Table 2.1.2-3

ITAAC For ~~The~~ Nuclear Boiler System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
23. The relief-mode actuator (and safety-related appurtenances) can open each SRV with the DW pressure at design pressure.	An analysis and/or type test will be performed to demonstrate the capacity of the relief-mode actuation for each SRV.	Test/analysis report(s) exist and conclude that the relief-mode actuation has the capacity to lift the SRVs to the full open position one time with the DW pressure at the DW design pressure when the accumulator is isolated from its pneumatic pressure source.
24. When actuated by an initiator (igniter charge), the booster assembly opens each DPV in less than or equal to the design opening time (opening time to full rated capacity).	Type testing will be performed on the booster assemblies to confirm that they are capable of opening the valve at design basis conditions. Type testing, along with analyses to adjust for design basis conditions (if necessary), will be performed to demonstrate that the booster opens each DPV within the design opening time (opening time to full rated capacity) and design conditions.	Report(s) exist~~s~~ and conclude~~s~~ that tests and analyses demonstrate that each DPV opens when actuated by the booster assembly in less than or equal to 0.45 seconds with an inlet pressure of 7,584 kPa ± 685 kPa gauge (1100 psig ± 99 psi) ~~or greater~~.
25. Each DPV minimum flow capacity is sufficient to support rapid depressurization of the RPV (i.e., has a flow capacity that is greater than or equal to the design flow capacity under design basis conditions).	Analyses and type tests (at a test facility) will be performed.	Test reports and analyses exist and conclude that the DPV flow capacity is greater than or equal to 239 kg/s (527 lbm/s) at an inlet pressure of 7.48 Mpa gauge (1085 psig).
26. ~~The equipment qualification of the NBS components is addressed in Tier 1, Section 3.8.~~ (Deleted)	~~See Tier 1 Section 3.8.~~	~~See Tier 1 Section 3.8.~~

(4) ~~Pressure Boundary Integrity~~a.~~The~~ Pressure boundary integrity components defined in Table 2.2.2-5 as ASME Code Section III retain their pressure boundary integrity at their design pressure.

b. ~~The~~ Pressure boundary integrity piping defined in Table 2.2.2-5 as ASME Code Section III retains its pressure boundary integrity at design pressure.

(5) The ~~Seismic Category I~~ safety-related equipment, including components and associated piping, defined in Table 2.2.2-1 and 2.2.2-5 can withstand ~~s~~Seismic ~~design basis~~Category I loads without loss of ~~structural integrity and~~ safety-related function.

(6) The FMCRD is capable of positioning CR incrementally and continuously over its entire range.

(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.

(8) The HPCRD has a high-pressure makeup mode of operation that injects water to the RPV via the RWCU/SDC return path.

(9) CRD system automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.2-3.

(10) CRD system controls and interlocks are defined in Table 2.2.2-4.

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

(12) CRD maximum allowable scram times are 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 Tier 1 Tables 2.2.2-1 and 2.2.2-6 is addressed in Subsection 2.2.15.~~(Deleted)

(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)

(15) The FMCRD has an electro-mechanical brake with a minimum required holding torque on the motor drive shaft.

(16) a. Valves on lines attached to the RPV system that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the CRD system that require maintenance shall be reconciled to design requirements.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.2-7 defines the inspections, tests, and/or analyses, together with associated acceptance criteria for the CRD system.

Table 2.2.2-7

ITAAC For The Control Rod Drive System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
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.
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 evaluation 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 a 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 evaluation.

(18) Re-positionable (not squib) valves designated in Table 2.2.4-4 as having an active safety-related function open, close, or both open and close under differential pressure, fluid flow, and temperature conditions.

(19) The pneumatically operated valve(s) designated in Table 2.2.4-4 fail in the mode listed if either electric power to the valve actuating solenoid is lost, or pneumatic pressure to the valve(s) is lost.

(20) Check valves designated in Table 2.2.4-4 as having a safety-related function open, close, or both open and close under system pressure, fluid flow, and temperature conditions.

(21) The SLC System injection squib valve will open as designed.

(22) The equivalent natural boron concentration at cold shutdown conditions for the total solution injection volume is based on the liquid inventory in the RPV at the main steam line nozzle elevation plus the liquid inventory in the reactor shutdown cooling piping and equipment of the RWCU/SDC system.

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

(24) a. Valves on lines attached to the RPV that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV in the SLC system that require maintenance shall be reconciled to design requirements.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.4-6 defines the inspections, tests, and/or analyses, together with associated acceptance criteria for the SLC system.

