System (FBVS)	Safety-Related Room Heater Control	Room Temperature
	FBVS EBS / FPCS Pump Rooms Heat Removal	Recirculation Temperature
	Isolation of FBVS on Containment Isolation	Containment Isolation Signal
Fuel Pool Cooling and Purification System (FPCPS)	FPCPS Pump Trip on Low Spent Fuel Pool (SFP) Level	SFP Level (WR)
In-Containment Refueling Water Storage Tank System (IRWST)	IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock	IRWST Level
Main Control Room Air Conditioning System (CRACS)	Iodine Filtration Train Heater Control	Carbon Filter Isolation Damper Position
		Protective Switch Temperature
		ESF Filtration Status

Rows Deleted
RAI 543, Question
14.03.08-5(b)

4.5 The RMS records the radiation level from the containment high range radiation monitors listed in Table 2.4.22-1. Display of containment radiation level is indicated in the main control room (MCR).

4.6 The RMS output signals identified in Table 2.4.22-2 are sent to the PS for generation of automatic engineered safety features (ESF) signals.

5.0 Electrical Power Design Features

5.1 The components designated identified as Class 1E in Table 2.4.22-1 are powered from the Class 1E division as listed in Table 2.4.22-1 in a normal or alternate feed condition.

6.0 Environmental Qualifications

6.1 Components designated as harsh environment in Table 2.4.22-1, that are designated as harsh environment, will perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.in the environments that exist during and following design basis events.

6.2 Components designated as mild environment in Table 2.4.22-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.

7.0 Equipment and System Performance

7.1 Deleted.

RAI 543, Question 14.03.08-5(e)

8.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.22-3 lists the RMS ITAAC.

RAI 543, Question 14.03.08-5(a)

Table 2.4.22-1—Radiation Monitoring System Equipment (2 Sheets)

Description	Tag Number	Location	Seismic Category	IEEE Class 1E	~~Harsh~~ Environment
Containment High Range Dose Rate Monitor	30JYK15CR101	~~Reactor~~ Containment Building	I	1[N] 2[A]	Harsh~~Yes~~
Containment High Range Dose Rate Monitor	30JYK15CR102	~~Reactor~~ Containment Building	I	2[N] 1[A]	Harsh~~Yes~~
Containment High Range Dose Rate Monitor	30JYK15CR103	~~Reactor~~ Containment Building	I	3[N] 4[A]	Harsh~~Yes~~
Containment High Range Dose Rate Monitor	30JYK28CR101	~~Reactor~~ Containment Building	I	4[N] 3[A]	Harsh~~Yes~~
Main Steam Line Radiation Monitors Division 1	30LBA10CR811 30LBA10CR821 30LBA10CR831 30LBA10CR841	Main Steam Valve Room	I	1[N] 2[A]	Harsh~~Yes~~
Main Steam Line Radiation Monitors Division 2	30LBA20CR811 30LBA20CR821 30LBA20CR831 30LBA20CR841	Main Steam Valve Room	I	2[N] 1[A]	Harsh~~Yes~~
Main Steam Line Radiation Monitors Division 3	30LBA30CR811 30LBA30CR821 30LBA30CR831 30LBA30CR841	Main Steam Valve Room	I	3[N] 4[A]	Harsh~~Yes~~
Main Steam Line Radiation Monitors Division 4	30LBA40CR811 30LBA40CR821 30LBA40CR831 30LBA40CR841	Main Steam Valve Room	I	4[N] 3[A]	Harsh~~Yes~~
Radiation Monitoring Cabinet Division 1	30CLE20	Safeguard Building 1	I	1[N] 2[A]	Mild~~No~~
Radiation Monitoring Cabinet Division 2	30CLF20	Safeguard Building 2	I	2[N] 1[A]	Mild~~No~~
Radiation Monitoring Cabinet Division 3	30CLG20	Safeguard Building 3	I	3[N] 4[A]	Mild~~No~~

RAI 543, Question 14.03.08-5(b)

Table 2.4.22-1—Radiation Monitoring System Equipment (2 Sheets)

