ArevaEPRDCPEm Resource

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Sent: Thursday, July 08, 2010 8:53 AM
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Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 386, FSAR Ch. 14, Supplement 1
Attachments: RAI 386 Supplement 1 Response - DRAFT.pdf

Getachew,

On June 3, 2010, AREVA NP provided a schedule for the 24 questions in RAI 386. To support the NRC review attached are DRAFT responses to the following 11 questions:

14.02-149
14.02-150
14.02-153
14.02-154
14.02-155
14.02-157
14.02-160
14.03.02-46
14.03.02-47
14.03.02-48
14.03.03-46

Let me know if the staff has questions or if these responses can be sent as final.

Thanks,

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Response to

Request for Additional Information No. 386(4306, 4418, 4532, 4349, 2666, 4512, 4341), Supplement 1

5/4/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 14.02 - Initial Plant Test Program - Design Certification and New License Applicants
SRP Section: 14.03.02 - Structural and Systems Engineering - Inspections, Tests, Analyses, and Acceptance Criteria
SRP Section: 14.03.03 - Piping Systems and Components - Inspections, Tests, Analyses, and Acceptance Criteria
SRP Section: 14.03.08 - Radiation Protection Inspections, Tests, Analyses, and Acceptance Criteria

Application Section: SRP 14.02 (NUREG 0800)

QUESTIONS for Quality and Vendor Branch 2 (ESBWR/ABWR) (CQVB)
QUESTIONS for Health Physics Branch (CHPB)
QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)
QUESTIONS for Engineering Mechanics Branch 2 (ESBWR/ABWR Projects) (EMB2)

Question 14.02-149:

RG 1.68 Appendix A.1.h states that the testing of engineered safety features (ESFs) should demonstrate that such features will perform satisfactorily in all expected operating configurations or modes; however, U.S. EPR FSAR Section 14.2.12.11.22, “Protection System (Test #146),” does not demonstrate the operation of the protection system (PS) in the presence of a simulated single failure of the PS. Additionally, U.S. EPR FSAR section 7.2 and 7.3 (Tables 7.2-2 and 7.3-2) state Failure Mode and Effect Analysis (FMEA) of the PS with certain assumptions of PS functionality in the presence of a ‘real’ single failure. The NRC staff requests that the applicant revise test abstract #146 to include assumptions made concerning reactor Trip (RT) and ESF in the FMEA tables and verification of single failure of the PS.

Response to Question 14.02-149:

U.S. EPR FSAR Tier 2, Section 14.2.12.11.22, Test #146 is used to perform a preoperational test on the protection system prior to fuel loading. The field sensors will be installed, if practical. For example, if the self-powered neutron detectors (SPND) can not be installed without fuel assemblies in the core, the SPNDs will be simulated using the maximum amount of field wiring. A bounding single failure for each division will be created as described in Step 3.11 by removing electrical power for an entire division and verifying protection system response. The planned test provides a bounding FMEA event but does not create every possible single failure. To create every possible single failure would require thousands of permutations and could potentially damage the protection system. The protection system constantly performs checks to verify that each sensor remains connected, so removing power from each division will test this function on each sensor.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 14.02-150:

Follow-up to RAI 275, Question 14.02-123

In response to RAI question 14.02-123 the applicant revised the test method item 3.6 of U.S. EPR FSAR Section 14.2.12.11.22 ,"Protection System (Test #146)," to observe ESF actuators response. The NRC staff requested that AREVA clarify the test method item 3.6 to address what is meant by the term "actuators".

Response to Question 14.02-150:

U.S. EPR FSAR Tier 2, Section 14.2.12.11.22, Test #146 uses the term "actuator" consistent with how it is used in U.S. EPR FSAR Tier 2, Chapter 7 when referring to any component that is controlled by a priority and actuator control system (PACS) module. Examples of actuators include motor operated valves (MOV), solenoid valves, dampers, and breakers. Actuators could be any component that uses an electrical signal to reposition. The protection system is expected to actuate the reactor trip breakers and engineered safety feature (ESF) components.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 14.02-153:

Follow-up to RAI 313, Question 14.02-132

Based on RAI 14.02-132 response the staff finds the inclusion of Test No. 193 in the response to Test No. 93 is not correct given that Test No. 193 addresses only the integrity of the bioshield during power ascension and not the adequacy of the radwaste "Drum Store" and "Tubular Shaft Store" located in the Radwaste Bldg. FSAR Section 12.3.2.2, as referenced in Test No.193, describes design criteria for the adequacy of the shielding based on design features and modeling, and does not address testing. Accordingly, the response to Test No. 93 should be revised to include provisions that confirm the integrity of the concrete shielding for the "Drum Store" and "Tubular Shaft Store" located in the Radwaste Bldg.

Response to Question 14.02-153:

The Response to RAI 313, Question 14.02-132 should be revised as follows:

Revised Response to Question 14.02-132:

U.S. EPR FSAR Tier 2, Section 14.2.12, Test #093 will be revised to include the subsystems described in U.S. EPR FSAR Tier 2, Section 11.4.2.3.1.