Table 2.2.4-6

ITAAC For The Standby Liquid Control System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
23. ~~SLC software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)	~~See Section 3.2.~~	~~See Section 3.2.~~
24a. 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.
24b. The as-built location of valves on lines attached to the RPV in the SLC system that require maintenance shall be reconciled to design requirements.	A reconciliation evaluation of valves on lines attached to the RPV that require maintenance using as-designed and as-built information will be performed.	Report(s) exist and conclude that a 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 evaluation.

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.

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.

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.
Each ATWS/SLC system is powered by a divisionally separated safety-related power supply.
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 supplies.
DPS triple redundant digital controllers require agreement in at least two channels out of three channels for a coincident trip actuation.
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.~~
DPS logic is "energize-to-actuate".
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
8. Confirmatory analyses support and validate the DPS design scope.	~~Confirmatory analyses to support and validate the DPS design scope will be performed.~~ i.Complete FMEA per NUREG/CR-6303 of the Q-DCIS to validate the DPS protection functions.	~~Report(s) exist(s) and conclude(s) that the DPS design ensures releases during a common mode protection system failure coincident with the design basis events discussed in the Safety Analyses are within 10 CFR 100 limits (or percentage thereof) as specified in BTP HICB-19. {{Design Acceptance Criteria}}~~ i.Report(s) exist and conclude that the FMEA completed per NUREG/CR-6303 of the Q-DCIS have been addressed in the DPS design scope.
	ii. Inspection of the DPS platform requirements phase summary baseline review report will be performed.	ii. Inspection report(s) exist and conclude that the platform requirements phase summary baseline review report contain the validated DPS design scope.
	iii. Inspection(s) of the DPS platform test phase summary baseline review report(s) will be performed.	iii. Inspection report(s) exist and conclude that the DPS platform(s) test phase summary baseline review report(s) • Identify and reconcile changes, deletions, and additions to the applicable DPS design scope. • Confirm that tests show that the DPS performs in accordance with the applicable DPS design scope.

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. Inspection 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.

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

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

(29) a. Valves on lines attached to the RPV system that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV system that require maintenance shall be reconciled to design requirements.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.4.1-3 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the Isolation Condenser System.

Table 2.4.1-3

ITAAC For The Isolation Condenser System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
26. Each ICS flow path is constrained to a maximum flow area at transitions between Class 1 piping from containment to Class 2 piping outside containment in order to limit flow in the event of a break.	Inspection will be performed to confirm that the flow area at these transition locations is limited.	Inspection report(s) ~~document~~ exist and conclude that each steam supply branch line contains a flow limiter which is no greater than 76.2 mm (3") in diameter, and that the condensate branch lines are no greater than 101.6 mm (4") in diameter.
27. ~~ICS software is developed in accordance with the software development program described in Section 3.2.~~ (Deleted)	~~See Section 3.2.~~	~~See Section 3.2.~~
28. (Deleted)		
29a. Valves on lines attached to the RPV system 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.
29b. The as-built location of valves on lines attached to the RPV system that require maintenance shall be reconciled to design requirements.	A reconciliation evaluation of valves on lines attached to the RPV using as-designed and as-built information will be performed.	Report(s) exist and conclude that a 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 evaluation.

(25) Deluge system has redundant nonsafety-related programmable logic controllers (PLCs) that are connected to thermocouples in each cell of the lower drywell Basemat-internal Melt Arrest Coolability (BiMAC) system.

(26) When temperatures exceed the setpoint at one set of thermocouples coincident with setpoints being exceeded at a second set of thermocouples in adjacent cells, each PLC starts an adjustable deluge squib valve non-bypassable timer.

(27) The GDCS deluge valve squib initiation signals are inhibited when either of the safety-related deluge system lower drywell temperature switches sense temperatures lower than a preset value coincident with the presence of both deluge squib valve timer signals.

(28) a. Valves on lines attached to the RPV that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV in the GDCS system that require maintenance shall be reconciled to design requirements.

(29) a. The BiMAC has an available volume, up to a height of the vertical segments of the BiMAC pipes, sized to contain approximately 400% of the full-core debris.

b. The BiMAC has a refractory material located on top of the BiMAC pipes to protect against melt impingement during the initial corium relocation event.

c. The BiMAC is designed with a cover so that debris will penetrate it in a short period of time while providing protection for the BiMAC from CRD housings falling from the vessel.

d. The BiMAC piping is inclined from horizontal to permit natural circulation flow.

~~Refer to Subsection 2.2.15 for "Instrumentation and Controls Compliance with IEEE Standard 603."~~

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.4.2-3 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the Gravity-Driven Cooling System.