Description	Tag Number	Location	Seismic Category	IEEE Class 1E	~~Harsh~~ Environment
Radiation Monitoring Cabinet Division 4	30CLH20	Safeguard Building 4	I	4^N^ 3^A^	Mild~~No~~
Main Control Room Vent Duct Gamma Activity Monitor	30KLK65CR001	CRACS Supply Air Duct	I	4^N^ 3^A^	Mild
Main Control Room Vent Duct Gamma Activity Monitor	30KLK65CR002	CRACS Supply Air Duct	I	2^N^ 1^A^	Mild
Main Control Room Vent Duct Gamma Activity Monitor	30KLK66CR001	CRACS Supply Air Duct	I	1^N^ 2^A^	Mild
Main Control Room Vent Duct Gamma Activity Monitor	30KLK66CR002	CRACS Supply Air Duct	I	3^N^ 4^A^	Mild
Containment Building Refueling Bridge Area Dose Rate Monitor	30JYK15CR003	Containment Building	NSC	4^N^ 3^A^ (Non-1E)	N/A
Fuel Building Spent Fuel Mast Bridge Dose Rate Monitor	30JYK28CR002	Fuel Building	NSC	1^N^ 2^A^ (Non-1E)	N/A
Fuel Building Equipment Hatch Dose Rate Monitor	30JYK28CR004	Fuel Building	NSC	4^N^ 3^A^ (Non-1E)	N/A

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.

Table 2.4.22-2—Radiation Monitoring System Output Signals

Item No.	Output Signal	Recipient	No. of Divisions
1	Containment High Range Dose Rate Monitor Signal	SCDS	4
2	Main Steam Line Radiation Monitor Signal	SCDS	4
3	CRACS Supply Gamma Activity	SCDS	4

RAI 543, Question 14.03.08-5(b)

Table 2.4.22-3—Radiation Monitoring System ITAAC
(32 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the RMS equipment is located as listed in Table 2.4.22-1.	An inspection will be performed of the location of RMS equipment listed in Table 2.4.22-1.	The RMS equipment listed in Table 2.4.22-1 is located as listed in Table 2.4.22-1.
3.1	Components identified as Seismic Category I in Table 2.4.22-1 can withstand seismic design basis loads without a loss of safety function.	a. Type tests, analyses, or a combination of type tests and analyses will be performed on the components identified as Seismic Category I in Table 2.4.22-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. Inspections will be performed of the Seismic Category I components identified as Seismic Category I in Table 2.4.22-1 to verify that the components, including anchorage, are installed per seismic qualification report (SQDP, EQDP, or analyses) requirementsas specified on the construction drawings..	a. Seismic qualification reports (SQDP, EQDP, or analyses) exist and conclude that the Seismic Category I components identified as Seismic Category I in Table 2.4.22-1 can withstand seismic design basis loads without a loss of safety function. b. Inspection reports exist and conclude that the Seismic Category I components identified as Seismic Category I in Table 2.4.22-1, including anchorage, are installed per seismic qualification report (SQDP, EQDP, or analyses) requirementsas specified on the construction drawings..
4.1	The RMS provides the output signals to the recipients listed in Table 2.4.22-2.	Tests will be performed using an internal check source, or a calibration check source with strengths at the lower level of monitor sensitivity., or test signals to verify the appropriate response over the design range of the RMS. Tests will be performed to verify the existence of output signals.	The RMS provides output signals to the recipients listed in Table 2.4.22-2.

RAI 543, Question 14.03.08-5(d)

