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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 306 Related to ESBWR Design Certification Application ESBWR RAI Number 14.3-449**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) dated February 19, 2009 (Reference 1).

The GEH response to RAI Number 14.3-449 is in Enclosure 1. The DCD markups associated with this response are in Enclosure 2.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 6.

Please note that this RAi response does not incorporate comments from phone conversations with the NRC Staff on May 11, 2009. A supplemental RAI is expected to be issued documenting the comments from that conversation.

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-146, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, GEH, *Request For Additional Information Letter No. 306 Related To ESBWR Design Certification Application*, dated February 19, 2009.

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 306 Related to ESBWR Design Certification Application DCD Tier 1 RAI Number 14.3-449

2. DCD Tier 1, Rev 6 MARKUPS

cc:	AE Cubbage	USNRC (with enclosure)
	JG Head	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRFSection	0000-0100-4455

Enclosure 1

MFN 09-350

Response to Portion of NRC Request for

Additional Information Letter No. 306

Related to ESBWR Design Certification Application

DCD Tier 1

RAI Numbers 14.3-449

NRC RAI 14.3-449

Question Summary: The use of functional arrangement in Tier 1

Full Text:

The use of the "Functional Arrangement" Tables associated with several of the different ESBWR systems appears inappropriate and, if not corrected, will result in significant "inspectability" concerns. The functional arrangement of any system is typically the first ITAAC in any system ITAAC Table and "functional arrangement" is defined in the Tier 1 "Definitions", as follows:

"Functional Arrangement (for a System) means the physical arrangement of systems and components to provide the service for which the system is intended, and which is described in the system Design Description."

This is augmented by another Definition:

"Verification of the functional arrangement of a system, as used in an ITAAC, means verifying that the system is constructed as depicted in the Tier 1 design description and design drawings, including equipment and instrument locations, if applicable."

The standard NRC interpretation of "functional arrangement" inspections would then typically involve walkdowns of as-built systems to verify visual and measurable attributes, as would be detailed on drawings, equipment specifications. and building layouts. The NRC staff does not assume that complex design requirements or analytical/testing results can be verified by such "functional arrangement" walkdown inspections alone.

However. in the ESBWR DCD Draft Tier 1 (Revision 06), Table 2.2.12-5 specifies just one ITAAC for the entire Leak Detection and Isolation System (LD&IS). This one ITAAC commits to a LD&IS "functional arrangement", as described in Table 2.2.12-1. Table 2.2.12-1 specifies safety-related, Seismic Category I features for the LD&IS; as well as component isolation function and logic requirements, "fail-safe" design attributes, and testing criteria. The ITA column for the one ITAAC specifies the conduct of "inspections and/or tests" while the AC requires the existence of a "Report" that concludes that the LD&IS conforms to the Table 2.2.12-1 provisions.

The generic NRC concern with this approach is as follows:

• This functional arrangement ITAAC does not comport with the two related "functional arrangement" definitions quoted above.

• The ITAAC constrains "functional arrangement" to that which is described in Table 2.2.12-1. (Using this approach, a walkdown inspection of the system may not even be required.)

• The ITAAC criteria listed in Table 2.2.12-1 expand the "functional arrangement" attributes to include the need for analysis (e.g., seismic), design feature (e.g., fail-safe, isolation) validation, and test results that are not specifically identified as appropriate ITA and AC details. (Using this approach, a typical as-built walkdown inspection would certainly not be sufficient to verify ITAAC completion.)

• This ESBWR approach for these ITAAC not only contradicts the Tier 1 Definitions, it renders the use of "functional arrangement" to be all those criteria listed in each separate system table, and only those attributes that are listed.

• This approach does not appear to provide proper recognition of the unique importance and individuality of separate ITAAC requirements. Does not the seismic qualification (analyses and type testing, as applicable) deserve its own ITAAC line item? Should not the component and system isolation and fail-safe features be handled as separate lines items (as applicable) because they are distinct from the seismic requirements? If testing is required to confirm specific quantitative results (as listed in Table 2.2.12-1), should this not be a separate ITAAC line item?

The example discussed above for the LD&IS, using Tables 2.2.12-1 and 2.2.12-5 for the one system ITAAC, is not the only occurrence of the problematic use of "functional arrangement" verification. In some cases (e.g., for the SLC system using Tables 2.2.4-1 and 2.2.4-6, Item 13), theSeismic Category I requirement is included both in the "functional arrangement" table and as a separate line item in the ITAAC table. In other cases, (e.g., for the RSS system using Tables 2.2.6-1 and 2.2.6-3), the "functional arrangement" table indicates a system is seismic, but there is no separate seismic ITAAC (even though, unlike the LD&IS, there may be other system ITAAC).

Therefore, based upon the examples provided above and the noted inconsistencies with the definitions for "Functional Arrangement" and "Verification of functional arrangement", the NRC requests that GEH review and reevaluate the use of the system Functional Arrangement Tables. The NRC staff expects that the use of "functional arrangement" ITAAC would comport with the definitions provided in Tier 1 and quoted above; and thus would involve the type of verification activities that could checked with as-built system walkdown inspections, independent measurements, and/or visual examinations and/or location checks.

With regard to the ESBWR "Functional Arrangement" Tables that accompany many systems, the NRC staff expects that unique and diverse technical attributes (such as analyses and test criteria) would be reevaluated for the purpose of being combined and/or separated, as applicable. into their own distinct ITAAC line items. If an attribute is listed in both in the "Functional Arrangement" Table, and also as a separate ITAAC line item (e.g., the SLC system "seismic" example noted above), this would be considered an unnecessary and redundant requirement.

In summary, the NRC staff requests that the current. extensive use of Functional Arrangement Tables for the ESBWR DCD Draft Tier 1 (Revision 06) be reconsidered to make it not only more consistent, but also more compliant with the standard definitions and accepted usage of "functional arrangement" ITAAC. In accommodating this *request. The NRC staff believes that improvements to the ITAAC, for "inspectability", appropriate language interpretation, and final acceptability standpoints, will be the result.*

GEH Response

Concur. The functional arrangement tables will be revised to remove those items that describe components or features that would require tests or analyses to verify. Items that will be removed from the functional arrangement tables fit into one of two categories: (1) new ITAAC required, or (2) component or feature is redundant to, i.e., demonstrated by an existing ITAAC, or not otherwise suitable for inspection (e.g., by as-built system walkdown inspections, independent measurements, and/or visual examinations and/or location checks). Category (1) items will be added to the design description as functional requirements (or to another table as a new function) and to the ITAAC table at the end of the subsection. Category (2) items will be deleted from the Functional Arrangement table.

The following general editorial changes will be made in the design description. The phrase “equipment qualification” will be revised to “environmental and seismic qualification” to match the title of Section 3.8 and the pertinent software project associated with Section 3.2 will be shown.

No changes will be made to the contents of the Functional Arrangement tables to delete information that is typically shown on the other simplified figures in the DCD, such as, seismic category. The functional identification of seismic category on a functional arrangement figure or functional arrangement table is made for the convenience of the inspector. DCD Tier 2, Tables 3.2-1 and 3.11-1, list the structures, systems, and components subject to seismic qualification. Separate ITAAC for seismic qualification of piping systems is shown for the relevant mechanical equipment in various subsections within DCD Tier 1. Separate ITAAC covering the equipment qualification program is shown in DCD Tier 1, Section 3.8.

Specific changes that will be made in each subsection are described below:

Table 2.2.1-1:

1. Deleted “RC&IS equipment provides the capability to perform the FMCRD-related surveillance tests, including periodic individual CRDS HCU scram performance testing” requirement redundant to function in Table 2.2.1-2, Rod Control and Information System Dedicated Operator Interface (RC&IS DOI).
2. Deleted “RC&IS is capable of continued operation when different subsystems of RC&IS are bypassed” and added it to Table 2.2.1-5.

Table 2.2.1-5:

1. Added “RC&IS is capable of continued operation when different subsystems of RC&IS are bypassed using the following bypass functions” from Table 2.2.1-1.

<u>Table 2.2.1-6:</u>

1. Item 1 and 2 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement and functional groups.
2. Items 3, 4, and 5, revised the column Inspections, Tests, and Analyses, to a single verification method, i.e., to only tests as shown.
3. In the column Acceptance Criteria, revised specific-type of reports to just reports.

<u>Section 2.2.2:</u>

1. Editorial revision of “equipment qualification” to “environmental and seismic qualification”.

<u>Table 2.2.2-1:</u>

1. Deleted “FMCRDs are capable of rapid hydraulic insertion of the CRs during ATWS peak reactor pressure transient”. Redundant ITAAC because scram insertion rate is tested by the ITAAC in Table 2.2.2-7, Item 12.
2. Deleted “FMCRDs are capable of maintaining RCPB continuously at the RPV design pressure and briefly during the ATWS peak reactor pressure transient”. Maintaining RCPB continuously is a function of the negative reactivity coefficient obtained as a result of scram insertion rate. Redundant ITAAC because scram insertion rate is tested by the ITAAC in Table 2.2.2-7, Item 12.
3. Deleted “FMCRD rotation, sufficient to decouple the CR, is precluded when fuel bundles are present”. Preclusion of FMCRD rotation is not verifiable prior to fuel load.
4. Added “are installed to” to provide the orientation of the scram inlet port check valve to facilitate inspection.
5. Deleted “FMCRD have passive safety-related integral internal blowout support that prevents ejection of the FMCRD and the attached control rod” because this feature is not inspectable.
6. Deleted “FMCRD hydraulic scram feature moves a CR pair (except for one single CR) to defined scram positions, starting from loss of signal to the scram solenoid pilot valves in the HCUs, using only the stored energy in the CRDS HCU scram accumulators, in time spans equal to or less than the times defined in Table 2.2.2-2”. Redundant ITAAC because scram insertion rate is tested by the ITAAC in Table 2.2.2-7, Item 12.

<u>Table 2.2.2-7:</u>

1. Item 1 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement.

2. Items 9, and 10, revised the column Inspections, Tests, and Analyses, to a single verification method, i.e., to only tests as shown.
3. In the column Acceptance Criteria, revised specific-type of reports to just reports.
4. Item 16b revised “evaluation” to “analysis”.

<u>Section 2.2.3:</u>

1. Item 1 revised “Table 3.3-3, Item 6” to “Section 3.3” for correctness.

<u>Table 2.2.3-4:</u>

1. Item 1 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement.
2. Items 2, and 3, revised the column Inspections, Tests, and Analyses, to a single verification method, i.e., to only tests as shown.
3. In the column Acceptance Criteria, revised specific-type of reports to just reports.

<u>Section 2.2.4:</u>

1. Restored Functional Requirement (2): “The SLC system automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.4-2” to be consistent with other subsections in Section 2.2. This requirement was previously found in the Design Description.
2. Restored Functional Requirement (3): “The SLC system controls and interlocks are defined in Table 2.2.4 3” to be consistent with other subsections in Section 2.2. This requirement was previously found in the Design Description.
3. Editorial revision of “equipment qualification” to “environmental and seismic qualification”.
4. Clarified reference to the software development program for ATWS/SLC.

<u>Table 2.2.4-1:</u>

1. Deleted “The SLC accumulators and piping upstream of the injection valves conforms with ASME Section III, Class NC.” This item is redundant to Table 2.2.4-6, ITAAC 10.
2. Deleted “The SLC accumulators and piping downstream of the injection valves conforms with ASME Section III, Class NB.” This item is redundant to Table 2.2.4-6, ITAAC 10.
3. Deleted “Electronic equipment, including instrumentation, located in SLC tank room and SLC tank instrumentation room is environmentally qualified.” This item is redundant to Design Description for environmental and seismic qualification. .

Table 2.2.4-6:

1. Restored ITAAC 2 as a test of the automatic functions defined in Table 2.2.4-2.
2. Restored ITAAC 3 as a test of the controls and interlocks defined in Table 2.2.4-3.

Section 2.2.5:

1. Restored Functional Requirement (2): “NMS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.5-2” to be consistent with other subsections in Section 2.2. This requirement was previously found in the Design Description.
2. Restored Functional Requirement (3): “NMS controls, interlocks, and bypasses are defined in Table 2.2.5-3” to be consistent with other subsections in Section 2.2. This requirement was previously found in the Design Description.
3. Added Functional Requirement (8): “NMS divisions fail-safe to a trip condition on critical hardware failure, power failure, or loss of communication failure” that was deleted from Table 2.2.5-1.
4. Added Functional Requirement (9): “The SRNM subsystem monitors neutron flux from the source range to 15% of the reactor rated power” that was deleted from Table 2.2.5-1.
5. Added Functional Requirement (10): “The LPRM subsystems monitor neutron flux from 1 % to 125 % of reactor rated power” that was deleted from Table 2.2.5-1.
6. Editorial revision of “equipment qualification” to “environmental and seismic qualification”.
7. Clarified reference to the software development program as part of the NMS software project.