The solid waste storage support systems are tested in the following tests:

- Test #080, “Radioactive Waste Building Ventilation System.”
- Test #093, “Solid Waste Storage System.”
- Test #094, “Radioactive Concentrates Processing System – Solid Waste.”
- Test #098, “Equipment and Floor Drainage System.”
- Test #129, “Process Information and Control System.”
- Test #193, “Low Power Biological Shield Survey.”

U.S. EPR FSAR Tier 2, Section 14.2, Test #093 will also be revised to clarify the following:

- Test Method: A new item “Verify the integrity of the concrete shielding for the Drum Store and Tubular Shaft Store located in the Radwaste Building” has been added.
- Acceptance Criteria: A new item “The concrete shielding associated with the solid waste management system meets design requirements” has been added.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2.12, Test #093 will be revised as described in the response and indicated on the enclosed markup.

Question 14.02-154:

Follow-up to RAI 313, Question 14.02-133

In response to RAI 14.02-133, a review of components listed in Section 3.0 of revised test abstract No. 94 indicates that the "Drum Measuring Device" is not included in the equipment listing, given the description of FSAR Section 11.4.2.3.2. Note that this equipment is not listed in FSAR Table 11.5-1 since it is not part of the liquid and gaseous process and effluent monitoring system. Accordingly, the response to Test No. 94 should be revised to include this piece of equipment and associated criteria.

Response to Question 14.02-154:

U.S. EPR FSAR Tier 2, Section 14.2, Test #094 will be revised to clarify the following:

- Test Method: A new item “Drum Measuring Device” has been added.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2, Test #094 will be revised as described in the response and indicated on the enclosed markup.

Question 14.02-155:

Follow-up to RAI 313, Question 14.02-134

Based on RAI 14.02-134 response,a review of components listed in Section 3.0 of revised test abstract No. 95 indicates that the "Evaporator Column" is not included in the equipment listing, given the description of FSAR Section 11.2.2.4.2.1. Accordingly, the response to Test No. 95 should be revised to include the Evaporator and Evaporator Column since the FSAR makes a technical distinction in their descriptions.

Response to Question 14.02-155:

U.S. EPR FSAR Tier 2, Section 14.2, Test #095 will be revised to clarify the following:

- Test Method: A new item “Evaporator Column” has been added.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2, Test #095 will be revised as described in the response and indicated on the enclosed markup.

Question 14.02-157:

Follow-up to RAI 313, Question 14.02-138

The response to RAI 14.02-138 refers to actions and activities that are associated with COL holder activities in concluding that the instrumentation used to meet the RCPB leakage rate TS need not be considered in the ITP. The focus of the RAI is on the inclusion of tests and definition of test criteria that confirm the operation of the instrumentation used to meet the associated TS. The fact that this instrumentation is used to comply with a TS does not give it special exemption for being excluded in the ITP. In this context, the RAI identifies a concern that is no different than those applied to any other rad monitoring instrumentation, e.g., see the test methods and acceptance criteria stated in Test No. 92, as revised by a similar type of RAI.

Response to Question 14.02-157:

Revised Response to Question 14.02-138:

U.S. EPR FSAR Tier 2, Section 14.2.12, Test #172 was reviewed and the relationship to Technical Specification (TS) 3.4.12 and 3.4.14 were examined. Plants typically perform a test periodically to meet the surveillance requirements described in TS 3.4.12 and rely on the instrumentation described in TS 3.4.14 to monitor signs of reactor coolant system (RCS) leakage between TS 3.4.12 surveillances. During hot functional (pre-core) testing, there are no radiological restrictions on personnel monitoring of the RCS pressure boundary, and the instrumentation described in TS 3.4.14 is not applicable.

U.S. EPR FSAR Tier 2, Section 14.2.12, Test #172 is a pre-core test that would be performed during hot functional testing (HFT). The appropriate reference for tests during this time is RG 1.68, Appendix A.2.d, Final Test of the Reactor Coolant System to Verify that System Leak Rates are within Limits. U.S. EPR FSAR Tier 2, Section 14.2.12, Test #172 meets the requirements of Appendix A.2.d and is similar to a plant test used to satisfy TS SR 3.4.12.1, which is a water balance as described in the Technical Specifications. U.S. EPR FSAR Tier 2, Section 14.2.12, Test #172 is performed during HFT conditions because the water densities in the systems connected to the RCS vary based on temperature and pressure. This test is performed again during power ascension to verify RCS leakage after fuel load.