Table 2.4.22-3—Radiation Monitoring System ITAAC
(3~~2~~ Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.2	Locking mechanisms are provided on the RMS cabinet doors. Opened RMS cabinet doors are indicated in the MCR.~~Deleted.~~	a. An inspection will be performed.~~Deleted.~~ b. A test will be performed. c. A test will be performed.	a. Locking mechanisms exist on the RMS cabinet doors.~~Deleted.~~ b. The locking mechanisms on the RMS cabinet doors operate properly. c. Opened RMS cabinet doors are indicated in the MCR when a RMS cabinet door is in the open position.
4.3	The RMS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following: • Single detectable failures within the RMS concurrent with identifiable but non-detectable failures. • Failures caused by the single failure. • Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.	A failure modes and effects analysis will be performed on the RMS at the level of replaceable modules and components.	A report concludes that the RMS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following: • Single detectable failures within the RMS concurrent with identifiable but non-detectable failures. • Failures caused by the single failure. • Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.
4.4	Class 1E RMS equipment listed in Table 2.4.22-1 can function when subjected to EMI, RFI, ESD, and power surges.	Type tests or type tests and analyses will be performed.	Equipment identified as Class 1E in Table 2.4.22-1 can function when subjected to EMI, RFI, ESD, and power surges.
4.5	The RMS records the radiation level from the ~~containment high range~~ radiation monitors listed in Table 2.4.22-1. Display of containment radiation level is indicated in the MCR.	a. A test will be performed using test signals to verify that the RMS records ~~containment high range~~ radiation monitor level.	a. The RMS can record radiation level from the ~~containment high range~~ radiation monitors listed in Table 2.4.22-1.

RAI 543, Question14.03.08-5(c)

RAI 543, Question14.03.08-5(c)

Table 2.4.22-3—Radiation Monitoring System ITAAC (3~~2~~ Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		b. A test will be performed using test signals to verify that the ~~containment~~ radiation monitor level is indicated in the MCR.	b. Display of ~~containment~~ radiation level from the radiation monitors listed in Table 2.4.22-1is indicated in the MCR.
4.6	The RMS output signals identified in Table 2.4.22-2 are sent to the PS for generation of automatic ESF signals.	Tests using test signals, analyses, or a combination of tests using test signals and analyses will be performed for the signal path from the radiation monitors to the PS output circuits.	The PS generates an automatic ESF signal when the test signal reaches the trip setpoint of the RMS signals identified in Table 2.4.22-2.
5.1	The components designated ~~identified~~ as Class 1E in Table 2.4.22-1 are powered from the Class 1E division as listed in Table 2.4.22-1 in a normal or alternate feed condition.	a. Testing will be performed ~~for components identified as Class 1E in Table 2.4.22-1~~ by providing a test signal in each normally aligned division. b. Testing will be performed ~~for components identified as Class 1E in Table 2.4.22-1~~ by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.4.22-1. b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E components identified in Table 2.4.22-1.

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Table 2.4.25-2—Signal Conditioning and Distribution System Input Signals (2 7 Sheets)

Item #	Signal	Source	# Divisions
112	Battery Room Supply Air Temperature	Electrical Division of Safeguard Building Ventilation System	4
113	EFWS Pump Room Temperature	Electrical Division of Safeguard Building Ventilation System	4
114	CCWS Pump Room Temperature	Electrical Division of Safeguard Building Ventilation System	4
115	SCWS Chiller Evaporator Outlet Temperature	Safety Chilled Water System	4
116	SCWS Chiller Compressor Oil Pressure	Safety Chilled Water System	4
117	SCWS Condenser Refrigerant Pressure	Safety Chilled Water System	4
118	SCWS Chiller Evaporator Flow Signal	Safety Chilled Water System	4
119	SCWS Cross-Tie Valves Position Signal	Safety Chilled Water System	4
120	SCWS Circulating Pump 1 Running Signal	Safety Chilled Water System	4
121	SCWS Circulating Pump 2 Running Signal	Safety Chilled Water System	4
122	SCWS Evaporator ΔP Signal	Safety Chilled Water System	4
123	SCWS Chiller Evaporator Flow Signal	Safety Chilled Water System	4
124	RHRS Flow Rate Signal	Safety Injection and Residual Heat Removal System	4
125	RHRS Temperature	Safety Injection and Residual Heat Removal System	4
126	LHSI Pump Pressure	Safety Injection and Residual Heat Removal System	4
127	Hot Leg Loop Level	Safety Injection and Residual Heat Removal System	4
128	Containment Isolation Signal	Fuel Building Ventilation System	4
129	Deleted. Fuel Building Ventilation Activity	Fuel Building Ventilation System	4
130	Deleted. Containment Building Ventilation Activity	Fuel Building Ventilation System	4
131	LHSI Suction Isolation Valve Position	Safety Injection and Residual Heat Removal System	4

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Table 2.4.25-3—Signal Conditioning and Distribution System Output Signals (82 Sheets)