Table 2.2.5-1:

1. Deleted “NMS divisions fail-safe to a trip condition on critical hardware failure, power failure, or loss of communication failure” in response to RAI 14.3-449. Not an inspection only item. Added to Section 2.2.5 as new Functional Requirement (8).
2. Deleted “NMS logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output when non-coincident logic is not imposed” in response to RAI 14.3-449. Requirement is redundant to the fail-safe statement.
3. Deleted “SRNM trip signal logic is interlocked with Coincident/Non-coincident switch and the Reactor Mode Switch” in response to RAI 14.3-449. Redundant item. The Coincident/Non-coincident switch interlock is shown in Table 2.2.5-2.

4. Deleted “The SRNM subsystem monitors neutron flux from the source range to 15% of the reactor rated power” in response to RAI 14.3-449. Not an inspection only item. Added to Section 2.2.5 as new Functional Requirement (9).
5. Deleted “The LPRM subsystems monitor neutron flux from 1 % to 125 % of reactor rated power” in response to RAI 14.3-449. Not an inspection only item. Added to Section 2.2.5 as new Functional Requirement (10).
6. Deleted “Each APRM division generates the PRNM trip signals for the associated RPS division based on LPRM signals, APRM calculations, OPRM calculations” in response to RAI 14.3-449. The trips are redundant to trips defined in Table 2.2.5-2, where the PRNM trip shows the APRM and OPRM initiator.
7. Deleted “OPRM provides neutron flux oscillation trip signals for the APRM trip signal” in response to RAI 14.3-449. The trips are redundant to trips defined in Table 2.2.5-2, where the PRNM trip shows the OPRM initiators.

Table 2.2.5-4:

1. Item 1 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement.
2. Restored ITAAC 2 as a test of the automatic functions defined in Table 2.2.5-2.
3. Restored ITAAC 3 as a test of the controls, interlocks, and bypasses defined in Table 2.2.5-3.
4. Added ITAAC 8 as a test.
5. Added ITAAC 9 as a test.
6. Added ITAAC 10 as a test.

Section 2.2.6:

1. Editorial revision of “equipment qualification” to “environmental and seismic qualification”.
2. Clarified reference to the software development program as part of the RTIF software project and SSLC/ESF software project.

Table 2.2.6-3:

1. Item 1 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement.
2. Item 2 revised the column Inspections, Tests, and Analyses, to a single verification method, i.e., to only tests as shown.
3. In the column Acceptance Criteria, revised specific-type of reports to just reports.

Section 2.2.7:

1. Added Functional Requirement (8): "The RPS logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output" that was deleted from Table 2.2.7-1.
2. Added Functional Requirement (9): "The RPS is fail-safe such that on loss of redundant divisional electrical power supplies the load drivers of that division change to the tripped state" that was deleted from Table 2.2.7-1.
3. Editorial revision of "equipment qualification" to "environmental and seismic qualification".
4. Clarified reference to the software development program as part of the RTIF software project.

Table 2.2.7-1:

1. Deleted "The RPS logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output". Not an inspection only item. Added to Section 2.2.7 as new Functional Requirement (8).
2. Deleted "The RPS trip actuator load drivers interrupt circuit power to scram pilot solenoids and scram air header dump valves".
3. Deleted "The RPS is fail-safe such that on loss of redundant divisional electrical power supplies the load drivers of that division change to the tripped state". Not an inspection only item. Added to Section 2.2.7 as new Functional Requirement (9).

Table 2.2.7-4:

1. Item 1 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement.
2. Revised ITAAC 2 as a test of the automatic functions defined in Table 2.2.7-2.
3. Revised ITAAC 3 as a test of the controls, interlocks, and bypasses defined in Table 2.2.7-3.
4. Added ITAAC 8 as a test.
5. Added ITAAC 9 as a test.
6. In the column Acceptance Criteria, revised specific-type of reports to just reports.

Table 2.2.9-3:

1. In the column Acceptance Criteria, revised specific-type of reports to just reports.

Section 2.2.12:

1. Restored Functional Requirement (2): "The LD&IS isolation function monitored variables are described in Table 2.2.12-2" to be consistent with other subsections in Section 2.2. This requirement was previously found in the Design Description.
2. Restored Functional Requirement (3): "The LD&IS leakage source monitored variables are described in Table 2.2.12-3" to be consistent with other subsections in Section 2.2. This requirement was previously found in the Design Description.
3. Restored Functional Requirement (4): "The LD&IS controls, interlocks, and bypasses are described in Table 2.2.12-4" to be consistent with other subsections in Section 2.2. This requirement was previously found in the Design Description.
4. Added Functional Requirement (10): "LD&IS isolation functions logic is designed to provide an actuation by requiring coincident trip of at least two divisions to cause the trip output" that was deleted from Table 2.2.12-1.
5. Added Functional Requirement (11): "LD&IS logic is de-energized to initiate the isolation function (i.e., fail-safe)" that was deleted from Table 2.2.12-1.
6. Added Functional Requirement (12): "DW floor drain high conductivity waste (HCW) sump instrumentation is designed with the sensitivity to detect a leakage step-change (increase) of 3.8 liters/min (1.0 gpm) within one hour and to alarm at sump flow rates in excess of 19 liters/min (5 gpm)" that was deleted from Table 2.2.12-1.
7. Editorial revision of "equipment qualification" to "environmental and seismic qualification".
8. Clarified reference to the software development program as part of the RTIF software project and SSLC/ESF software project.

Table 2.2.12-1:

1. Deleted "LD&IS isolation functions logic is designed to provide an actuation by requiring coincident trip of at least two divisions to cause the trip output". Not an inspection only item. Added to Section 2.2.12 as new Functional Requirement (10).
2. Deleted "LD&IS logic is de-energized to initiate the isolation function (i.e., fail-safe)". Not an inspection only item. Added to Section 2.2.12 as new Functional Requirement (11).
3. Deleted "LD&IS logic channels and associated sensors are powered from safety-related power supplies". LD&IS power supplies are associated with the SSLC/ESF that are shown in Table 2.2.13-1.
4. Deleted "DW floor drain high conductivity waste (HCW) sump instrumentation is designed with the sensitivity to detect a leakage step-change (increase) of 3.8

liters/min (1.0 gpm) within one hour and to alarm at sump flow rates in excess of 19 liters/min (5 gpm)". Not an inspection only item. Added to Section 2.2.12 as new Functional Requirement (12).

Table 2.2.12-5:

1. Item 1 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement.
2. Restored ITAAC 2 as a test of the automatic functions defined in Table 2.2.12-2 and split ITAAC 2 into a (MSIV) and b (non-MSIV) parts.
3. Restored ITAAC 3 as a test of the automatic functions defined in Table 2.2.12-3.
4. Restored ITAAC 4 as a test of the controls, interlocks, and bypasses defined in Table 2.2.12-4.
5. Added ITAAC 10 as a test.
6. Added ITAAC 11 as a test.
7. Added ITAAC 12 as a test.

Section 2.2.13:

1. Added Functional Requirement (9): "SSLC/ESF uses "energized-to-trip" and "fail-as-is" logic that was deleted from Table 2.2.13-1.
2. Editorial revision of "equipment qualification" to "environmental and seismic qualification".
3. Clarified reference to the software development program as part of the SSLC/ESF software project.

Table 2.2.13-1:

1. Deleted "SSLC/ESF receives inputs from, and sends outputs to interfacing systems as described in Tables 2.2.13-2 and 2.2.13-3". Duplicates Tables 2.2.13-2 and 2.2.13-3.
2. Deleted "SSLC/ESF uses "energized-to-trip" and "fail-as-is" logic". Not an inspection only item. Added to Section 2.2.13 as new Functional Requirement (9).
3. Deleted "ADS (SRVs and DPVs), ICS, GDCS, and SLC are actuated sequentially and/or in groups" because this item is duplicated in Table 2.2.13-2.
4. Deleted "SSLC/ESF transmits and receives safety-related human system interface (HSI) information as described in Table 3.3-3, Item 6, to and from the safety-related VDUs" because it is redundant to the second item in Table 2.2.13-1.

<u>Table 2.2.13-4:</u>

1. Item 1 revised the column Inspections, Tests, and Analyses, to require only inspection(s) of the functional arrangement.

2. Items 2, and 3, revised the column Inspections, Tests, and Analyses, to a single verification method, i.e., to only tests as shown.

3. In the column Acceptance Criteria, revised specific-type of reports to just reports.

4. Added ITAAC 9 as a test.

<u>Section 2.2.14:</u>

1. Added Functional Requirement (12): "ATWS/SLC system logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output" that was deleted from Table 2.2.14-1.

2. Added Functional Requirement (13): "Each ATWS/SLC system division is powered from its respective safety-related power supply" that was deleted from Table 2.2.14-1.

3. Added Functional Requirement (14): "DPS is powered from nonsafety-related load group power supplies" that was deleted from Table 2.2.14-1.

4. Added Functional Requirement (15): "DPS triple redundant digital controllers require agreement in at least two channels out of three channels for a coincident trip actuation" that was deleted from Table 2.2.14-1.

5. Added Functional Requirement (16): "DPS logic is "energize-to-actuate" that was deleted from Table 2.2.14-1.

6. Clarified reference to the software development program as part of the ATWS/SLC software project.

<u>Table 2.2.14-1:</u>

1. Deleted "ATWS/SLC system logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output". Not an inspection only item. Added to Section 2.2.14 as new Functional Requirement (12).

2. Deleted "Each ATWS/SLC system is powered by a divisionally separated safety-related power supply". Not an inspection only item. Added to Section 2.2.14 as new Functional Requirement (13).

3. Deleted portion of sentence "… is powered from nonsafety-related load group power supplies". Not an inspection only item. Added to Section 2.2.14 as new Functional Requirement (14).

4. Deleted “DPS triple redundant digital controllers require agreement in at least two channels out of three channels for a coincident trip actuation”. Not an inspection only item. Added to Section 2.2.14 as new Functional Requirement (15).

5. Deleted “DPS logic is “energize-to-actuate””. Not an inspection only item. Added to Section 2.2.14 as new Functional Requirement (16).

<u>Table 2.2.14-4:</u>

1. Item 3 revised the column Inspections, Tests, and Analyses, to a single verification method, i.e., to only tests as shown.
2. Items 1, 2, 3, and 4, in the column Acceptance Criteria, revised specific-type of reports to just report(s).
3. Added ITAAC 12 as a test.
4. Added ITAAC 13 as a test.
5. Added ITAAC 14 as a test.
6. Added ITAAC 15 as a test.
7. Added ITAAC 16 as a test.

<u>Section 2.13.1:</u>

1. Editorial revision of “environmental qualification” to “environmental and seismic qualification”.

<u>Section 2.13.3:</u>

1. Editorial revision of “environmental qualification” to “environmental and seismic qualification”.

<u>Section 2.13.5:</u>

1. Revised “equipment qualification” to “environmental and seismic qualification” in Design Description.
2. Deleted Functional Requirement (8) as a result of adding reference to Section 3.8 in Design Description.

<u>Section 2.15.1:</u>

1. Revised “equipment qualification” to “environmental and seismic qualification” in Design Description.

<u>Section 2.15.4:</u>

1. Revised “equipment qualification” to “environmental and seismic qualification” in Design Description.

Table 2.15.4-2:

1. Deleted ITAAC 8 as a result of adding reference to Section 3.8 in Design Description.

Section 2.15.5:

1. Deleted Functional Requirement (2) because it is duplicated by an existing reference to Subsection 2.15.1 in the Design Description.

Table 2.15.5-2:

1. Deleted ITAAC 2 as a result of adding reference to Subsection 2.15.1 in Design Description.

Section 2.15.7:

1. Added Design Description “The environmental and seismic qualification of CMS components is addressed in Section 3.8.”
2. Added Design Description “The containment isolation portions of the CMS system are addressed in Tier 1, Subsection 2.15.1.”
3. Added Design Description “CMS software is developed in accordance with the software development program described in Section 3.2 as part of SSLC/ESF software project.”
4. Deleted Functional Requirements (7), (8), and (9) as a result of adding reference to Section 3.8 in Design Description.