The appropriate reference for measuring RCS leakage by radiological methods is described in RG 1.68, Appendix A.5.o, Calibrate Instrumentation and Demonstrate the Proper Response of Reactor Coolant Detection Systems, if not Previously Demonstrated. The instrumentation used to perform this function is calibrated and preoperational tested in U.S. EPR FSAR Tier 2, Section 14.2.12, Test #143. The missing step is to “demonstrate the proper response of reactor coolant detection systems.” This will be accomplished by comparing the calculated leakage in U.S. EPR FSAR Tier 2, Section 14.2.12, Test #187 with the indication produced by the radiation monitors.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2, Test #187 will be revised as described in the response and indicated on the enclosed markup.

Question 14.02-160:

Follow-up to RAI 330, Question 14.02-144

The response to RAI 330 question 14.02-144 related to Test #143, the term safety related was added to the prerequisite section. The term adds some confusion as to which radiation monitors are safety-related or how the radiation monitors are part of the safety-related monitoring system. Regulatory Guide 1.206 Part, C.I.14.2.12, Individual Test Descriptions, states that the COL applicant's test abstracts should emphasize SSCs and design features which meets any of the eight criteria. Criterion (6) states that SSC's and design features which "process, store, control, measure, or limit the release of radioactive materials." Since the installed radiation monitoring system measures and limits the release of radioactive materials by warning workers of dose rate increases, the staff finds the added term of safety-related misleading.

Response to Question 14.02-160:

U.S. EPR FSAR Tier 2, Section 14.2, Test #143 will be revised to remove the term “safety-related”.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2, Test #143 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-46:

Follow-up to RAI 230, Question 14.03.02-25

In Revision 1 to U.S EPR FSAR, Tier1, Item 2.2 in Table 2.1.1-8 for the Reactor Building addresses prevention of water ingress into the core melt spreading area. Under the "Acceptance Criteria" column, it references a watertight door shown in Figure 2.1.1-4. However, the door is not shown in the referenced figure. In **RAI 230, Question 14.03.02**-25 the staff requested that the figure be corrected. In response to the staff request, the applicant stated that the water tight door identified in U.S. EPR FSAR Tier 1, Section 2.1.1, Item 2.2 and Table 2.1.1-8, Item 2.2 is not a safety-significant design feature and should not be included as part of the ITAAC item. Therefore, it stated that the reference to the watertight door would be removed from U.S. EPR FSAR Tier 1, Section 2.1.1, Item 2.2 and Table 2.1.1-8, Item 2.2. In SRP Section 14.3, Appendix C.I.A.iii, Item (6) it states that severe accident features should be described in the design description, and the basic configuration ITAAC should verify that they exist. The staff notes that other severe accident features have been included in the ITAAC tables, such as the concrete support structures that limit the downward expansion of the lower head. Since the watertight door is a feature intended to mitigate a severe accident the staff is requesting that the applicant include it in the design description and its existence be confirmed by ITAAC.

Response to Question 14.03.02-46:

The watertight door that was originally noted in U.S. EPR FSAR Tier 1, Table 2.1.1-8, Item 2.2 is not a feature that is intended to mitigate a severe accident. The entire watertight barrier around the core melt spreading area is the safety-significant feature intended to mitigate a severe accident as currently identified in U.S EPR FSAR Tier 1, Table 2.1.1-8, Item 2.2. However, it is important that any doors or penetrations within the water ingression barrier are watertight to confirm that this barrier performs its safety-significant function. Therefore, the Acceptance Criteria for this ITAAC will be revised to include confirmation that doors or penetrations within the water ingression barrier are watertight.

FSAR Impact:

The U.S. EPR FSAR Tier 1, Table 2.1.1-8, Item 2.2 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.02-47:

Follow-up to RAI 230, Question 14.03.02-29

In **RAI 230, Question 14.03.02-29**, the staff requested that a requirement for a final inspection and reconciliation of the as-built condition to the final design basis loads be added to the ITAAC tables. In its response, the applicant referred to its response to **RAI 230, Question 14.03.02-28**. **The response to RAI 230, Question 14.03.02-28** does not address this issue. To ensure the requirements of GDC 2, GDC 4 and GDC 50 have been met and the guidance of SRP 14.3.2, SAC-03 has been implemented, the applicant is requested to add under the Inspections, Tests, Analyses column in Tables 2.1.1-8, 2.1.1-11, 2.1.1-4.2, 2.1.1-10, 2.1.1-11, 2.1.2-3 and 2.1.5-3 a statement which requires that a final analysis be performed to verify that as built conditions of the structures are reconciled, as appropriate, with their structural design basis loads.

Response to Question 14.03.02-47:

The SRP calls for 'reconciliation,' not complete re-analysis. If there are no deviations to the design as supported by the final analysis, there is no reason to require a complete re-analysis. Or, if deviations are reconciled prior to completion of construction and there are no subsequent deviations, there is no need to redo the analysis.