Item #	Signal	DestinationRecipient	# Divisions
117	SCWS Condenser Refrigerant Pressure	Safety Automation System	4
118	SCWS Chiller Evaporator Flow Signal	Safety Automation System	4
119	SCWS Cross-Tie Valves Position Signal	Safety Automation System	4
120	SCWS Circulating Pump 1 Running Signal	Safety Automation System	4
121	SCWS Circulating Pump 2 Running Signal	Safety Automation System	4
122	SCWS Evaporator ΔP Signal	Safety Automation System	4
123	SCWS Chiller Evaporator Flow Signal	Safety Automation System	4
124	RHRS Flow Rate Signal	Safety Automation System	4
125	RHRS Temperature	Safety Automation System	4
126	LHSI Pump Pressure	Safety Automation System	4
127	Hot Leg Loop Level	Safety Automation System	4
128	Containment Isolation Signal	Safety Automation System	4
129	Deleted.Fuel Building Ventilation Activity	Safety Automation System	4
130	Deleted.Containment Building Ventilation Activity	Safety Automation System	4
131	LHSI Suction Isolation Valve Position	Safety Automation System	4
132	RHR 1st RCPB Isolation Valve Position	Safety Automation System	4
133	RHR 2nd RCPB Isolation Valve Position	Safety Automation System	4

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2.6.4 Fuel Building Ventilation System

1.0 Description

The fuel building ventilation system (FBVS) receives the conditioned air supply from the nuclear auxiliary building ventilation system (NABVS). The exhaust from the FBVS is processed by the NABVS through a filtration train, and the exhaust air is directed to the vent stack.

The FBVS controls the Fuel Building temperature, humidity and air change rate for personnel comfort, personnel safety, and equipment protection during normal plant operation. The FBVS provides cooling, heating, and ventilation for the Fuel Building (FB) to remove equipment heat and heat generated from other sources. The FBVS also provides heat to maintain a minimum temperature in the building. The FBVS provides a minimal air change rate for the building and controls the building pressurization to reduce spreading of contamination.

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The FBVS provides the following safety-related functions:

- ~~Isolation of the supply and exhaust airflow of the fuel handling hall.~~
- ~~Isolation of the supply and exhaust airflow of the hall in front of equipment hatch.~~
- ~~Isolation of the supply and exhaust airflow to the room in front of the emergency air lock.~~

- Isolation of the FB from NABVS supply and exhaust on receipt of containment isolation signal. The FB atmosphere is then processed through iodine filtration trains of the safeguard building controlled-area ventilation system (SBVS).
- Heating of the rooms which have safety-related systems, structures, or components containing borated fluid and the rooms surrounding the extra borating system tanks to maintain minimum ambient room temperatures.
- Cooling of rooms which have the extra borating system pumps and the fuel pool cooling system pumps to maintain ambient conditions.

The FBVS provides the following non-safety related functions:

- Maintains the room ambient conditions for operation of equipment and to allow personnel access during normal operation.
- Reduces spread of contamination from the contaminated rooms to less contaminated rooms during normal operation.
- Reduces concentration of aerosols and radioactive gases from the room air.
- Maintains a negative pressure within the Fuel Building with respect to outside atmosphere.

- Isolation of the supply and exhaust airflow of the fuel handling hall.
- Isolation of the supply and exhaust airflow of the hall in front of equipment hatch.
- Isolation of the supply and exhaust airflow to the room in front of the emergency air lock.

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2.0 Arrangement

2.1 The functional arrangement of the FBVS is as shown on Figure 2.6.4-1—Fuel Building Ventilation System Functional Arrangement.

2.2 The location of the FBVS equipment is as listed in Table 2.6.4-1—Fuel Building Ventilation System Equipment Mechanical Design.

2.3 Separation exists between the FBVS ventilation trains in the Fuel Building. The FBVS is divided into two subsystems referred to as cells. The cells separate the ventilation system serving the systems in the Fuel Building.

3.0 Mechanical Design Features

3.1 Deleted.

3.2 Components ~~Equipment~~ listed in Table 2.6.4-1 can perform the function listed in Table 2.6.4-1 under system operating conditions.