Table 2.15.7-2:

1. Deleted ITAAC 7 as a result of adding reference to Section 3.8 in Design Description.
2. Deleted ITAAC 8 as a result of adding to Design Description.
3. Deleted ITAAC 9 as a result of adding to Design Description.

DCD Impact

DCD Tier 1, Sections 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.2.7, 2.2.9, 2.2.12, 2.2.13, 2.2.14, 2.13.1, 2.13.3, 2.13.5, 2.15.1, 2.15.4, 2.15.5, 2.15.7; Tables 2.2.1-1, 2.2.1-5, 2.2.1-6, 2.2.2-1, 2.2.2-7, 2.2.3-4, 2.2.4-1, 2.2.4-6, 2.2.5-1, 2.2.5-4, 2.2.6-3, 2.2.7-1, 2.2.7-4, 2.2.9-4, 2.2.12-1, 2.2.12-5, 2.2.13-1, 2.2.13-4, 2.2.14-1, 2.2.14-4, 2.15.4-2, 2.15.5-2, and 2.15.7-2, will be revised as noted in the attached markup.

ENCLOSURE 2

DCD Tier 1, Rev 6 MARKUPS

Table 2.2.1-1

RC&IS Functional Arrangement

RC&IS is dual-redundant architecture divided into major functional groups as defined in Table 2.2.1-2.
RC&IS Dedicated Operator Interface (DOI) is located in the MCR.
RC&IS equipment is located in a mild environment rooms within the Reactor Building (RB) and Control Building (CB).
RC&IS equipment is powered by separate, non-divisional AC power sources with at least one power source being a nonsafety-related uninterruptible power supply.
~~RC&IS equipment provides the capability to perform the FMCRD-related surveillance tests, including periodic individual CRDS HCU scram performance testing.~~ (Deleted)
~~RC&IS is capable of continued operation when different subsystems of RC&IS are bypassed.~~ (Deleted)

Table 2.2.1-5

RC&IS Controls, Interlocks, and Bypasses

Function	Description
Control	Single / Ganged mode selection. Automatic / semi-automatic / manual mode selection. Normal / notch / continuous CR movement mode Insert / Withdraw. SCRRI/SRI manual initiation. ARI manual initiation (DPS)
Interlock	Single / Dual Rod Sequence Restriction Override (S/DRSRO) allows an operator to place up to two CR associated with the same HCU in S/DRSRO for scram time surveillance testing. Rod Inoperable Bypass condition allows up to 8 CR to be selected with the Reactor Mode Switch (RMS) in RUN position (RPS). Rod Inoperable Bypass condition allows up to 54 CR to be selected with the RMS in REFUEL position (RPS).
Bypass	RC&IS is capable of continued operation when different subsystems of RC&IS are bypassed using the following bypass functions: Rod position detector channel bypass. S/DRSRO. Rod Inoperable Bypass selection. RCC (communication) channel bypasses. ATLM channel bypass. RWM channel bypass. RAPI channel bypass.

Table 2.2.1-6

ITAAC For The Rod Control and Information System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. RC&IS functional arrangement is defined in Table 2.2.1-1.	~~Test(s) and i~~Inspection(s) of the as-built system will be performed.	~~Test and inspection r~~Report(s) ~~document~~ exist and conclude that the as-built system conforms with the functional arrangement defined in Table 2.2.1-1.
2. RC&IS is divided into major functional groups as defined in Table 2.2.1-2.	~~Test(s) and i~~Inspection(s) of the as-built system will be performed.	~~Test and inspection r~~Report(s) ~~document~~ exist and conclude that the as-built system is divided into major functional groups as defined in Table 2.2.1-2.
3. RC&IS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.1-3.	Test(s) ~~and type test(s)~~ will be performed for the initiators on the as-built RC&IS using simulated signals and actuators ~~to perform~~ for the automatic functions ~~listed~~ defined in Table 2.2.1-3.	~~Test and type test r~~Report(s) ~~document~~ exist and conclude that the RC&IS is capable of performing the automatic functions ~~for the initiators~~ as defined in Table 2.2.1-3.
4. RC&IS rod block functions and the permissive conditions under which the rod block is active are defined in Table 2.2.1-4.	Test(s) ~~and type test(s)~~ will be performed using simulated signals and manual actions to confirm that the rod withdrawal and insertion commands are blocked as defined in Table 2.2.1-4.	~~Test and type test r~~Report(s) ~~document~~ exist and conclude that the rod block functions defined in Table 2.2.1-4 are performed in response to simulated signals and manual actions.
5. RC&IS controls, interlocks, and bypasses are defined in Table 2.2.1-5.	~~Inspection(s), test(s) and type t~~Test(s) will be performed on the as-built system using simulated signals and manual actions.	~~Inspection, test and type test r~~Report(s) ~~document~~ exist and conclude that the system controls, interlocks, and bypasses exist, can be retrieved in the main control room, or are performed in response to simulated signals and manual actions as defined in Table 2.2.1-5.

2.2.2 Control Rod Drive System

Design Description

The control rod drive (CRD) system, manually and automatically upon command from the RPS, DPS, and RC&IS, executes rapid control rod (CR) insertion (scram), performs fine CR positioning (reactivity control), detects CR separation (prevent rod drop accident), limits the rate of CR ejection due to a break in the CR pressure boundary (prevent fuel damage), and supplies high pressure makeup water to the reactor during events in which the feedwater system is unable to maintain reactor water level.

CRD system minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Tier 1 Tables 2.2.2-1 and 2.2.2-6 is addressed in Subsection 2.2.15.

The environmental and seismic qualification of CRDS components defined in Tables 2.2.2-1, 2.2.2-5, and 2.2.2-6, is addressed in Section 3.8.

Functional Arrangement

(1) The functional arrangement of the CRD System comprises three major functional groups: fine motion control rod drive (FMCRD), hydraulic control unit (HCU), and CRD hydraulic subsystem ~~(CRDHS)~~, as defined in Table 2.2.2-1 and shown in Figure 2.2.2-1.

Functional Requirements

(2) ~~ASME Code Section III~~a1. The components identified in Table 2.2.2-5 as ASME Code Section III are designed in accordance with ASME Code Section III requirements and seismic Category I requirements.

a2. The components identified in Table 2.2.2-5 as ASME Code Section III shall be reconciled with the design requirements.

a3. The components identified in Table 2.2.2-5 as ASME Code Section III are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

b1. The piping identified in Table 2.2.2-5 as ASME Code Section III is designed in accordance with ASME Code Section III requirements and seismic Category I requirements.

b2. The as-built piping identified in Table 2.2.2-5 as ASME Code Section III shall be reconciled with the with the piping design requirements.

b3. The piping identified in Table 2.2.2-5 as ASME Code Section III is fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

(3) ~~Pressure Boundary Welds~~a. Pressure boundary welds in components defined in Table 2.2.2-5 as ASME Code Section III meet ASME Code Section III requirements.

b. Pressure boundary welds in piping defined in Table 2.2.2-5 as ASME Code Section III meet ASME Code Section III requirements.

Table 2.2.2-1

CRDS Functional Arrangement

FMCRDs, including the equipment defined in Table 2.2.2-5 and 2.2.2-6, are safety-related, Seismic Category I.
~~FMCRDs are capable of rapid hydraulic insertion of the CRs during ATWS peak reactor pressure transient.~~ (Deleted) ~~FMCRDs are capable of maintaining RCPB continuously at the RPV design pressure and briefly during the ATWS peak reactor pressure transient.~~(Deleted)
FMCRDs have continuous CR position indication sensors that detect CR position based on motor rotation. FMCRDs have scram position indication switches that detect intermediate and scram completion CR positions. FMCRDs have a bayonet CR coupling mechanism that requires a minimum rotation to decouple.
~~FMCRD rotation, sufficient to decouple the CR, is precluded when fuel bundles are present.~~(Deleted)
FMCRDs have spring-loaded latches in the hollow piston that engage slots in the guide tube to prevent rotation of the bayonet coupling except at predefined positions. FMCRDs have redundant safety-related rod separation switches that detect separation of the FMCRD from the CR. FMCRDs have a magnetic coupling that provides seal-less, leak-free operation of the CRD mechanism. FMCRDs have safety-related holding brakes that engage on loss of power. FMCRDs~~d~~ have safety-related scram inlet port check valves that are installed to close under reverse flow.
~~FMCRD have passive safety-related integral internal blowout support that prevents ejection of the FMCRD and the attached control rod.~~(Deleted) ~~FMCRD hydraulic scram feature moves a CR pair (except for one single CR) to defined scram positions, starting from loss of signal to the scram solenoid pilot valves in the HCUs, using only the stored energy in the CRDS HCU scram accumulators, in time spans equal to or less than the times defined in Table 2.2.2-2.~~(Deleted)
HCUs are safety-related, Seismic Category I. HCUs are located in four dedicated rooms in the Reactor Building (RB).

Table 2.2.2-7

ITAAC For The Control Rod Drive System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement of the CRD System comprises three major functional groups: fine motion control rod drive (FMCRD), hydraulic control unit (HCU), and CRD hydraulic subsystem ~~(CRDHS)~~, as defined in Table 2.2.2-1 and shown in Figure 2.2.2-1.	Inspection(s)~~, test(s), and type test(s)~~ of the as-built system will be conducted.	~~A r~~Report(s) exist~~s~~ ~~that~~and ~~documents~~ conclude the results of inspection(s)~~, test(s), and type test(s)~~ that confirm the functional arrangement defined in Table 2.2.2-1 and as shown in Figure 2.2.2-1. For components and piping identified in Table 2.2.2-5 as ASME Code Section III, this report is an ASME Code report.
2.~~ ASME Code Section III~~ a1. The components i~~n~~dentified in Table 2.2.2-5 as ASME Code Section III are designed in accordance with ASME Code Section III requirements and Seismic Category I requirements.	Inspection of ASME Code Design Reports (NCA-3350) and required documents will be conducted.	ASME Code Design Report(s) (NCA-3550) (certified, when required by ASME Code) exist and conclude that the design of the CRD system components identified in Table 2.2.2-5 as ASME Code Section III complies with the requirements of the ASME Code, Section III, including for those stresses and loads related to fatigue (including environmental effects), thermal expansion, seismic, and combined.

Table 2.2.2-7

ITAAC For The Control Rod Drive System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. The FMCRD is capable of positioning CR incrementally and continuously over its entire range.	Type test(s) will be performed of the motor run-in and withdrawal function on the FMCRD using a simulated CR.	~~Type test r~~Report(s) ~~document~~ exist and conclude that FMCRD is capable of positioning CR incrementally ~~in minimum increments of 36.] mm (1.44 in.)~~ and continuously over its entire range ~~at a speed of 28 ± 5 mm/sec~~.
7. Valves defined in Table 2.2.2-5 and 2.2.2-6 as having an active safety-related function open, close, or both open and close under differential pressure, fluid flow, and temperature conditions.	Tests of installed valves will be performed for opening, closing, or both opening and closing under system preoperational differential pressure, fluid flow, and temperature conditions.	~~Test r~~Report(s) ~~document~~ exist and conclude that, upon receipt of the actuating signal, each valve opens, closes, or both opens and closes, depending upon the valve's safety function.
8a. The CRD hydraulic subsystem ~~The HP_CRD~~ has a high-pressure makeup mode of operation that injects water to the RPV via the RWCU/SDC return path.	Test(s) of the CRD hydraulic subsystem ~~HP_CRD~~ high-pressure makeup mode of operation will be conducted on the as-built system verifying that water is injected to the RPV via the RWCU/SDC return path.	~~Test r~~Report(s) ~~document~~ exist and conclude that the CRD hydraulic subsystem ~~HP_CRD~~ high-pressure makeup mode of operation injects water to the RPV via the RWCU/SDC return path.
8b. The CRD hydraulic subsystem has a safety-related isolation capability terminating injection into the RPV.	Test(s) of the CRD hydraulic subsystem high pressure makeup mode of operation will be conducted on the as-built system verifying that water is terminated to the RPV via the safety-related isolation.	Report(s) exist and conclude that the CRD hydraulic subsystem high pressure makeup mode of operation terminates water to the RPV via the safety-related isolation.