The current ITAAC requires reconciliation of deviations as stated in the SRP and as provided by existing certified designs.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 14.03.02-48:

Follow-up to RAI 230, Question 14.03.02-15

In SRP Section 14.3.2, SAC-08, for internal flood, it states that ITAAC should require inspections to verify that penetrations in division walls are at least 2.5 M above the floor and safety-related electrical, instrumentation, and control equipment are located at least 20 cm above the floor surface. The staff in **RAI 230, Question 14.03.02-15** requested that inspections for these features be added to the ITAAC tables or that the applicant provide justification for not doing so. The applicant's response was that the requirements for penetration and equipment locations are not part of the U.S. EPR design approach for protection against internal flooding which is described in U.S. EPR FSAR, Tier 2, Section 3.4.1. Therefore, an ITAAC to confirm that these requirements are met in U.S. EPR FSAR, Tier 1 is not appropriate. The staff reviewed U.S. EPR FSAR, Tier 2, Section 3.4.1 in which it states that the principal protective measure for Seismic Category I buildings is physical separation of the redundant safe shutdown systems and components. Starting on the bottom of page 3.4-1, it states that division walls below elevation 0 ft, 0 inches provide separation and serve as flood barriers to prevent flood waters spreading to adjacent divisions. However, it goes on to state that these division walls are water tight, have no doors, and a *minimal number of penetrations*. Thus, it appears penetrations may be present in which case it might be possible for water to flow from one division to another division and thus compromise the design approach for protection from internal flooding through physical separation. The applicant needs to state how water is prevented from entering adjacent safety divisions through these penetrations and why the acceptance criteria of SRP 14.3.2, SAC-08 need not be met for the U.S. EPR design.

Response to Question 14.03.02-48:

Penetrations through division walls are watertight up to elevation +0 feet preventing water from entering adjacent safety divisions. SRP 14.3.2, SAC-08 design requirements for penetrations to be at least 2.5 m above the floor, and safety-related electrical, instrumentation, and control equipment to be at least 20 cm above the floor do not apply to the U.S. EPR because penetrations in division walls are watertight and flooding above the cited distances can occur in the U.S. EPR design. For instance, in Seismic Category I buildings designed with divisional separation, including the Safeguard Building (SB), Fuel Building (FB), Emergency Power Generating Building (EPGB), and Essential Service Water Pump Building (ESWPB), one division of safe shutdown systems and components can flood without compromising the plant's ability to safely shut down. In buildings not designed with divisional separation (e.g., the RB, all safety-related SSC required to achieve safe shutdown or mitigate the consequences of an accident) are located above the maximum flood water level.

The design approach for protection from internal flooding through physical separation is confirmed in U.S. EPR FSAR Tier 1, Table 2.1.1.10, Item 2.2 and U.S. EPR FSAR Tier 1, Table 2.1.1.11, Item 2.2. The commitment wording for these ITAAC items identify the barriers that must maintain physical separation between adjacent divisions in the event of an internal hazard, such as internal flooding. The ITAAC requires that an internal flooding analysis and a walkdown are performed to establish that flooding protection features are installed to confirm that the impact of an internal flood in one division cannot affect an adjacent division. This includes verifying that penetrations in divisional barriers below the internal flood elevation are appropriately sealed to prevent flooding in one division from affecting an adjacent division.

U.S. EPR FSAR Tier 2, Section 3.4.1 will be revised to clarify that penetrations in divisional walls are watertight up to elevation +0 feet.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.4.1 will be revised as described in the response and indicated on the enclosed markup.

Question 14.03.03-46:

Follow up to RAI 260, Question 14.03.03-39.

In its response to RAI 14.03.03-39, the applicant included reference of SQDP, EQDP, or analyses in the ITA and AC for item b of the ITAAC related to the seismic Category I components. In its response, the applicant also stated that this seismic qualification ITAAC were clarified and standardized in the Response to RAI 210, Supplement 1, Question 14.03.02-12. However, the staff found the response not acceptable and there are two concerns.

1) In the ITAAC proposed, the applicant did not verify whether the seismic category I components will be located in a seismic Category I building. Thus, the staff requests the applicant to amend the ITA and AC of item b of the ITAAC to reflect that the seismic Category I components should be installed in the seismic Category I building as specified on the construction drawing.

2) The applicant proposed in the ITA and AC of item b of the ITAAC that the deviations will be reconciled to the seismic qualification reports (SQDP, EQDP, or analyses). The proposed clarifies that the reconciliation will be performed to compare the deviation with the SQDP, EQDP, or analyses and the staff found this portion of statement is acceptable. However, simply indicating that deviations will be reconciled, as proposed by the applicant, is insufficient. The staff believes that the proper acceptance criteria should be such that the conclusion of reconciliation reflects that the components, including anchorage, are seismically bounded by the tested or analyzed conditions. The staff was aware of and reviewed several RAI Questions (14.03.02-12, 14.03.06-27, 14.03.03-02, and 14.03.04-03) and AREVA's responses related to the Seismic qualification ITAAC. In all the original questions (14.03.06-27 and 14.03.04-03), the applicant was requested to include the statement "equipment including anchorage is seismically bounded by tested or analyzed conditions" in the ITA and AC of item b of the seismic qualification ITAAC. However, AREVA did not make the acceptable changes in the responses to the aforementioned questions. Thus, the applicant is requested to amend the ITA and AC of item b to reflect that "the reconciliation concludes that components identified in Table x.x.x-x, including anchorage, are seismically bounded by the tested or analyzed conditions".