3.3 Components identified as Seismic Category I in Table 2.6.4-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.6.4-1.

3.4 Components listed in Table 2.6.4-1 as ASME AG-1 Code are designed in accordance with ASME AG-1 Code requirements.

3.5 Components listed in Table 2.6.4-1 as ASME AG-1 Code are fabricated in accordance with ASME AG-1 Code requirements, including welding requirements.

3.6 Components listed in Table 2.6.4-1 as ASME AG-1 Code are inspected and tested in accordance with ASME AG-1 Code requirements.

4.0 Displays and Controls

4.1 Displays listed in Table 2.6.4-2—Fuel Building Ventilation System Equipment I&C and Electrical Design, are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.6.4-2.

4.2 The FBVS equipment controls are provided in the MCR and RSS as listed in Table 2.6.4-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.6.4-2 responds to the state requested by a test signal.

Table 7.1-5—SAS Automatic Safety Function
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System[1]	Function Name[2]	Function Safety Basis[3]	Interdivisional Communications[4]	Type of Data[5]	Signal Selection Type[6]	Comments ~~FSAR Section Referenced~~
Fuel Building Ventilation System (FBVS)	Isolation of FBVS on Containment Isolation (Figure 7.3-62)	This function is described in Sections 7.3.1.4.4 and 9.4.2.3.	NO	N/A	N/A	
Fuel Pool Cooling and Purification System (FPCPS)	~~FPCPS~~ Pump Trip on Low SFP Level (Figure 7.3-41)	This function is described in Sections 7.3.1.4.5 and 9.1.3. ~~The FPCPS has a safety-related function to:~~ ~~1. Remove decay heat from the spent fuel pool during normal plant operation, outages, AOOs, and PAs.~~ ~~2. Provide containment isolation by closure of the reactor pool purification supply and return containment isolation valves.~~ ~~3. Preclude, by design, the drain down of the spent fuel pool (SFP) below its required level to verify that the spent fuel remains covered with water during storage conditions.~~ ~~4. Provide SFP make-up capability (Seismic Category I water sources, pump, and piping) to compensate for normal SFP evaporation for up to seven days.~~	NO	N/A	N/A	~~The I&C associated with the FPCPS is described in Section 9.1.3.~~

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Table 7.1-7—SAS FMEA Results
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
Systems With Functions in 4 Divisions / Trains								
1	Fuel Building Ventilation System (FBVS)	Isolation of FBVS on Containment Isolation (Figure 7.3-62)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
2	Deleted.							
3	Deleted.							
4	Safety Injection and Residual Heat Removal System (SIS/ RHRS)	RHR Isolation Valves Interlock (Figure 7.6-11)	Master CU in 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Master / Standby CU switchover occurs and the function remains operable	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	

Table 7.1-7—SAS FMEA Results
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No	System	SAS Function	Name of Sensor, Functional Unit, or Equipment (2)	Failure Mode (1)	Method of Detection	Inherent Compensating Provision	Effect on the SAS Function	Comments
Systems With Functions in 4 Division/Trains								
48	Fuel Building Ventilation System (FBVS)	Isolation of FBVS on Containment Isolation (Figure 7.3-62)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function.	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
49	Deleted.							
50	Deleted.							
51	Safety Injection and Residual Heat Removal System (SIS/ RHRS)	RHR Isolation Valves Interlock (Figure 7.6-11)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Affected division switches to the standby CU	Three remaining divisions / trains provide safety function.	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	
52	Component Cooling Water System (CCWS)	CCWS Emergency Temperature Control (Figure 7.3-34)	Loss of 1 Division	a) Detected Failure	TXS inherent or engineered fault detection mechanism	Four redundant divisions/ trains	Three remaining divisions / trains provide safety function	No effects on the system function
				b) Undetected - Spurious	None	Four redundant divisions/ trains	Spurious trigger of one division / train. Three remaining divisions / trains provide safety function.	
				c) Undetected - Blocking	None	Four redundant divisions/ trains	Loss of one division / train. Three remaining divisions / trains provide safety function.	

tanks to prevent crystallization in extra borating system piping (GDC 27, GDC 60, GDC 61). The functional logic is shown in Figure 7.3-39—FBVS Safety-Related Rooms Heater Control.