Table 2.4.2-3

ITAAC For The Emergency Core Cooling System – Gravity-Driven Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
27. The GDCS deluge valve squib initiation signals are inhibited when either of the safety-related deluge system lower drywell temperature switches sense temperatures lower than a preset value coincident with the presence of both deluge squib valve timer signals.	Tests will be performed using simulated signals to confirm that the GDCS deluge valve squib initiation signals are inhibited when either of the safety-related deluge system lower drywell temperature switches sense temperatures lower than a preset value coincident with the presence of both deluge squib valve timer signals.	Report(s) ~~confirm~~ exist and conclude that GDCs deluge valve squib initiation signals are inhibited when either of the safety-related deluge system lower drywell temperature switches sense temperatures lower than a preset value coincident with the presence of both deluge squib valve timer signals.
28a. 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.
28b. The as-built location of valves on lines attached to the RPV in the GDCS system that require maintenance shall be reconciled to design requirements..	A reconciliation evaluation of valves on lines attached to the RPV using as-designed and as-built information will be performed.	Report(s) exist and conclude that a 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 evaluation.
29a. The BiMAC has an available volume, up to a height of the vertical segments of the BiMAC pipes, sized to contain approximately 400% of the full-core debris.	Inspections of the as-built system will be conducted.	Inspection reports conclude that the as built BiMAC is sized to contain approximately 400% of the full-core debris.

Table 2.4.2-3

ITAAC For The Emergency Core Cooling System – Gravity-Driven Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
29b. The BiMAC has a refractory material located on top of the BiMAC pipes to protect against melt impingement during the initial corium relocation event.	Inspections of the as-built system will be conducted.	Inspection reports conclude that the as built BiMAC contains a refractory material located on top of the BiMAC pipes to protect against melt impingement during the initial corium relocation event.
29c. The BiMAC is designed with a cover plate so that debris will penetrate it in a short period of time while providing protection for the BiMAC from CRD housings falling from the vessel.	Inspections of the as-built system will be conducted.	Report(s) exist and conclude that the BiMAC includes a cover plate providing protection for the BiMAC from CRD housings falling from the vessel while allowing debris to penetrate it in a short period of time.
29d. The BiMAC piping is inclined at from horizontal to permit natural circulation flow.	Inspections of the as-built system will be conducted.	Inspection reports conclude that the as built BiMAC includes piping inclined sufficiently from horizontal to permit natural circulation flow.

b2. The as-built piping identified in Table 2.6.1-1 as ASME Code Section III shall be reconciled with the with the piping design requirements.

b3. The piping identified in Table 2.6.1-1 as ASME Code Section III is fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

(9) ~~Pressure Boundary Welds~~a. Pressure boundary welds in components identified in Table 2.6.1-1 as ASME Code Section III meet ASME Code Section III requirements.

b. Pressure boundary welds in piping identified in Table 2.6.1-1 as ASME Code Section III meet ASME Code Section III requirements.

(10) a. Valves on lines attached to the RPV system that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV system of the RWCU/SDC system that require maintenance shall be reconciled to design requirements.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.1-2 provides the inspections, tests, and/or analyses that will be undertaken for the RWCU/SDC system.

Table 2.6.1-2

ITAAC For The Reactor Water Cleanup/Shutdown Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
b) Pressure boundary welds in piping identified in Table 2.6.1-1 as ASME Code Section III meet ASME Code Section III requirements	Inspection of the as-built pressure boundary welds will be performed in accordance with the ASME Code Section III.	An ASME Code Report exists and concludes that the ASME Code Section III requirements are met for non-destructive examination of pressure boundary welds in the RWCU/SDC System
10a. Valves on lines attached to the RPV system 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
10b. The as-built location of valves on lines attached to the RPV system of the RWCU/SDC system that require maintenance shall be reconciled to design requirements.	A reconciliation evaluation of valves on lines attached to the RPV requiring maintenance using as-designed and as-built information will be performed.	Report(s) exist and conclude that a 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 evaluation.

(5) The Seismic Category I equipment, including components and associated piping identified in Table 2.6.2-1, can withstand ~~s~~Seismic ~~design basis~~Category loads without loss of safety-related function.

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

(7) The FAPCS performs the following nonsafety-related functions:

~~α.~~• Suppression pool cooling mode

~~β.~~• Low-pressure coolant injection mode.

~~χ.~~• External connection for emergency water to IC/PCC pool and Spent Fuel Pool.

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

(9) Level instruments with adequate operating ranges are provided for the Spent Fuel Pool and IC/PCC pools.

(10) ~~Equipment qualification for the FAPCS is addressed in Tier 1 Section 3.8.~~(Deleted)

(11) Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Spent Fuel Pool remains above the top of active fuel.