Response to Question 14.03.03-46:

1) Justifying the adequacy of the design is a Tier 2 provision. U.S. EPR FSAR Tier 1 verifies that design commitments made in U.S. EPR FSAR Tier 2 are implemented. In U.S. EPR FSAR Tier 1, each system addresses the location of Seismic Category 1 components by verifying the location of the components as listed in the system equipment tables. For example, for the U.S. EPR FSAR Tier 1, Section 2.2.3, safety injection system, the second ITAAC verifies that the equipment is located as listed in U.S. EPR FSAR Tier 1, Table 2.2.3-1. U.S. EPR FSAR Tier 1, Table 2.2.3-1 has a column labeled "Location" that lists the building of which the equipment is installed. ITAAC on the design of those structures are provided separately in the structure sections of U.S. EPR FSAR Tier 1.

2) The statement, "is seismically bounded by the tested or analyzed conditions," is difficult to interpret. It is assumed that this phrase is intended to mean that the qualification (test or analysis) conditions bound the installed conditions relative to the seismic design basis. The current U.S. EPR FSAR, Tier 1 seismic ITAAC, related to installation in accordance with the construction drawings, provides the trigger to perform any necessary reconciliation to the

qualified design basis (test or analysis). If required, this reconciliation will involve re-qualification to achieve the result that the qualification bounds the installation.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

U.S. EPR Final Safety Analysis Report Markups

Table 2.1.1-8—Reactor Building ITAAC (~~5~~ 6 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
2.1	Six rib support structures are provided at the bottom of the reactor cavity as shown on Figure 2.1.1-9.	Inspection of the reactor vessel cavity will be performed.	Six rib support structures are provided at the bottom of the reactor cavity as shown on Figure 2.1.1-9.
2.2	As shown on Figure 2.1.1-4, a flooding barrier ~~consisting of several walls~~ is provided to prevent ingress of water into the core melt spreading area. ~~This barrier includes a watertight door that provides entry to the venting shaft of the spreading area.~~	Inspection of the ~~RCB will be performed~~core melt water ingression barrier will be performed. 14.03.02-46	The RCB provides a spreading area water ingression barrier ~~consisting of flooding walls and a water-tight door~~ as shown on Figure 2.1.1-4. Penetrations and doors within the core melt water ingression barrier are water tight.
2.3	Core melt cannot relocate to upper containment due to the existence of concrete barriers as shown on Figure 2.1.1-9.	Inspection of the RCB will be performed.	Concrete barriers are located within the RCB as shown on Figure 2.1.1-9.

3.4 Water Level (Flood) Design

In accordance with GDC 2 and RG 1.29, the Seismic Category I structures, systems, and components (SSC) identified in Table 3.2.2-1 can withstand the effects of flooding due to natural phenomena or onsite equipment failures, without losing the capability to perform their safety-related functions. A description of these structures is provided in Section 3.8. The U.S. EPR design meets the requirements of GDC 4 because safety-related SSC accommodate the effects of discharged fluid resulting from the high- and moderate-energy line breaks postulated in Sections 3.6.1 and 3.6.2. The criteria in RG 1.59 and ANSI/ANS-2.8-1992 "Determining Design Basis Flooding at Power Reactor Sites" (Reference 1) are used to establish the probable maximum flood (PMF), probable maximum precipitation (PMP), seiche, and other hydrologic considerations. The flood protection measures for Seismic Category I SSC are designed in accordance with RG 1.102. Section 2.4 provides further information on hydrologic engineering. Section 2.5 provides information on safe shutdown earthquake ground motion. Section 3.8 provides information on the design of Seismic Category I structures. The risk assessment for external and internal flooding is provided in the U.S. EPR probabilistic risk assessment addressed in Chapter 19.

3.4.1 Internal Flood Protection

The U.S. EPR includes measures for protecting safety-related SSC against the effects of internal flooding from postulated flooding sources. These measures also protect safety-related SSC from flooding from non-safety-related SSC that are not required to be protected from either internal or external flooding. Because of these measures, a failure of components due to an internal flooding event will not prevent safe shutdown of the plant or mitigation of the flooding event. The nuclear island general arrangement drawings in Section 3.8 are a useful reference for the following description of protective measures for internal flooding.