EBS / FPCS Pump Rooms Heater Removal

The FBVS has an safety-related function that maintains the room ambient conditions in the extra borating system pump rooms and fuel pool cooling system pump rooms (GDC 27, GDC 60, GDC 61). The functional logic is shown in Figure 7.3-40—FBVS EBS / FPCS Pump Rooms Heat Removal.

Isolation of FBVS on Containment Isolation

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The FBVS has a safety-related function to automatically isolate the NABVS supply and exhaust ducts in the event of a containment isolation signal. The functional logic is shown in Figure 7.3-62—Isolation of FBVS on Containment Isolation.

7.3.1.4.5 Fuel Pool Cooling and Purification System

FPCPS Pump Trip on Low SFP Level

The safety-related function to trip the FPC pump on low level so that the FPCPS is capable of fulfilling its safety-related function of precluding the drain down of the SFP to eliminate the potential for fuel damage and its consequences. The functional logic is shown in Figure 7.3-41—FPCPS Pump Trip on Low SFP Level.

7.3.1.4.6 Electrical Division of Safeguard Building Ventilation System

Supply and Recirculation-Exhaust Air Flow Control

The safeguard building ventilation system (electrical) (SBVSE) has a safety-related function to ventilate and maintain acceptable ambient temperature in the Safeguard Building areas and rooms ventilated by the system (GDC 4, GDC 17). The Supply and Recirculation-Exhaust Air Flow Control function supports this system safety function by controlling supply, exhaust, and recirculation air flow as required to maintain ambient temperature and air quality (via filtration) within applicable limits for safety-related equipment located within the Safeguard Building areas and rooms. The functional logic is shown in Figure 7.3-48—SBVSE Supply and Recirculation-Exhaust Air Flow Control.

Supply Fan Safe Shut-Off

The SBVSE has a safety-related function to ventilate and maintain acceptable ambient temperature in the Safeguard Building areas and rooms ventilated by the system (GDC 4, GDC 17). An inadvertent stopping of the supply fan, due to a spurious system action, may cause the SBVSE for a given division to become inoperable. Therefore, to

Figure 7.3-63—Deleted

Figure 7.3-64—Deleted

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Failure of Heaters and Recirculation Cooling Units

In each room provided with safety-related heaters, two 100 percent capacity heaters are provided to fulfill the single failure criteria of the heaters. For heaters serving a safety-related function, the required power has been calculated based on failure of an electrical division. Thus, failure of one electrical division will not prevent other divisions from supplying power and fulfilling their functions.

Failure of one recirculation cooling unit will lead to the loss of cooling in the corresponding room. As a result, the extra borating and fuel pool cooling system pumps located in that room may not operate properly. Redundant extra borating and fuel pool cooling system pumps located in a separate room and served from a separate train will, however, still be operational.

Failure of Isolation Dampers

For safety-related isolation functions, automatic isolation is provided in the design by placing two dampers in series, with power for each damper supplied by a different electrical division. Failure of one electrical division thus does not hinder the isolation function of the system.

Fuel Handling Accident in the Fuel Building

In the event of a fuel handling accident in the FB, the air exhaust and supply of the space above the fuel pools are isolated by closing the isolation dampers serving this room. This occurs automatically by the sampling activity monitoring system signal. Alternatively, this isolation also can be performed via local push buttons located in the fuel pool room.

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To prevent spread of airborne contamination, the iodine filtration trains of the safeguard building ventilation are used to process the exhaust air and to maintain the required pressure in the FB fuel pool hall (refer to Section 9.4.5, Section 11.5.3.1.7, and Table 11.5-1, Monitor R-19). However, no credit is taken for iodine filtration in the fuel handling accident dose consequence analysis described in Section 15.0.3.10.2. The remainder of the FB is ventilated by the NABVS.

Fuel Handling Accident in the Containment Building

In the event of a fuel handling accident in the Containment Building, to preclude uncontrolled migration of contamination, the FB areas in front of the emergency airlock and in front of the equipment hatch are isolated by closing the air exhaust and supply dampers dedicated to these areas.