Table 2.2.2-7

ITAAC For The Control Rod Drive System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8c. The CRD hydraulic subsystem has an isolation bypass capability allowing injection to the RPV.	Test(s) of the CRD hydraulic subsystem high pressure makeup mode of operation will be conducted on the as-built system verifying that water is injected to the RPV via the isolation bypass.	Report(s) exist and conclude that the CRD hydraulic subsystem high pressure makeup mode of operation injects water to the RPV via the isolation bypass.
9. CRD system automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.2-3.	~~Inspections will be performed to verify that the as-built CRD system conforms with the automatic functions, initiators, and associated interfacing systems defined in Table 2.2.2-3.~~ Test(s) ~~and type test(s)~~ will be performed on the as-built system using simulated signals initiated from all of the associated interfacing as-built systems specified in Table 2.2.2-3.	~~Inspection report(s) document that the as-built CRD system conforms with the automatic functions, initiators, and associated interfacing systems defined in Table 2.2.2-3.~~ ~~Test and type test r~~Report(s) document the system is capable of performing the automatic functions defined in Table 2.2.2-3 using simulated signals initiated from all of the associated interfacing as-built systems specified in Table 2.2.2-3.
10. CRD system controls and interlocks are defined in Table 2.2.2-4.	Test(s) ~~and type test(s)~~ will be performed on the as-built system using simulated signals.	~~Test and type test r~~Report(s) exist and conclude ~~document~~ that the system controls and interlocks exist, can be retrieved in the main control room, or are performed in response to simulated signals and manual actions as defined in Table 2.2.2-4.

Table 2.2.2-7

ITAAC For The Control Rod Drive System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11. CRD system minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.(Deleted)	See Section 3.3.	See Section 3.3.
12. CRD maximum allowable scram times are defined in Table 2.2.2-2.	Test(s) will be performed of each CRD control rod pair scram function using simulated signals.	Test rReport(s) document exist and conclude that scram times for each control rod pair are less than or equal to the maximum allowable scram times defined in Table 2.2.2-2.
13. Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Tables 2.2.2-1, 2.2.2-5, and 2.2.2-6, is addressed in Subsection 2.2.15.(Deleted)	See Subsection 2.2.15.	See Subsection 2.2.15.
14. The equipment qualification of CRDS components defined in Tables 2.2.2-1, 2.2.2-5, and 2.2.2-6, is addressed in Section 3.8.(Deleted)	See Section 3.8.	See Section 3.8.
15. The FMCRD has an electro-mechanical brake with a minimum required holding torque on the motor drive shaft.	Tests of each FMCRD brake will be conducted in a test facility	The FMCRD electro-mechanical brake has a minimum required holding torque of 49 N. m (36 ft-lb_f) on the motor drive shaft.

Table 2.2.2-7

ITAAC For The Control Rod Drive System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
16a. Valves on lines attached to the RPV that require maintenance have maintenance valves installed such that freeze seals will not be required.	Inspections of piping design isometric drawings will be conducted.	Report(s) exist and conclude that, based on a review of piping design isometric drawings, maintenance can be performed on valves without the use of freeze seals
16b. The as-built location of valves on lines attached to the CRD system that require maintenance shall be reconciled to design requirements.	A reconciliation analysis of valves on lines attached to the RPV system that require maintenance using as-designed and as-built information will be performed.	Report(s) exist and conclude that design reconciliation has been completed for the as-built location of valves relative to the design requirements. The report documents the results of the reconciliation analysis.
17. HP CRD makeup water isolation valves are normally open and close on a signal and on loss of air.	Tests of the as-built HP CRD makeup water isolation valves will be performed	Report(s) exist and conclude that as-built HP CRD makeup water isolation valves are normally open and close on a signal and on loss of air.
18. HP CRD makeup water isolation bypass valves are normally closed and open on a signal.	Tests of the as-built HP CRD makeup water isolation bypass valves will be performed.	Report(s) exist and conclude that as-built HP CRD makeup water isolation bypass valves are normally closed and open on a signal.

2.2.3 Feedwater Control System

Design Description

The Feedwater Control System (FWCS), automatically or manually, controls RPV water level by modulating the supply of feedwater flow to the RPV, the low flow control valve (LFCV), individual reactor feed pump ASD, or the RWCU/SDC system overboard control valve (OBCV).

The FWCS changes reactor power by automatically or manually controlling FW temperature by modulating the 7th FW heater steam heating valves or the high-pressure FW heater bypass valves.

FWCS minimum inventory of alarms, displays, controls and status indications in the main control room are addressed in Section 3.3.

Functional Arrangement

(1) FWCS functional arrangement is defined in Table 2.2.3-1.

Functional Requirements

(2) FWCS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.3-2.

(3) FWCS controls are defined in Table 2.2.3-3.

(4) ~~FWCS minimum inventory of alarms, displays, controls and status indications in the main control room are addressed in Table 3.3-1, Item 6.~~(Deleted)

(5) FWCS controllers are fault tolerant.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.3-4 defines the inspections, tests, and/or analyses, together with associated acceptance criteria for the FWCS.

Table 2.2.3-4

ITAAC For The Feedwater Control System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The FWCS functional arrangement is defined in Table 2.2.3-1.	Inspections ~~and tests~~ will be performed on the FWCS functional arrangement using simulated signals and simulated actuators.	~~Inspection and test r~~Report(s) exist and conclude~~document~~(s) that FWCS functional arrangement is as defined in Table 2.2.3-1.
2. FWCS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.3-2.	Test(s) ~~and type test(s)~~ will be performed on the as-built system using simulated signals.	~~Test and type test r~~Report(s) exist and conclude ~~document~~ the system performs the functions defined in Table 2.2.3-2.
3. FWCS controls are defined in Table 2.2.3-3.	~~Inspection(s), t~~Test(s) ~~and type test(s)~~ will be performed on the as-built system using simulated signals and manual actions.	~~Test and type test r~~Report(s) exist and conclude ~~document~~ that the system controls and interlocks exist, can be retrieved in the main control room, or are performed in response to simulated signals and manual actions as defined in Table 2.2.3-3.
4. ~~FWCS minimum inventory of alarms, displays, controls and status indications in the main control room are addressed in Table 3.3-1, Item 6.~~(Deleted)	~~See Table 3.3-1, Item 6.~~	~~See Table 3.3-1, Item 6.~~

Table 2.2.3-4

ITAAC For The Feedwater Control System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. FWCS controllers are fault tolerant.	i. Test(s) will be performed simulating failure of each FWCS temperature controller.	i. Test and type test rReport(s) exist and conclude document that failure of any one FWCS temperature controller will not affect FWCS output.
	a.ii.b.Test(s) will be performed simulating failure of each FWCS level controller.	a.iib.Test and type test rReport(s) exist and conclude document that failure of any one FWCS level controller will not affect FWCS output.
	iii. Test(s) will be performed simulating discrepancy between field voter output and FTDC output of each FWCS level controller.	iii. Report(s) exist and conclude that "Lock-up" signal will be sent to ASD following discrepancy between field voter output and FTDC output of each FWCS level controller.
	iv. Test(s) will be performed simulating discrepancy between field voter output and FTDC output of each FWCS temperature controller.	iv. Report(s) exist and conclude that "Lock-Up" signal will be sent to the modulating steam admission valves of the seventh stage feedwater heater, and the modulating heater bypass valves following discrepancy between field voter output and FTDC output of each FWCS temperature controller.

2.2.4 Standby Liquid Control System

Design Description

The Standby Liquid Control (SLC) system is an alternative means to reduce core reactivity to ensure complete shutdown of the reactor core from the most reactive conditions at any time in core life, and provides makeup water to the RPV to mitigate the consequences of a Loss-of-Coolant-Accident (LOCA).

The SLC system minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.4-1 is addressed in Subsection 2.2.15.

The environmental and seismic qualification of SLC system components defined in Table 2.2.4-1 is addressed in Section 3.8.

SLC software is developed in accordance with the software development program described in Section 3.2 as part of the ATWS/SLC software project and SSLC/ESF software project.

Functional Arrangement

(1) The SLC system functional arrangement is defined in Table 2.2.4-1 and shown in Figure 2.2.4-1.

Functional Requirements

(2) The SLC system automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.4-2.

(3) The SLC system controls and interlocks are defined in Table 2.2.4-3.

(4) ~~The SLC system minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.~~(Deleted)

(5) ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.4-1 is addressed in Subsection 2.2.15.~~(Deleted)

(6) ~~The equipment qualification of SLC system components defined in Table 2.2.4-1 is addressed in Section 3.8.~~(Deleted)

(7) During an ATWS, the SLC system shall be capable of injecting borated water into the RPV at flowrates that assure rapid power reduction.

(8) The SLC system shall be capable of injecting borated water for use as makeup water to the RPV in response to a Loss-of-Coolant-Accident (LOCA).

(9) The redundant injection shut-off valves shown in Figure 2.2.4-1 as V1, V2, V3, and V4 are automatically closed by low accumulator level signals from the respective accumulator.

(10) ~~ASME Code Section III~~a1.The components identified in Table 2.2.4-4 as ASME Code Section III are designed in accordance with ASME Code Section III requirements and seismic Category I requirements.

Table 2.2.4-1

SLC System Functional Arrangement

The SLC system is safety-related, Seismic Category I.
The SLC system comprises two 50% capacity trains with an accumulator tank for each train.
Each accumulator tank has an injectable liquid volume of at least 7.8 m^3 (2061 gal).
Each accumulator tank has a cover gas volume above the liquid of at least 14.8 m^3 (523 ft^3).
Each accumulator tank is capable of maintaining an initial nitrogen cover gas absolute pressure of least 14.82 MPa (2150 psia).
Each SLC train has redundant squib-type injection valves, installed in parallel, connected to a common injection line.
Each injection line is connected to manifolds within the RPV core region, which have injection nozzles in each quadrant.
Each accumulator has redundant level and pressure instrumentation.
Each accumulator has redundant shut-off valves, installed in series, which automatically close after injection.
Each accumulator has a pressure relief line and valve.
Each accumulator has vent piping and valves to permit depressurization of each accumulator.
Each accumulator has piping and valves used for initial and periodic solution addition and gas (nitrogen) charging.
Each SLC system train is powered by a separate safety-related power supply.
~~The SLC accumulators and piping upstream of the injection valves conforms with ASME Section III, Class NC.~~ (Deleted)
~~The injection valves and piping downstream of the injection valves conforms with ASME Section III, Class NB.~~ (Deleted)
~~Electronic equipment, including instrumentation, located in SLC tank room and SLC tank instrumentation room is environmentally qualified.~~ (Deleted)

Table 2.2.4-6

ITAAC For The Standby Liquid Control System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement of the SLC system is defined in Table 2.2.4-1 and shown in Figure 2.2.4-1.	Inspection(s), test(s), and type test(s) of the as-built system will be performed.	Report(s) exist and concludedocument(s) that the as-built system conforms to the functional arrangement defined in Table 2.2.4-1 and shown in Figure 2.2.4-1. For components and piping identified in Table 2.2.4-4 as ASME Code Section III, this report is an ASME Code report.
2. The SLC system automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.4-2.	Test(s) will be performed on the as-built SLC system Train A and Train B Logic Controllers using simulated signals and actuators for the automatic functions defined in Table 2.2.4-2.See Subsection 2.2.15	Report(s) exist and conclude that the SLC system Train A and Train B Logic Controllers are capable of performing the automatic functions defined in Table 2.2.4-2. See Subsection 2.2.15
3. The SLC system controls and interlocks are defined in Table 2.2.4-3.	Test(s) will be performed on the as-built SLC system Train A and Train B Logic Controllers using simulated signals and actuators for the controls and interlocks defined in Table 2.2.4-3.See Subsection 2.2.15	Report(s) exist and conclude that the SLC system Train A and Train B Logic Controllers are capable of performing the controls and interlocks defined in Table 2.2.4-3. See Subsection 2.2.15
4. The SLC system minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.(Deleted)	See Section 3.3.	See Section 3.3.

2.2.5 Neutron Monitoring System

Design Description

The Neutron Monitoring System (NMS) monitors thermal neutron flux and supports the Reactor Protection System (RPS).

NMS minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.5-1 is addressed in Subsection 2.2.15.

The environmental and seismic qualification of NMS components defined in Table 2.2.5-1 is addressed in Section 3.8.

NMS software is developed in accordance with the software development program described in Section 3.2 as part of the NMS software project.

Functional Arrangement

(1) NMS functional arrangement is defined in Table 2.2.5-1.

Functional Requirements

(2) NMS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.5-2.

(3) NMS controls, interlocks, and bypasses are defined in Table 2.2.5-3.

(4) ~~NMS minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.~~ (Deleted)

(5) ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.5-1 is addressed in Subsection 2.2.15.~~ (Deleted)

(6) ~~The equipment qualification of NMS components defined in Table 2.2.5-1 is addressed in Section 3.8.~~ (Deleted)

(7) ~~NMS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)

(8) NMS divisions fail-safe to a trip condition on critical hardware failure, power failure, or loss of communication failure.