The principal protective measure for Seismic Category I buildings is physical separation of the redundant safe shutdown systems and components. The safeguard buildings (SB), emergency power generating buildings (EPGB), and essential service water pump buildings (ESWPB) are Seismic Category I buildings designed with complete divisional separation of the four divisions of safety systems and are therefore consistent with an N+2 safety concept. With four divisions, one division can be down for maintenance and one can fail to operate due to an event such as internal flooding, while the remaining two divisions are available and sufficient to perform the necessary safety functions. The fuel building (FB) is designed with complete separation into two divisions below elevation +0 feet 0 inches such that in the event of an internal flood, the flood is restricted to one division of the FB while the other division is available and sufficient to perform the necessary safety functions. Each of the two divisions is designed to fulfill the safety function assuming the other division is not available. These buildings are designed such that the consequences of an internal hazard are contained within the division of hazard origin and are not allowed to propagate to other divisions. Consequently, in a large internal flooding event in buildings with divisional separation safety-related SSC within the affected division are assumed to be flooded. The principal protective measure for Seismic Category I buildings is physical separation of the redundant safe shutdown systems and components. The plant arrangement provides divisional separation walls to physically separate the redundant trains of safe shutdown systems and components. A combination of fluid diversion flow paths and passive features contain the water within the affected division. A COL applicant that references the U.S. EPR design certification will perform internal flooding analyses prior to fuel load for the Safeguard Buildings and Fuel Building to demonstrate that the impact of internal flooding is contained within the Safeguard Building or Fuel Building division of origin. Features credited in the analysis will be verified by walk-down.

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Division walls below elevation +0 feet, 0 inches (hereinafter +0 feet) provide separation and serve as flood barriers to prevent flood waters spreading to adjacent divisions. These division walls are watertight, have no doors, and a minimal number of penetrations all of which are watertight up to elevation +0 feet. Water is directed within one division to the building elevations below +0 feet, where it is stored. Above elevation +0 feet, a combination of watertight doors and openings for water flow to the lower building levels prevent water ingress into adjacent divisions. Watertight doors have position indicators for control of the closed position and are periodically inspected and maintained so that they remain capable of performing their intended function. Existing openings (e.g., stair cases, elevator shafts, and building drainsequipment openings) are credited as water flow paths when available. Watertight doors are designed to functional requirements such as leak-rate limits, door-closure indication, door-seal aging-degradation characteristics, and maintainability. Maintenance requirements are based on manufacturer recommendations and maintenance procedures are written by COL applicants in accordance with their respective regulatory approved maintenance programs.

A COL applicant that references the U.S. EPR design certification will include in its maintenance program appropriate watertight door preventive maintenance in accordance with manufacturer recommendations so that each Safeguards Building watertight door above elevation +0 feet remains capable of performing its intended function.

Flooding pits with burst openings collect and direct water flow to lower building levels. Rooms within divisions have interconnections so that the maximum released water volume can be distributed and stored in the lower building levels of the affected division. Interconnections include doors with flaps, wall openings, and other wall penetrations that are not required to be sealed. Elevated thresholds, curbs, and pedestals are provided as necessary.

requirements. The source of initiation of the signal, listed in order of preference, should be one of the following:

3.6.1 Internal check source (verify that check source strength is capable of generating desired actuations).

3.6.2 Radiation calibration check source (verify that check source does not generate a personnel hazard during the test).

3.6.3 Simulated high radiation signal at the radiation detector. ~~Simulate a high radiation signal to the radiation monitors to verify that alarm actuations in the MCR or locally,as designed.~~

4.0 DATA REQUIRED

4.1 The monitor response to check source.

4.2 Technical data associated with the source.

4.3 Signal levels necessary to cause alarm actuation.

4.4 Response time of the monitor to perform control functions.

5.0 ACCEPTANCE CRITERIA

5.1 The SAMS operates as designed (refer to Section 11.5).

5.2 Radiation monitoring instrumentation used to monitor the sampling activity at the vent and stack release point that is described in Table 11.5-1 will meet the design requirements for the radiation monitor. This includes, but is not limited to, the following (that could adversely impact the ability to measure the parameters described in Table 11.5-1):

5.2.1 Range.

5.2.2 Response time.

5.2.3 Sensitivity.

5.2.4 Maximum anticipated drift between calibrations.

14.2.12.9.3 Solid Waste Storage System (Test #093)

1.0 OBJECTIVE

1.1 To demonstrate the functionality of the solid waste storage system to collect and package solid wastes for shipment.

2.0 PREREQUISITES

2.1 Construction activities on the solid waste management system have been completed.

2.2 Solid waste management system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the solid waste management system are completed and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

~~3.1 Verify the operation of the solid waste transfer system.~~

3.1 Verify the radioactive waste processing building crane can reach design points.

3.2 Solid radioactive waste processing and storage components (dry active wastes) function as designed.

3.2.1 Sorting box (shredder and in-drum compactor).

3.2.2 Drum transport carts.

3.2.3 Shielding casks.

3.2.4 Vehicle entrance area crane.

3.2.5 Drum store crane.

3.2.6 Drum store.

3.2.7 Tubular shaft store.

~~3.2 Verify expended resin beds from the LWPS can be sluiced to the solid waste storage system.~~

3.3 Verify that operation of alarms, controls and interlocks meets design requirements.

3.4 Verify system design flow paths.

3.5 Verify the integrity of the concrete shielding for the drum store and tubular shaft store location in the Radwaste Building.