Prior to opening the emergency airlock during an outage, the air exhaust in front of the emergency airlock is isolated by closing the dampers dedicated to this area.

- Isolation dampers for the fuel pool room so that the dampers can be closed in the event of high temperature in the fuel pool.

The power for the equipment listed above is supplied from the SBO emergency diesel generators (SBODG).

9.4.2.3 Safety Evaluation

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The FBVS provides the following safety-related functions:

- ~~Automatic isolation of the supply and exhaust air to the fuel handling hall in order to mitigate the consequences of a fuel handling accident in the hall.~~
- ~~Manual isolation from the main control room (MCR) of the supply and exhaust airflow to the hall in front of the equipment hatch prior to opening of the hatch. This isolation mitigates the consequences of a fuel handling accident in the RB with the hatch opened.~~
- ~~Automatic isolation of the supply airflow to the room in front of the emergency airlock in order to mitigate the consequences of a fuel handling accident in the RB. The isolation of the exhaust airflow from the room in front of the emergency airlock is performed manually from the MCR prior to opening of the emergency airlock.~~
- Automatic isolation of the FB from NABVS supply and exhaust ducts in the event of containment isolation signal. The SBVS maintains negative pressure in the FB and filters the FB atmosphere through SBVS iodine filtration trains.
- Maintains ambient conditions in the extra borating system pump rooms and pipe chase and the fuel pool cooling system pump rooms during normal, abnormal, and postulated accident events.
- Safety-related components can function as required with failure of a single active component. The safety-related redundant components are powered from different electrical divisions so that the system can remain operable in case of failure of one of the electrical divisions.

9.4.2.4 Inspection and Testing Requirements

The FBVS major components, such as dampers, cooling units, heaters, and ducts are located to provide access for initial and periodic testing to verify their integrity.

Test and analysis will be completed during normal operation with the system operating in an accident alignment. Analysis will use as-built information from equipment to extrapolate the performance of the air-conditioning system. Analysis will show that the equipment performance is adequate to maintain design conditions during plant operating conditions.

A COL applicant that references the U.S. EPR design certification and that chooses to install and operate skid-mounted radiation monitoring and sampling systems connected to permanently installed radioactive process and waste management systems will include plant-specific information describing how design features and implementation of operating procedures for the PERMSS will address the requirements of 10 CFR Part 20.1406(b) and guidance of SRP Section 11.5, Regulatory Guides 4.21 and 1.143, IE Bulletin 80-10, ANSI/HPS-13.1-1999 and ANSI N42.18-2004, and NEI 08-08.

11.5.1.1 Design Objectives

Portions of the process and effluent radiological monitoring and sampling systems perform safety related functions. For those portions of the systems, the safety design bases functions are as follows:

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- Initiate main control room air conditioning system supplemental filtration in the event of abnormally high gaseous radioactivity in the main control room supply air.
- ~~Initiate fuel handling area ventilation isolation on high exhaust activity from fuel handling area.~~
- Provide long-term post-accident monitoring (using both safety-related and non-safety-related monitors) in the event of a postulated accident.

11.5.1.2 Design Criteria

The process and effluent radiological monitoring and sampling systems monitor the containment atmosphere; spaces containing components for recirculation of loss of coolant accident fluids; and effluent discharge paths for radioactivity released from normal operations, AOOs, and postulated accidents. Sampling points are located on both process and effluent radiological monitoring and sampling systems to permit representative sampling for radiochemical analysis. The process and effluent radiological monitoring and sampling systems measure, record and provide a readout in the control room for containment radiation levels, and noble gas effluents at all potential, accident release points. The process and effluent radiological monitoring and sampling systems continuously sample for radioactive iodines and particulates in gaseous effluents from all potential accident release points, and provides for onsite capability to analyze and measure these samples. The monitoring of inplant radiation and airborne radioactivity is provided for a broad range of routine and accident conditions.

This design complies with applicable portions of 10 CFR 50.34(f)(2)(xvii) and 10 CFR 50.34(f)(2)(xxvii), 10 CFR Part 50, Appendix A, GDC 64, and RG 1.97.

The process radiological monitoring and sampling systems indicate the existence and, to the extent possible, the magnitude of reactor coolant and reactor auxiliary system