(9) The SRNM subsystem monitors neutron flux from the source range to 15% of the reactor rated power.

(10) The LPRM subsystems monitor neutron flux from 1 % to 125 % of reactor rated power.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.5-4 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the NMS.

Table 2.2.5-1

NMS Functional Arrangement

NMS comprises the safety-related startup range neutron monitor (SRNM) subsystem and the power range neutron monitor (PRNM) subsystem; and the nonsafety-related automatic fixed in-core probe (AFIP) subsystem and multi-channel rod block monitor (MRBM) subsystem.
NMS SRNM and PRNM subsystems are safety-related.
NMS is a four division, redundant, logic based system.
~~NMS divisions fail-safe to a trip condition on critical hardware failure, power failure, or loss of communication failure.~~ (Deleted)
NMS controllers and their preamplifiers are located in mild environments in divisionally separate rooms in the Control Building (CB) and Reactor Building (RB).
~~NMS logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output when non-coincident logic is not imposed.~~(Deleted)
Each NMS division is powered by its divisional safety-related UPS power supply.
The PRNM subsystem comprises the local power range monitors (LPRM), the average power range monitors (APRM), and the oscillation power range monitors (OPRM).
~~SRNM trip signal logic is interlocked with Coincident/Non-coincident switch and the Reactor Mode Switch.~~(Deleted)
The SRNM subsystem has 12 SRNM channels, each channel having one fixed in-core regenerative fission chamber sensor.
~~The SRNM subsystem monitors neutron flux from the source range to 15% of the reactor rated power.~~(Deleted)
The LPRM detector assemblies, SRNM detector assemblies, wiring, cables, and connector are located in a harsh environment within the lower DW in the RB.
LPRM provides signals that are proportional to the local neutron flux.
LPRM subsystem comprises 64 assemblies, divided into four divisions, distributed uniformly throughout the core, each assembly having four uniformly spaced fixed in-core fission chamber detectors and seven AFIP sensors .
The LPRM detector assemblies have a design pressure of 8.62 MPa g (1250 psig).
~~The LPRM subsystems monitor neutron flux from 1 % to 125 % of reactor rated power.~~(Deleted)

Table 2.2.5-1

NMS Functional Arrangement

~~Each APRM division generates the PRNM trip signals for the associated RPS division based on LPRM signals, APRM calculations, OPRM calculations.~~(Deleted) ~~OPRM provides neutron flux oscillation trip signals for the APRM trip signal.~~(Deleted)

Table 2.2.5-4

ITAAC For The Neutron Monitoring System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. NMS functional arrangement is defined in Table 2.2.5-1.	Inspection(s), test(s), and/or type test(s) will be performed on the as-built configuration as described in Table 2.2.5-1.	Inspection, test, and/or type test rReport(s) documentexist and conclude(s) that the system conforms to the functional arrangement as described in Table 2.2.5-1.
2. NMS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.5-2.	Test(s) will be performed on the as-built NMS using simulated signals and actuators for the automatic functions defined in Table 2.2.5-2.See Subsection 2.2.15.	Report(s) exist(s) and conclude(s) that the NMS performs the automatic functions defined in Table 2.2.5-2.See Subsection 2.2.15.
3. NMS controls, interlocks, and bypasses are defined in Table 2.2.5-3.	Test(s) will be performed on the as-built NMS and MCRP SSLC/ESF VDUs using simulated signals and actuators for the controls, interlocks, and bypasses defined in Table 2.2.5-3.See Subsection 2.2.15.	Report(s) exist(s) and conclude(s) that the system controls, interlocks and bypasses exist, can be retrieved in the main control room, or are performed in response to simulated signals and manual actions as defined in Table 2.2.7-3.See Subsection 2.2.15.
4. The NMS system minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3. (Deleted)	See Section 3.3.	See Section 3.3.
5. Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.5-1 is addressed in Subsection	See Subsection 2.2.15.	See Subsection 2.2.15.

Table 2.2.5-4

ITAAC For The Neutron Monitoring System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
2.2.15.(Deleted)		
6. The equipment qualification of NMS components defined in Table 2.2.5-1 is addressed in Section 3.8.(Deleted)	See Section 3.8.	See Section 3.8.
7. NMS software is developed in accordance with the software development program described in Section 3.2. (Deleted)	See Section 3.2.	See Section 3.2.
8. NMS divisions fail-safe to a trip condition on critical hardware failure, power failure, or loss of communication failure.	Test(s) will be performed using simulated signals.	Test report(s) exist and conclude that NMS divisions fail-safe to a trip condition on critical hardware failure, power failure, or loss of communication failure.
9. The SRNM subsystem monitors neutron flux from the source range to 15% of the reactor rated power.	Test(s) will be performed using simulated signals.	Test report(s) exist and conclude that SRNM subsystem monitors neutron flux from the source range to 15% of the reactor rated power.
10. The LPRM subsystems monitor neutron flux from 1 % to 125 % of reactor rated power.	Test(s) will be performed using simulated signals.	Test report(s) exist and conclude that LPRM subsystems monitor neutron flux from 1 % to 125 % of reactor rated power.

2.2.6 Remote Shutdown System

Design Description

The Remote Shutdown System (RSS) provides remote manual control of the systems necessary to: (a) perform a prompt shutdown (scram) of the reactor, (b) perform safe (hot) shutdown of the reactor after a scram, (c) perform subsequent cold shutdown of the reactor, and (d) monitor the reactor to ensure safe conditions are maintained during and following a reactor shutdown.

RSS minimum inventory of alarms, displays, controls, and status indications is addressed in Section 3.3.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.6-1 is addressed in Subsection 2.2.15.

The environmental and seismic qualification of RSS components defined in Table 2.2.6-1 is addressed in Section 3.8.

RSS software is developed in accordance with the software development program described in Section 3.2 as part of the RTIF software project and SSLC/ESF software project.

Functional Arrangement

(1) RSS functional arrangement is described in Subsection 2.2.6 and defined in Table 2.2.6-1.

Functional Requirements

(2) RSS dedicated controls are defined in Table 2.2.6-2.

(3) ~~RSS minimum inventory of alarms, displays, controls, and status indications is addressed in Section 3.3.~~ (Deleted)

(4) ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.6-1 is addressed in Subsection 2.2.15.~~ (Deleted)

(5) ~~The equipment qualification of RSS components defined in Table 2.2.6-1 is addressed in Section 3.8.~~ (Deleted)

(6) ~~RSS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.6-3 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the RSS.

Table 2.2.6-3

ITAAC For The Remote Shutdown System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. RSS functional arrangement is described in Subsection 2.2.6 and defined in Table 2.2.6-1.	Inspection(s) ~~and test(s)~~ will be performed to confirm that the as-built panels are configured as described in Subsection 2.2.6 and defined in Table 2.2.6-1.	~~Test r~~Report(s) ~~document~~exist and conclude~~(s)~~ that the as-built panels are configured as described in Subsection 2.2.6 and defined Table 2.2.6-1.
2. RSS dedicated controls are defined in Table 2.2.6-2.	Test(s) ~~and type test(s)~~ will be performed on the dedicated controls defined in Table 2.2.6-2.	~~Test r~~Report(s) exist and conclude~~document(s)~~ that the RSS panels are capable of issuing control signals from the dedicated controls defined in Table 2.2.6-2.
3. ~~RSS minimum inventory of alarms, displays, controls, and status indications is addressed in Section 3.3.~~(Deleted)	~~See Section 3.3~~	~~See Section 3.3.~~
4. ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.6-1 is addressed in Subsection 2.2.15.~~(Deleted)	~~See Subsection 2.2.15.~~	~~See Subsection 2.2.15.~~
5. ~~The equipment qualification of DICS components defined in Table 2.2.6-1 is addressed in Section 3.8.~~(Deleted)	~~See Section 3.8.~~	~~See Section 3.8.~~
6. ~~RSS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)	~~See Section 3.2.~~	~~See Section 3.2.~~

2.2.7 Reactor Protection System

Design Description

The Reactor Protection System (RPS) initiates a reactor trip (scram) automatically whenever selected plant variables exceed preset limits or by manual operator action.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15.

RPS minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.

The environmental and seismic qualification of RPS components is addressed in Section 3.8.

RPS software is developed in accordance with the software development program described in Section 3.2 as part of the RTIF software project.

Functional Arrangement

(1) RPS functional arrangement is defined in Table 2.2.7-1.

Functional Requirements

(2) RPS automatic trip initiators and associated interfacing systems are defined in Table 2.2.7-2.

(3) RPS controls, interlocks (system interfaces), and bypasses are defined in Table 2.2.7-3.

(4) ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15.~~(Deleted)

(5) ~~RPS minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.~~(Deleted)

(6) ~~The equipment qualification of RPS components is addressed in Section 3.8.~~(Deleted)

(7) ~~RPS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)

(8) The RPS logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output.

(9) The RPS is fail-safe such that on loss of redundant divisional electrical power supplies the load drivers of that division change to the tripped state.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.7-4 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria, which will be performed for the RPS.

Table 2.2.7-1

RPS Functional Arrangement

The RPS comprises four redundant safety-related, Seismic Category I, divisions of sensor channels, trip logics and trip actuators.
The RPS comprises two divisions of manual scram controls and scram logic circuitry.
~~The RPS logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output.~~(Deleted)
~~The RPS trip actuator load drivers interrupt circuit power to scram pilot solenoids and scram air header dump valves.~~(Deleted)
~~The RPS is fail-safe such that on loss of redundant divisional electrical power supplies the load drivers of that division change to the tripped state.~~(Deleted)
Redundant safety-related power supplies are provided for each division.
Automatic and manual scram initiation logic systems are independent of each other.

Table 2.2.7-4

ITAAC For The Reactor Protection System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement is as described in Table 2.2.7-1.	Inspection(s), test(s), and/or type test(s) will be performed on the as-built configuration as described in Table 2.2.7-1.	Inspection, test, and/or type test rReport(s) exist and concludedocument(s) that the system conforms to the functional arrangement as described in Table 2.2.7-1.
2. RPS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.7-2.	Test(s) will be performed on the as-built RPS using simulated signals and actuators for the automatic functions defined in Table 2.2.7-2. Test(s) and type test(s) will be performed on the as-built system using simulated signals.	Test and type test report(s) exist and concludedocument that the system is capable of performing theRPS performs the automatic functions defined in Table 2.2.7-2.
3. RPS controls, interlocks (system interfaces), and bypasses are defined in Table 2.2.7-3.	Test(s) will be performed on the as-built RPS and SSLC/ESF VDUs using simulated signals and actuators for the controls, interlocks (system interfaces), and bypasses defined in Table 2.2.7-3.Test(s) and type test(s) will be performed on the as-built system using simulated signals.	Test and type test rReport(s) exist and concludedocument that the system controls and interlocks (system interfaces), and bypasses exist, can be retrieved in the main control room, or are performed in response to simulated signals and manual actions as defined in Table 2.2.7-3.
4. Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15.(Deleted)	See Subsection 2.2.15.	See Subsection 2.2.15.
5. RPS minimum inventory of alarms,	See Section 3.3.	See Section 3.3.

Table 2.2.7-4

ITAAC For The Reactor Protection System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
displays, and status indications in the main control room (MCR) are addressed in Section 3.3.(Deleted)		
6. The equipment qualification of RPS components is addressed in Section 3.8.(Deleted)	See Section 3.8.	See Section 3.8.
7. RPS software is developed in accordance with the software development program described in Section 3.2. (Deleted)	See Section 3.2.	See Section 3.2.
8. The RPS logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output.	Test(s) will be performed on the as-built RTIF platform of the RPS functions.	Test report(s) exist and conclude that the RTIF platform performs the RPS function trip outputs when a coincident trip of at least two divisions occurs.
9. The RPS is fail-safe such that on loss of redundant divisional electrical power supplies the load drivers of that division change to the tripped state.	Test(s) will be performed on the as-built RTIF platform of the RPS functions by de-energizing the RTIF platform by division.	Test report(s) exist and conclude that the RTIF platform de-energizes the RPS trip outputs when a coincident de-energization of at least two divisions occurs.