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4.0 DATA REQUIRED

4.1 Setpoints at which alarms and interlocks occur.

4.2 Solid waste transfer system operating data.

4.3 Radioactive waste processing building crane data.

4.4 System flow path data.

5.0 ACCEPTANCE CRITERIA

5.1 The solid waste management system operates as designed (refer to Section 11.4).

5.2 The concrete shielding associated with the solid waste management system meets design requirements.

14.2.12.9.4 Radioactive Concentrates Processing System - Solid Waste (Test #094)

1.0 OBJECTIVE

1.1 To verify the performance of the radioactive concentrates processing system.

2.0 PREREQUISITES

2.1 Construction activities have been completed on the radioactive concentrates processing system.

2.2 Support systems required for operation of the radioactive concentrates processing evaporator are complete and functional.

2.3 Radioactive concentrates processing system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

3.0 TEST METHOD

~~3.1 Operate radioactive concentrates processing evaporator control valves from appropriate control positions and observe valve operation and position indication.~~

3.1 Radioactive concentrates processing system components (wet solid wastes) function as designed.

3.1.1 Vacuum unit.

3.1.2 High pressure cleaning device.

3.1.3 Condensate collection pump.

3.1.4 Resin proportioning tank.

3.1.5 Concentrate buffer tank.

3.1.6 Condensate collection tank.

3.1.7 Scrubber tank.

3.1.8 Resin traps.

3.1.9 Condenser drying unit.

3.1.10 Condensate counter.

3.1.11 Condensate buffer sluice.

3.1.12 Transfer station.

3.1.13 Measuring glass.

3.1.14 Drum drying stations.

3.1.15 Drum transfer device.

3.1.16 High integrity container.

3.1.17 Sampling box.

3.1.18 Drum capping device.

3.1.19 Sampling device for dried waste.

3.1.20 Drum handling device.

14.2-154 → 3.1.21 Drum measuring device.

3.2 Initiate a high radiation signal to the appropriate radiation monitors to verify that system response (control and alarm actuations) meet design requirements. The source of initiation of the signal, listed in order of preference, should be one of the following:~~Simulate interlock signals~~

~~from interfacing equipment and observe radioactive concentrates processing system response, including observation of alarms.~~

3.2.1 Internal check source (verify that check source strength is capable of generating desired actuations).

3.2.2 Radiation calibration check source (verify that check source does not generate a personnel hazard during the test).

3.2.3 Simulated high radiation signal at the radiation detector.

3.3 Line up the radioactive concentrates processing system to interfacing systems and, using appropriate operating modes and indications, establish flow paths to these systems.

3.4 Verify that expended resin beds from the LWPS can be sluiced to the radioactive concentrates processing system.

4.0 DATA REQUIRED

4.1 Valve position indication.

4.2 Radioactive concentrates processing system response to simulated interlocks.

4.3 Setpoints at which alarms interlock and automatic actuations occur.

4.4 Flow indications.

5.0 ACCEPTANCE CRITERIA

5.1 The radioactive concentrates processing system performs as described in Sections 11.2.2 ~~and~~ , 11.4, and 11.5.

5.2 Radiation monitoring instrumentation used to monitor the radioactive concentrations activity prior to entry of the solid radwaste system that is described in Table 11.5-1 will meet the design requirements for the radiation monitor. This includes, but is not limited to, the following (that could adversely impact the ability to measure the parameters described in Table 11.5-1):

5.2.1 Range.

5.2.2 Response time.

5.2.3 Sensitivity.

5.2.4 Maximum anticipated drift between calibrations.

14.2.12.9.5 Liquid Waste Processing System (Test #095)

1.0 OBJECTIVE

1.1 To demonstrate the functionality of the liquid waste processing system (LWPS) for collection, processing and recycling of liquid wastes and for preparation of liquid waste for release to the environment.

2.0 PREREQUISITES

2.1 Construction activities on the liquid waste processing system have been completed.

2.2 Verify that the liquid waste processing system's demineralizers and ultra filtration are loaded with the proper types and amounts of ion exchange resins and filtration media.

2.3 Liquid waste processing system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.4 Support systems required for operation of the liquid waste processing system are completed and functional.

2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Evaporator system components function as designed.

3.1.1 Evaporator feed pumps.

3.1.2 Pre-heater.

3.1.3 Forced recirculation pump.

3.1.4 Evaporator.

14.2-155 → 3.1.5 Evaporator column.