Table 2.2.9-3

ITAAC For The Steam Bypass and Pressure Control System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The SB&PC System functional arrangement is described in Table 2.2.9-1.	Inspections of the as-built system will be conducted.	~~Inspection r~~Reports(s) exist and concludedocument that the as-built SB&PC system conforms to the functional arrangement as defined in Table 2.2.9-1.
2. SB&PC system functions and initiating conditions as defined in Table 2.2.9-2.	Tests will be performed on the SB&PC system using simulated signals.	~~Test r~~Report(s) exist and confirm that the SB&PC system is capable of performing the functions defined in Table 2.2.9-2.
3. ~~SB&PC system minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.~~(Deleted)	~~See Section 3.3~~	~~See Section 3.3.~~
4. SB&PC controllers are fault tolerant.	i~~a~~. Test(s) will be performed simulating failure of any one SB&PC controller.	i~~a~~. ~~Test r~~Report(s) exist and conclude~~document~~ that failure of any one SB&PC controller has no effect on SB&PC valve position demand signal.
	ii~~b~~. Test(s) will be performed simulating failure of any two SB&PC controllers.	~~b~~ii. ~~Test r~~Report(s) exist and conclude~~document~~ that failure of any two SB&PC controllers generates a turbine trip signal.

2.2.12 Leak Detection and Isolation System

Design Description

The Leak Detection and Isolation System (LD&IS) detects and monitors leakage from the containment, and initiates closure of inboard and outboard main steamline isolation valves (MSIVs), containment isolation valves (CIVs), and Reactor Building (RB) isolation dampers by the safety-related reactor trip and isolation function (RTIF) and SSLC/ESF programmable logic controller platforms.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15.

The environmental and seismic qualification of LD&IS components described in Table 2.2.12-1 is addressed in Section 3.8.

The LD&IS minimum inventory of alarms, displays, and status indications in the main control room are addressed in Section 3.3.

The containment isolation components that correspond to the isolation functions described in Tables 2.2.12-2 and 2.2.12-3 are addressed in Subsection 2.15.1.

LD&IS software is developed in accordance with the software development program described in Section 3.2 as part of the RTIF software project and SSLC/ESF software project.

Functional Arrangement

(1) The LD&IS functional arrangement is described in Tables 2.2.12-1.

Functional Requirements

(2) The LD&IS isolation function monitored variables are described in Table 2.2.12-2.

(3) The LD&IS leakage source monitored variables are described in Table 2.2.12-3.

(4) The LD&IS controls, interlocks, and bypasses are described in Table 2.2.12-4.

(5) ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15.~~ (Deleted)

(6) ~~The equipment qualification of LD&IS components described in Table 2.2.12-1 is addressed in Section 3.8.~~ (Deleted)

(7) ~~The LD&IS minimum inventory of alarms, displays, and status indications in the main control room are addressed in Section 3.3.~~ (Deleted)

(8) ~~The containment isolation components that correspond to the isolation functions described in Tables 2.2.12-2 and 2.2.12-3 are addressed in Subsection 2.15.1.~~ (Deleted)

(9) ~~LD&IS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)

(10) LD&IS isolation functions logic is designed to provide an actuation by requiring coincident trip of at least two divisions to cause the trip output.

(11) LD&IS logic is de-energized to initiate the isolation function (i.e., fail-safe).

(12) DW floor drain high conductivity waste (HCW) sump instrumentation is designed with the sensitivity to detect a leakage step-change (increase) of 3.8 liters/min (1.0 gpm) within one hour and to alarm at sump flow rates in excess of 19 liters/min (5 gpm).

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.12-5 specifies the inspections, tests, and/or analyses, together with associated acceptance criteria for the LD&IS.

Table 2.2.12-1

LD&IS Functional Arrangement

LD&IS is safety-related, Seismic Category I. LD&IS functions, other than MSIV isolation function, are implemented by SSLC/ESF platform. LD&IS MSIV isolation function is implemented by the RTIF platform.
~~LD&IS isolation functions logic is designed to provide an actuation by requiring coincident trip of at least two divisions to cause the trip output.~~(Deleted) ~~LD&IS logic is de-energized to initiate the isolation function (i.e., fail-safe).~~(Deleted) ~~LD&IS logic channels and associated sensors are powered from safety-related power supplies.~~ (Deleted) ~~DW floor drain high conductivity waste (HCW) sump instrumentation is designed with the sensitivity to detect a leakage step-change (increase) of 3.8 liters/min (1.0 gpm) within one hour and to alarm at sump flow rates in excess of 19 liters/min (5 gpm).~~ (Deleted)

Table 2.2.12-5

ITAAC For The Leak Detection and Isolation System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The LD&IS functional arrangement is described in Tables 2.2.12-1.	Inspections ~~and/or tests~~ will be conducted on the as-built configuration as defined in Tables 2.2.12-1.	Report(s) exist and conclude~~document~~(s) that the system conforms to the functional arrangement described in Tables 2.2.12-1.
2. The LD&IS isolation function monitored variables are described in Table 2.2.12-2.	i. Test(s) will be performed on the as-built RTIF platform using simulated signals and actuators for the MSIV isolation functions defined in Table 2.2.12-2. ~~See Subsection 2.2.15.~~	i. Report(s) exist and conclude that the RTIF platform performs the MSIV isolation functions defined in Table 2.2.12-2. ~~See Subsection 2.2.15.~~
	ii. Test(s) will be performed on the as-built SSLC/ESF platform using simulated signals and actuators for the non-MSIV isolation functions defined in Table 2.2.12-2.	ii. Report(s) exist(s) and conclude(s) that the SSLC/ESF platform performs the non-MSIV isolation functions defined in Table 2.2.12-2.
3. The LD&IS leakage source monitored variables are described in Table 2.2.12-3.	Test(s) will be performed on the as-built RTIF platform, SSLC/ESF platform, and SSLC/ESF platform VDUs using simulated signals and actuators for the monitored variables defined in Table 2.2.12-3. ~~See Subsection 2.2.15.~~	Test report(s) exist(s) and conclude(s) that the monitored variables exist and can be retrieved in the main control room in response to simulated signals as defined in Table 2.2.12-3.~~See Subsection 2.2.15.~~
4. The LD&IS controls, interlocks, and bypasses are defined in Table 2.2.12-4.	Test(s) will be performed on the as-built RPS, SSLC/ESF, and SSLC/ESF VDUs using simulated signals and actuators for the controls, interlocks, and bypasses defined in Table 2.2.12-4. ~~See Subsection 2.2.15.~~	Test report(s) exist(s) and conclude(s) that the RPS performs the controls, interlocks, and bypasses defined in Table 2.2.12-4. ~~See Subsection 2.2.15.~~

Table 2.2.12-5

ITAAC For The Leak Detection and Isolation System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. LD&IS isolation functions logic is designed to provide an actuation by requiring coincident trip of at least two divisions to cause the trip output.	Test(s) will be performed on the as-built SSLC/ESF platform of the LD&IS functions.	Report(s) exist and conclude that the SSLC/ESF platform performs the LD&IS function trip outputs when a coincident trip of at least two divisions occurs.
11. LD&IS logic is de-energized to initiate the isolation function (i.e., fail-safe).	Test(s) will be performed on the as-built SSLC/ESF platform of the LD&IS functions by de-energizing the SSLC/ESF platform by division.	Report(s) exist and conclude that the SSLC/ESF platform de-energizes the LD&IS trip outputs when a coincident de-energization of at least two divisions occurs.
12. DW floor drain high conductivity waste (HCW) sump instrumentation is designed with the sensitivity to detect a leakage step-change (increase) of 3.8 liters/min (1.0 gpm) within one hour and to alarm at sump flow rates in excess of 19 liters/min (5 gpm).	Test(s) will be performed on the as-built DW floor drain high conductivity waste (HCW) sump instrumentation.	Report(s) exist and conclude that the DW floor drain high conductivity waste (HCW) sump instrumentation detects leakage step-changes (increases) of 3.8 liters/min (1.0 gpm) within one hour and sump flow rates in excess of 19 liters/min (5 gpm).

2.2.13 Engineered Safety Features Safety System Logic and Control

Design Description

The Safety System Logic and Control for the Engineered Safety Features systems (SSLC/ESF) addressed in this subsection performs the safety-related Emergency Core Cooling System (ECCS) control logic, the isolation logic for the Control Room Habitability System (CRHS), and controls the safety-related video display units (VDUs) for the Q-DCIS.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15.

The SSLC/ESF minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.

The environmental and seismic qualification of SSLC/ESF components described in Table 2.2.13-1 is addressed in Section 3.8.

The SSLC/ESF software is developed in accordance with the software development program described in Section 3.2 as part of the SSLC/ESF software project.

Functional Arrangement

(1) The SSLC/ESF functional arrangement is described in Table 2.2.13-1.

Functional Requirements

(2) The SSLC/ESF automatic functions, initiators, and associated interfacing systems are described in Table 2.2.13-2.

(3) The SSLC/ESF controls, interlocks, and bypasses in the main control room (MCR) are described in Table 2.2.13-3.

(4) ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15.~~ (Deleted)

(5) ~~The SSLC/ESF minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.~~ (Deleted)

(6) ~~The equipment qualification of SSLC/ESF components described in Table 2.2.13-1 is addressed in Section 3.8.~~ (Deleted)

(7) ~~The SSLC/ESF software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)

(8) SSLC/ESF logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output.

(9) SSLC/ESF uses "energized-to-trip" and "fail-as-is" logic.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.13-4 defines the inspections, tests, and/or analyses, together with associated acceptance criteria for the SSLC/ESF system.

Table 2.2.13-1

SSLC/ESF Functional Arrangement

SSLC/ESF comprises four redundant, safety-related, Seismic Category I, divisions of trip logics and trip actuators.
SSLC/ESF video display units (VDUs) comprise two redundant sets of four divisions of safety-related, Seismic Category I, VDUs, housed in two separate main control room panels.
~~SSLC/ESF receives inputs from, and sends outputs to interfacing systems as described in Tables 2.2.13-2 and 2.2.13-3.~~ (Deleted)
~~SSLC/ESF logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output.~~ (Deleted)
Redundant safety-related power supplies are provided for each division.
~~SSLC/ESF uses "energized-to-trip" and "fail-as-is" logic.~~(Deleted)
~~ADS (SRVs and DPVs), ICS, GDCS, and SLC are actuated sequentially and/or in groups.~~ (Deleted)
~~SSLC/ESF transmits and receives safety-related human system interface (HSI) information as described in Table 3.3-1, Item 6, to and from the safety-related VDUs.~~ (Deleted)

Table 2.2.13-4

ITAAC For The Safety System Logic and Control/~~ESF~~ System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The SSLC/ESF functional arrangement is described in Table 2.2.13-1.	Inspection ~~and/or tests~~ will be conducted in the as-built configuration as described in Table 2.2.13-1.	~~Inspection and/or test r~~Report(s) exist~~(s)~~ and conclude~~(s)~~ that the system conforms to the functional arrangement as described in Table 2.2.13-1.
2. The SSLC/ESF automatic trip initiators and associated interfacing systems are described in Table 2.2.13-2.	Test(s) ~~and type test(s)~~ will be performed on the as-built system using simulated signals.	~~Test and type test r~~Report(s) exist and conclude~~document~~ the system is capable of performing the functions described in Table 2.2.13-2.
3. The SSLC/ESF controls, interlocks, and bypasses in the main control room (MCR) are described in Table 2.2.13-3.	Test(s) ~~and type test(s)~~ will be performed on the as-built system using simulated signals.	~~Test and type test r~~Report(s) exist and conclude~~document~~ that the system controls and interlocks exist, can be retrieved in the main control room, or are performed in response to simulated signals and manual actions as described in Table 2.2.13-3.
4. ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components is addressed in Subsection 2.2.15~~(Deleted).	~~See Subsection 2.2.15.~~	~~See Subsection 2.2.15.~~
5. ~~The SSLC/ESF minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.~~(Deleted)	~~See Section 3.3.~~	~~See Section 3.3.~~

Table 2.2.13-4

ITAAC For The Safety System Logic and Control/ESF System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. ~~The equipment qualification of SSLC/ESF components is addressed in Section 3.8~~(Deleted).	~~See Section 3.8.~~	~~See Section 3.8.~~
7. ~~The SSLC/ESF software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)	~~See Section 3.2.~~	~~See Section 3.2.~~
8. SSLC/ESF logic is designed to provide a trip initiation by requiring a coincident trip of at least two divisions to cause the trip output.	Test(s) will be performed of the as-built SSLC/ESF system using simulated signals and actuators.	Report(s) exist and conclude that the as-built SSLC/ESF system performs trip initiation when a coincident trip occurs in at least two divisions.
9. SSLC/ESF uses "energized-to-trip" and "fail-as-is" logic.	Test(s) will be performed of the as-built SSLC/ESF system using simulated signals and actuators.	Report(s) exist(s) and conclude(s) that the as-built SSLC/ESF system uses "energized-to-trip" and "fail-as-is" logic.

2.2.14 Diverse Instrumentation and Controls ~~Systems~~

Design Description

The ~~D~~diverse ~~I~~instrumentation and ~~C~~control ~~S~~systems ~~(DICS)~~ comprise the Anticipated Transients Without Scram Standby Liquid Control (ATWS/SLC) system and the Diverse Protection System (DPS).

The ATWS/SLC and DPS minimum inventory of alarms, displays, controls, and status indications in the MCR are addressed in Section 3.3.

The environmental and seismic qualification of ATWS/SLC and DPS components defined in Table 2.2.14-1 is addressed in Section 3.8.

The containment isolation components that correspond to the DPS isolation functions are addressed in Subsection 2.15.1.

Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.14-1 are addressed in Subsection 2.2.15.

DPS hardware and software is developed in accordance with the software development program described in Section 3.2 as part of the ATWS/SLC software project and GENE DPS software project.

Functional Arrangement

(1) The ATWS/SLC and DPS~~DICS~~ functional arrangement is defined in Table~~s~~ 2.2.14-1 ~~and 2.2.14-2~~.

Functional Requirements

(2) The ATWS/SLC and DPS~~DICS~~ automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.14-2.

(3) The ATWS/SLC and DPS~~DICS~~ controls, interlocks and bypasses in the MCR are defined in Table 2.2.14-3.

(4) ~~DICS minimum inventory of alarms, displays, controls, and status indications in the MCR are addressed in Section 3.3.~~ (Deleted)

(5) ~~The equipment qualification of DICS ATWS/SLC and DPS components defined in Table 2.2.14-1 is addressed in Section 3.8.~~ (Deleted)

(6) ~~The containment isolation components that correspond to the DPS isolation functions defined in Table 2.2.14-2 are addressed in Subsection 2.15.1.~~ (Deleted)

(7) ~~Conformance with IEEE Std. 603 requirements by the safety-related control system structures, systems, and components defined in Table 2.2.14-1 is addressed in Subsection 2.2.15.~~ (Deleted)

(8) Confirmatory analyses to support and validate the DPS design scope and fire separation criteria.

(9) ~~Failure Modes and Effects Analysis (FMEA) per NUREG/CR-6303 of safety-related protection system platforms (RPS and SSLC/ESF) completed to validate the DPS diverse protection function.~~ (Deleted)

(10) ~~DICS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)

(11) DPS Cabinet train separation exists.

(12) ATWS/SLC system logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output.

(13) Each ATWS/SLC system division is powered from its respective safety-related power supply.

(14) DPS is powered from nonsafety-related load group power supplies.

(15) DPS triple redundant digital controllers require agreement in at least two channels out of three channels for a coincident trip actuation.

(16) DPS logic is "energize-to-actuate".

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.14-4 defines the inspections, tests, and/or analyses, together with associated acceptance criteria for the ATWS/SLC and DPS~~DICS~~.

Table 2.2.14-1

Diverse Instrumentaion and Control Systems Functional Arrangement

ATWS/SLC system is safety-related. ATWS/SLC system is housed within each of the divisional safety-related reactor trip and isolation function (RTIF) cabinets on a separate chassis from the other equipment within the cabinet. RTIF cabinets housing the ATWS/SLC system are located within the divisional electrical rooms in the control building (CB) in a mild environment.
ATWS/SLC system logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output. (Deleted) Each ATWS/SLC system is powered by a divisionally separated safety-related power supply. (Deleted)
ATWS/SLC has RPV dome pressure sensors and RPV water level sensors that are hardwired to their respective divisional controller.
DPS uses a triple redundant, digital controller, powered from nonsafety-related load group power suppliesplatform. DPS triple redundant digital controllers require agreement in at least two channels out of three channels for a coincident trip actuation. (Deleted)
DPS is housed in a cabinet located in a mild environment in the CB, in separate fire zones. DPS scram initiation logic is "energize-to-actuate" applied at the power return side of the control circuit going to the scram pilot valve solenoids(Deleted).
DPS logic is "energize-to-actuate". (Deleted)
DPS process variable sensors are different from those used by the RPS and SSLC/ESF. The DPS logic platform uses diverse hardware and software that is separate and independent from that used by the RPS and SSLC/ESF, including meeting fire separation criteria.

Table 2.2.14-4

ITAAC For The Diverse Instrumentation and Controls

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The DICSThe ATWS/SLC and DPS functional arrangement is described in Tables 2.2.14-1 and 2.2.14-2.	Inspection(s), test(s), and/or type test(s) will be conducted on the as-built system configuration described in Tables 2.2.14-1 and 2.2.14-2.	Inspection(s), test(s), and/or type test(s) Rreport(s) exist and conclude document(s) that the system's conformance to the functional arrangement described in Tables 2.2.14-1 and 2.2.14-2.
2. DICS The ATWS/SLC and DPS automatic functions, initiators, and associated interfacing systems are described in Table 2.2.14-2.	a. Tests will be performed conducted on the DICS ATWS/SLC and DPS safety-related and nonsafety-related components will be conducted on the as-built system configuration using simulated signals.	a. Test rReport(s) exist and conclude confirm that the DICS ATWS/SLC and DPS are is capable of performing the functions described in Table 2.2.14-2.
	b. For safety-related DCIS components, see Subsection 2.2.15. (Deleted)	b. For safety-related DCIS components, see Subsection 2.2.15.
3. DICSThe ATWS/SLC and DPS interlocks, bypasses, and controls are described in Table 2.2.14-3.	a. Test(s) and type test(s) will be performed on the DICS ATWS/SLC and DPS safety-related and nonsafety-related logic process interlocks, bypasses, and controls described in Table 2.2.14-3.	a. Test rReport(s) exist and conclude(s) that the DICS ATWS/SLC and DPS logic process interlocks and bypasses, and issue control signals described in Table 2.2.14-3.
	b. For safety-related DCIS components, see Subsection 2.2.15. (Deleted)	b. For safety-related DCIS components, see Subsection 2.2.15.

Table 2.2.14-4

ITAAC For The Diverse Instrumentation and Controls

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	iv. Inspections will be performed to confirm the control logic cabinets for each of the containment vacuum breaker isolation valves meet train separation criteria for fire zones.	iv. Report(s) exist and conclude that the as-build location of the control logic cabinets for the containment vacuum breaker isolation valves are separated by fire barriers.
9. ~~Failure Modes and Effects Analysis (FMEA) per NUREG/CR-6303 of safety-related protection system platforms (RPS and SSLC/ESF) completed to validate the DPS diverse protection function.~~(Deleted)	~~Complete FMEA per NUREG/CR-6303 to validate the DPS protection functions described in LTR NEDO-33251.~~	~~Report(s) exist(s) and conclude(s) that the completed FMEA for the RPS and SSLC/ESF safety-related platforms have been addressed in the DPS design scope. {{Design Acceptance Criteria}}~~
10. ~~DICS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)	~~See Section 3.2.~~	~~See Section 3.2.~~
11. DPS Cabinet train separation exists.	Inspections will be performed to confirm as-built location of DPS Cabinets meet train separation criteria for fire zones.	Report(s) exist and conclude that the as-built physical location of the DPS Cabinets are separated by fire barriers.
12. ATWS/SLC system logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output.	Test(s) will be performed on the ATWS/SLC system logic.	Report(s) exist and conclude that the as-built ATWS/SLC system logic provides trip initiation signals when a coincident trip signal exists in at least two unbypassed divisions.

Table 2.2.14-4

ITAAC For The Diverse Instrumentation and Controls

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
13. Each ATWS/SLC system division is powered from its respective safety-related power supply.	Test(s) will be performed on the ATWS/SLC system by providing a test signal in only one safety-related division at a time.	Report(s) exist and conclude that a test signal exists in the safety-related division under test in the ATWS/SLC system.
14. DPS is powered from nonsafety-related load group power supplies.	Test(s) will be performed on the DPS by providing a test signal in only one DPS load group at a time	Report(s) exist and conclude that a test signal exists in the load group under test in the DPS.
15. DPS triple redundant digital controllers require agreement in at least two channels out of three channels for a coincident trip actuation.	Test(s) will be performed on the DPS by providing simulated signals to each DPS channel.	Report(s) exist and conclude that trip actuation signals exist only when at least two channels are in coincident agreement.
16. DPS logic is "energize-to-actuate".	Test(s) will be performed on the DPS system logic.	Report(s) exist and conclude that trip actuation signals are "energize-to-actuate".

2.13 ELECTRICAL SYSTEMS

2.13.1 ~~Onsite AC~~Electric Power Distribution System

Design Description

The purpose of the ~~Onsite AC Power~~Electric Power Distribution System is to provide power to the power generation nonsafety-related loads and the plant's investment protection (PIP) nonsafety-related loads. The PIP buses also supply power to the four (4) safety-related, 480VAC, Isolation Power Center buses and the two (2) ancillary diesel buses. The nonsafety-related PIP buses and ancillary diesel buses have a ~~Regulatory Treatment of Non-Safety Systems (RTNSS)~~ function to supply power to RTNSS credited loads.

The Electric Power Distribution System minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.

Environmental and seismic qualification of safety-related 480 VAC Isolation Power Center equipment is addressed in Section 3.8.

(1) The functional arrangement of ~~Onsite AC Power~~Electric Power Distribution System is as described in the Design Description of subsection 2.13.1 and Table 2.13.1-1, and as shown on Figure 2.13.1-1.

(2) The safety-related 480 VAC Isolation Power Center equipment identified in Table 2.13.1-1 ~~conforms~~ can withstand ~~to~~ Seismic Category I r~~equirements and is housed in Seismic Category I structures~~loads without loss of safety-related function.

(3) a. Independence is provided between safety-related divisions as required by Regulatory Guide 1.75.

b. Separation is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment as required by Regulatory Guide 1.75.

(4) Each safety-related Isolation Power Center supplies power to safety-related loads in its respective division.

(5) Isolation Power Centers and their associated loads are protected against undervoltage, degraded voltage and under-frequency conditions.

(6) ~~The Onsite AC Power System provides the following nonsafety-related functions:~~a.The ~~Onsite AC Power System~~Electric Power Distribution System provides the capability for distributing nonsafety-related AC power from onsite sources to nonsafety-related RTNSS loads.

b. The ~~Onsite AC~~ Electric Power Distribution System provides a PIP bus undervoltage signal to trip the PIP bus normal and alternate preferred power supply breakers.

(7) ~~The onsite AC Power System minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.~~ (Deleted)

(8) ~~Environmental qualification of safety-related 480 VAC Isolation Power Center equipment is addressed in Tier 1 Section 3.8.~~(Deleted)

2.13.3 Direct Current Power Supply

Design Description

Completely independent safety-related and nonsafety-related DC power systems are provided.

Nonsafety-related DC power systems are not part of the plant safety-related design basis, and are independent and separate from the safety-related DC power supplies.

The 250 V Safety-Related DC systems provide four divisions of power to operate safety–related loads for at least 72 hours following a design basis accident. The 250V Safety-Related DC systems are also adequately sized for the station blackout conditions.

The Direct Current Power Supply minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.

Environmental and seismic qualification of the 250 V Safety-Related DC systems is addressed in Section 3.8.

(1) The functional arrangement of the 250 V Safety-Related DC systems is as described in subsection 2.13.3 Design Description and Table 2.13.3-1 and as shown on Figure 2.13.3-1.

(2) The functional arrangement of the 125 V and 250 V Nonsafety-Related DC systems is as described in subsection 2.13.3 and as shown on Figure 2.13.3-2.

(3) Two 250 V safety-related batteries in each division are together sized to supply their design loads, at the end of installed life, for a minimum of 72 hours without recharging.

(4) The 250 V Safety-Related DC systems safety-related equipment identified in Table 2.13.3-1 ~~conform to~~can withstand Seismic Category I ~~requirements and are housed in Seismic Category I structures~~loads without loss of safety-related function.

(5) The 250 V Safety-Related DC systems provide four independent and redundant safety-related divisions.

(6) Separation is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment as required by Regulatory Guide 1.75.

(7) Each battery charger associated with each 250 VDC safety-related battery is capable of restoring its battery after a bounding design basis event discharge to a state that the battery can perform its design basis function for subsequent postulated operational and design basis functions, while at the same time supplying the largest combined demands associated with the battery, within the time stated in the design basis, consistent with the requirement given in IEEE 308.

(8) The 250 V Safety-Related DC battery and battery charger circuit breakers, and DC distribution panels and their circuit breakers and fuses, are sized to supply their load requirements.

(9) The battery chargers are designed to prevent their AC source from becoming a load on the 250 VDC safety-related batteries when the AC power source is de-energized or has degraded voltage.