3.1.6 Vapor compressor.

3.1.7 Distillate tank.

3.1.8 Distillate pump.

3.1.9 Distillate cooler.

3.1.10 Compressor injection cooler.

3.1.11 Electric heater.

3.1.12 Vent gas cooler.

3.1.13 Control valves.

3.1.14 Sealing liquids.

3.2 Centrifuge system components function as designed.

3.2.1 Centrifuge feed pump.

3.2.2 Decanter.

3.2.3 Separator.

3.2.4 Sludge tank.

3.2.5 Decanter feed pump.

3.2.6 Control valves.

3.3 Demineralizer system components function as designed.

3.3.1 Prefilter.

3.3.2 Demineralizer.

14.2.12.11.18 Excore Instrumentation System (Test #142)

1.0 OBJECTIVE

1.1 To verify the proper functional performance of the safety-related excore instrumentation system.

1.2 To verify the proper performance of audio and visual indicators.

1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

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2.1 Construction activities on the excore instrumentation system have been completed.

2.2 Excore instrumentation system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 External test equipment has been calibrated and is functional.

2.4 Support systems required for operation of the excore instrumentation system are functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Simulate and vary input signals to the startup, safety, and control channels of the excore instrumentation system using appropriate test instrumentation.

3.2 Monitor and record output signals as a function of variable inputs provided by test instrumentation.

3.3 Record the performance of audio and visual indicators in response to changing input signals.

3.4 Verify that the excore instrumentation system operates over the design range using actual or simulated signals.

3.5 Verify that the excore system responds as designed to actual or simulated limiting malfunctions or failures.

3.6 Verify that the excore system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

3.7 Verify redundancy and electrical independence of the excore design.

3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

14.2.12.14.9 Post-Core Reactor Coolant System Leak Rate Measurement (Test #187)

1.0 OBJECTIVE

1.1 To measure the RCS leakage at HZP (pressure and temperature) conditions. In general, it is better to measure leakage over a one hour period unless VCT makeup precludes test duration of one hour.

1.2 To distinguish between identified and unidentified leakage.

2.0 PREREQUISITES

2.1 The RCS is at HZP (pressure and temperature) conditions.

2.2 The RCS and the CVCS are operating normally with no makeup or letdown diversion.

2.3 The VCT level is high enough to prevent makeup during the test.

2.4 Permanently mounted instrumentation is calibrated and is operating satisfactorily prior to performing the following test.

3.0 TEST METHOD

3.1 Convert mass changes to gallons of water at normal atmospheric conditions (pressure and temperature).

3.2 Measure changes in water inventory of the RCS as follows:

3.2.1 Record mass changes in the pressurizer due to temperature and level changes.

3.2.2 Record mass changes due to RCS pressure and temperature changes.

3.3 Measure changes in water inventory of the CVCS and connected systems as follows:

3.3.1 Record mass changes in the VCT due to level changes.

3.3.2 Record mass changes in the RCDT due to level changes.

3.3.3 Record mass changes in the passive SI accumulators due to temperature and level changes. If SI accumulator mass has not increased it shall be ignored in the RCS leakrate calculation.

3.4 Determine total leakage, identified leakage (i.e., leakage into identifiable sources) and unidentified leakage (e.g., leakage into the containment atmosphere and other, valve packing and other paths that include leakage from non–RCS sources).

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3.5 Demonstrate proper response of radiation monitors that are used to determine RCS leakage by comparing calculated values to the radiation monitor estimated leakage values.

4.0 DATA REQUIRED

4.1 Pressurizer pressure, level, and temperature.

4.2 VCT level, temperature, and pressure.

4.3 RCDT level, temperature, and pressure.

4.4 RCS temperature and pressure.

4.5 SI Accumulator level and pressure.

4.6 Time interval.

5.0 ACCEPTANCE CRITERIA

5.1 Identified and unidentified leakage shall be within the limits described in Technical Specification 3.4.12.

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5.2 The values determined by the radiation monitoring instrumentation described in Technical Specification 3.4.14 are within reasonable agreement with the instrumentation used to calculate Technical Specification 3.4.12 leakage.

14.2.12.14.10 Post-Core Incore Instrumentation (Test #188)

1.0 OBJECTIVE

1.1 To measure the leakage resistance of the fixed incore detectors.

1.2 To demonstrate that the incore thermocouples are functional (refer to Section 7.1.1.5.2 for a description of fixed thermocouples).

2.0 PREREQUISITES

2.1 Permanently installed instrumentation is calibrated and is operating satisfactorily prior to performing the following test.

2.1.1 The calibration will demonstrate that currents generated by the thermocouples will be accurately translated into temperature indications.

2.2 Special test equipment for measurement of thermocouple resistance is available and calibrated.

2.3 The reactor is at 350°F conditions.

3.0 TEST METHOD

3.1 Measure and record the leakage resistance of each incore detector. This step can be performed at a lower RCS temperature than 350°F but the test can not be completed until the various temperature indications are compared at 350°F.

3.2 Verify that the core exit thermocouples indicate a temperature that corresponds to 350°F.

3.3 Increase RCS temperature by 50°F and collect corresponding thermocouple and RTD data.

3.4 Repeat data collection until RCS temperature is ≥568°F.