(10) ~~The Direct Current Power Supply minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.~~(Deleted)

2.13.5 Uninterruptible AC Power Supply

Design Description

The Uninterruptible AC Power Supply (UPS) is divided into two subsystems, the safety-related UPS and the nonsafety-related UPS.

The nonsafety-related UPS system and the nonsafety-related Technical Support Center UPS system are not part of the plant safety design basis, and are independent and separated from the safety-related UPS system.

The safety-related UPS system provides four divisions of 120 VAC power to safety-related loads during normal, upset and accident conditions.

The Uninterruptible AC Power Supply minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.

Environmental and seismic qualification of the safety-related UPS system is addressed in Section 3.8.

(1) The functional arrangement of the safety-related UPS system is as described in Subsection 2.13.5 and Table 2.13.5-1 and is as shown on Figure 2.13.5-1.

(2) The functional arrangement of the nonsafety-related UPS system is as described in Subsection 2.13.5 and as shown on Figure 2.13.5-2.

(3) The ~~safety-related~~ UPS system safety-related equipment identified in Table 2.13.5-1 ~~conforms to~~ can withstand Seismic Category I ~~requirements and is housed in Seismic Category I structures~~loads without loss of safety-related function.

(4) The safety-related UPS system provides four independent and redundant safety-related divisions.

(5) Separation is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment, as required by Regulatory Guide 1.75.

(6) Each safety-related UPS inverter is capable of supplying its AC load~~.~~ at both minimum and maximum battery terminal voltages.

(7) ~~The Uninterruptible AC Power Supply minimum inventory of alarms, displays, controls, and status indications in the main control room are addressed in Section 3.3.~~(Deleted)

(8) ~~Environmental qualification of the safety-related UPS system is addressed in DCD Tier 1 Section 3.8.~~(Deleted)

(9) The safety-related UPS rectifiers are designed to prevent their AC source from becoming a load on the 250 VDC safety-related batteries when the AC power source is de-energized or has degraded voltage.

(10) The safety-related UPS inverter high DC input voltage trip setpoint and time delay are greater than the associated battery charger and UPS rectifier high DC output voltage trip setpoint and time delay.

(11) The safety-related UPS system supplies a voltage at the terminals of the safety-related utilization equipment that is within the equipment voltage tolerance limits.

2.15 CONTAINMENT, COOLING AND ENVIRONMENTAL CONTROL SYSTEMS

2.15.1 Containment System

Design Description

The Containment System confines the potential release of radioactive material in the event of a design basis accident. The Containment System is safety-related and is comprised of a reinforced concrete containment vessel (RCCV), penetrations and DW head.

The Containment System is as shown in Figure 2.15.1-1. The RCCV is located in the Reactor Building.

The environmental and seismic qualification of Containment Systems components is addressed in Section 3.8.

(1) The functional arrangement of the Containment System is as described in the Design Description of this Section 2.15.1 and as shown in Figure 2.15.1-1.

(2) ~~2.~~a1.~~i~~.The components identified in Table 2.15.1-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements and seismic Category I requirements.

~~2.~~a2.~~ii~~.The RCCV and its liners are designed to meet the requirements in Article CC-3000 of ASME Code, Section III, Division 2, and seismic Category I requirements. The steel components of the RCCV are designed to meet the requirements in Article NE-3000 of ASME Code, Section III, Division 1, and seismic Category I requirements.

~~2.~~a3.~~iii~~. The piping identified in Table 2.15.1-1 as ASME Code Section III is designed in accordance with ASME Code Section III requirements and seismic Category I requirements.

~~2.~~b1.~~i~~. The design of the components identified in Table 2.15.1-1 as ASME Code Section III will be reconciled with the design requirements.

~~2.~~b2.~~ii~~. The RCCV and its liners are designed to meet the requirements in Article CC-3000 of ASME Code, Section III, Division 2, and seismic Category I requirements. The steel components of the RCCV are designed to meet the requirements in Article NE-3000 of ASME Code, Section III, Division 1, and seismic Category I requirements. The design of these components will be reconciled with the design requirements.

~~2.~~b3.~~iii~~. The as-built piping identified in Table 2.15.1-1 as ASME Code Section III shall be reconciled with the piping design requirements.

~~2.~~c1.~~i~~. The components identified in Table 2.15.1-1 as ASME Code Section III are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

~~2.~~c2.~~ii~~. The RCCV and its liners are fabricated, installed, and inspected in accordance with the requirements in Article CC-3000 of ASME Code, Section III, Division 2. The steel components of the RCCV are designed to meet the requirements in Article NE-3000 of ASME Code, Section III, Division 1.

2.15.4 Passive Containment Cooling System

Design Description

The Passive Containment Cooling System (PCCS), in conjunction with the suppression pool, maintains the containment within its pressure limits for DBAs such as a LOCA, by condensing steam from the DW atmosphere and returning the condensed liquid to the Gravity Driven Cooling System (GDCS) pools. The system is passive, with no components that must actively function in the first 72-hours after a DBA.

The environmental and seismic qualification of PCCS components is addressed in Section 3.8.

(1) The functional arrangement for the PCCS is as described in the Design Description in this subsection 2.15.4, Table 2.15.4-1 and Figure 2.15.4-1.

(2) ASME Code Section III

a1. The components identified in Table 2.15.4-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements and seismic Category I requirements.

a2. The components identified in Table 2.15.4-1 as ASME Code Section III shall be reconciled with the design requirements.

a3. The components identified in Table 2.15.4-1 as ASME Code Section III are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

b1. The piping identified in Table 2.15.4-1 as ASME Code Section III is designed in accordance with ASME Code Section III requirements and seismic Category I requirements.

b2. The as-built piping identified in Table 2.15.4-1 as ASME Code Section III shall be reconciled with the with the piping design requirements.

b3. The piping identified in Table 2.15.4-1 as ASME Code Section III is fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

(3) Pressure Boundary Welds

a. Pressure boundary welds in components identified in Table 2.15.4-1 as ASME Code Section III meet ASME Code Section III requirements.

b. Pressure boundary welds in piping identified in Table 2.15.4-1 as ASME Code Section III meet ASME Code Section III requirements.

(4) The pressure boundary of the PCCS retains its integrity under the design pressure of 310 kPa gauge (45 psig).

(5) The ~~seismic Category I components~~safety-related equipment identified in Table 2.15.4-1, including associated piping, can withstand ~~s~~Seismic ~~design basis~~Category I loads without loss of safety-related function.

(6) ~~Deleted~~ Each mechanical train of the PCCS located inside the containment is physically separated from the other train(s) so as not to preclude accomplishment of the intended safety-related function..

Table 2.15.4-2

ITAAC For The Passive Containment Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		134˚C (273˚F) • IC/PCC pool water temperature is at atmospheric pressure and 102˚C (216˚F)
8. ~~The equipment qualification of PCCS components is addressed in Tier 1 Section 3.8.~~(Deleted)	~~See Tier 1 Section 3.8.~~	~~See Tier 1 Section 3.8.~~
9. The elevation of the PCCS vent discharge point is submerged in the suppression pool at an elevation below low water level and above the uppermost horizontal vent.	A visual inspection will be performed of the PCCS vent discharge point relative to the horizontal vents.	The elevation of the discharge on the PCCS vent line is > 0.85 m (33.5 in) and < 0.90 m (35.4 in) above the top of the uppermost horizontal vent.
10. The PCCS will be designed to limit the fraction of containment leakage through the condensers to an acceptable value.	A pneumatic leakage test of the PCCS will be conducted.	Test report(s) and analysis ~~document~~ report(s) exist and conclude that the combined leakage from each of the PCCS heat exchangers is ≤0.025L_a

2.15.5 Containment Inerting System

Design Description

The Containment Inerting System (CIS) establishes and maintains an inert atmosphere within the containment during all plant operating modes, except during plant shutdown for refueling or equipment maintenance and during limited periods of time to permit access for inspection at low reactor power. The objective of the system is to reduce oxygen concentration to levels that do not support post-accident hydrogen combustion. The CIS also provides instruments and logic for MCR monitoring and alarming of DW temperature described in Table 2.15.5-1 associated with ITAAC (3) below.

The CIS does not perform any safety-related function except for its containment isolation function. Containment Isolation Valves and Penetrations are addressed in Tier 1 Subsection 2.15.1 for the Containment System.

(1) The containment can be inerted to less than or equal to 4% oxygen by volume.

(2) ~~The containment isolation portions of the CIS are addressed in Tier 1, Subsection 2.15.1.~~(Deleted)

(3) The DW temperature indications are retrievable in the main control room (see Table 2.15.5-1).

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.5-2 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the Containment Inerting System.

Table 2.15.5-2

ITAAC For The Containment Inerting System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The containment can be inerted to less than or equal to 4% oxygen by volume.	Test of the containment in an inerted state will be conducted to determine oxygen concentration by volume.	Test report concludes that the containment can be inerted to less than or equal to 4% oxygen by volume.
2. ~~The containment isolation portions of the CIS are addressed in Tier 1, Subsection 2.15.1.~~(Deleted)	~~See Tier 1 Subsection 2.15.1.~~	~~See Tier 1 Subsection 2.15.1.~~
3. The DW temperature indications are retrievable in the main control room.	Inspections of main control room indications will be conducted and verified for retrievability of DW temperature indications.	Inspection report ~~documents~~ concludes that DW temperature indications are provided in the MCR.

2.15.7 Containment Monitoring System

Design Description

The Containment Monitoring System (CMS) provides instrumentation listed in Table 2.15.7-1 to monitor the following parameters:

- DW and WW Hydrogen and Oxygen concentrations
- DW and WW Gross Gamma Radiation levels
- DW and WW Pressures
- DW/WW Differential Pressure
- Upper DW Level
- Lower DW Level
- Suppression Pool Water Level
- Suppression Pool Temperature

The environmental and seismic qualification of CMS components is addressed in Section 3.8.

The containment isolation portions of the CMS system are addressed in Subsection 2.15.1.

CMS software is developed in accordance with the software development program described in Section 3.2 as part of the SSLC/ESF software project.

(1) The functional arrangement for the CMS is as described in the Design Description in this subsection 2.15.7, Table 2.15.7-1 and Figure 2.15.7-1.

(2) Each of the safety-related components identified in Table 2.15.7-1 is powered from its respective safety-related division.

(3) Each CMS measured parameter in Table 2.15.7-1 will indicate the measured parameter and initiate separate alarms in the control room when levels exceed applicable setpoints.

(4) The Hydrogen/Oxygen (H_2/O_2) monitoring subsystem of CMS is active during normal operation and additional sampling capacity is automatically initiated by a LOCA signal for post-accident monitoring of oxygen and hydrogen content in the containment.

(5) In each CMS Suppression Pool Temperature Monitoring (SPTM) division, signals from the CMS SPTM temperature and the CMS suppression pool water narrow range transmitters are provided for the divisional Reactor Protection System (RPS) logic processors to calculate the suppression pool average temperature.

(6) The seismic Category I equipment identified in Table 2.15.7-1 can withstand seismic design basis loads without loss of safety function.

(7) ~~The equipment qualification of CMS components is addressed in Tier 1 Section 3.8.~~(Deleted)

(8) ~~The containment isolation portions of the CMS system are addressed in Tier 1, Subsection 2.15.1.~~(Deleted)

(8) ~~The containment isolation portions of the CMS system are addressed in Tier 1, Subsection 2.15.1.~~(Deleted)

(9) ~~CMS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)

Refer to Subsection 2.2.15 for "Instrumentation & Controls Compliance With IEEE Std. 603."

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.7-2 provides the definitions of the inspections, tests, and/or analyses, together with associated acceptance criteria, which will be undertaken for the Containment Atmospheric Monitoring System and the suppression pool monitoring portions of CMS.

Table 2.15.7-2

ITAAC For The Containment Monitoring System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	iii) Inspection will be performed for the existence of a report verifying that the as-installed equipment including anchorage is seismically bounded by the tested or analyzed conditions.	iii) A report exists and concludes that the as-installed equipment including anchorage is seismically bounded by the tested or analyzed conditions.
7. ~~The equipment qualification of CMS components is addressed in Tier 1 Section 3.8.~~(Deleted)	~~See Tier 1 Section 3.8.~~	~~See Tier 1 Section 3.8.~~
8. ~~The containment isolation portions of the CMS system are addressed in Tier 1, Subsection 2.15.1.~~(Deleted)	~~See Tier 1 Subsection 2.15.1.~~	~~See Tier 1 Subsection 2.15.1.~~
9. ~~CMS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)	~~See Section 3.2.~~	~~See Section 3.2.~~