(12) Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Buffer Pool remains above the top of active fuel.

(13) a. Valves on lines attached to the RPV system that require maintenance valves installed such that freeze seals will not be required

b. The as-built location of valves on lines attached to the RPV system in the FAPCS that require maintenance shall be reconciled to design requirements

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.2-2 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the FAPCS.

Table 2.6.2-2

ITAAC For The Fuel and Auxiliary Pools Cooling ~~Cleanup~~ System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
12. Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Buffer Pool remains above the top of active fuel.	Inspection of the Buffer Pool as-built dimensions will be performed to determine the elevation of the pool weir relative to the bottom of the pool and the free volume between the top of the active fuel and the weir elevation.	A report or analysis exists and concludes that the elevation of the Buffer Pool weir relative to the bottom of the pool is at least 6.7 m and that there is at least 288 m^3 of free volume above the top of the active fuel that can be filled with water.
13a. Valves on lines attached to the RPV system 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.
13b. The as-built location of valves on lines attached to the RPV system in the FAPCS that require maintenance shall be reconciled to design requirements.	A reconciliation evaluation 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 a 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 evaluation.

(7) The non-seismic portion of the MSIV leakage path to the condenser (main steam piping from the stop valve (inclusive) to turbine nozzle, bypass piping, required drain piping, and main condenser) maintains structural integrity under SSE loading conditions.

(8) The TMSS piping is sized to ensure that reactor pressure vessel (RPV) dome to turbine stop valve pressure drop, total main steam system volume, and steamline length are consistent with assumptions in Abnormal Event analyses.

(9) a1. The TMSS piping portion designated as ASME Code Section III is designed in accordance with ASME Code Section III requirements and ~~s~~Seismic Category II requirements.

a2. The as-built TMSS piping portion designated as ASME Code Section III shall be reconciled with the ~~with~~ piping design requirements.

a3. The TMSS piping portion designated as ASME Code Section III is fabricated, installed, and inspected in accordance with ASME Code Section III requirements..

(10) ~~TMSS Pressure Boundary Welds~~ a.Pressure boundary welds in the ASME Code Section III components of TMSS meet ASME Code Section III requirements.

b. Pressure boundary welds in the ASME Code Section III piping of the TMSS meet the ASME Code Section III requirements.

(11) a. Valves on lines attached to the RPV system that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV in the TMSS that require maintenance shall be reconciled to design requirements.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.11.1-1 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the TMSS.

Table 2.11.1-1

ITTAC For The Turbine Main Steam System ~~ITAAC~~

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9.a3. The TMSS piping portion designated as ASME Code Section III is fabricated, installed, and inspected in accordance with ASME Code Section III requirements.	Inspections of the piping will be conducted.	ASME Code Data Report(s) (certified, when required by ASME c~~C~~ode) and inspection reports (including N-5 Data Reports where applicable) ~~document~~ exist and conclude that the TMSS piping portion designated as ASME Code Section III is fabricated, installed, and inspected in accordance with ASME Code Section III requirements.
10~~ TMSS Pressure Boundary Welds~~a. Pressure boundary welds in the ASME Code Section III components of TMSS meet ASME Code Section III requirements.	Inspection of the as-built pressure boundary welds will be performed in accordance with the ASME Code Section III.	~~An~~ ASME Code Report(s) exist~~s~~ and conclude~~s~~ that the ASME Code Section III requirements are met for non-destructive examination of pressure boundary welds in the TMSS.
10b. Pressure boundary welds in the ASME Code Section III piping of the TMSS meet the ASME Code Section III requirements.	Inspection of the as-built pressure boundary welds will be performed in accordance with the ASME Code Section III.	~~An~~ ASME Code Report(s) exist~~s~~ and conclude~~s~~ that the ASME Code Section III requirements are met for non-destructive examination of pressure boundary welds in the TMSS.
11a. Valves on lines attached to the RPV system 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.

Table 2.11.1-1

ITTAC For The Turbine Main Steam System ~~ITAAC~~

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11b. The as-built location of valves on lines attached to the RPV in the TMSS that require maintenance shall be reconciled to design requirements.	A reconciliation evaluation 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 a 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 evaluation.

2.11.2 Condensate and Feedwater System

Design Description

The function of the Condensate and Feedwater System (C&FS) is to receive condensate from the condenser hotwells, supply condensate to the Condensate Purification System (CPS), and deliver feedwater to the reactor. The C&FS is classified as nonsafety-related.

Condensate is pumped from the main condenser hotwell(s) by the condensate pumps, passes through the CPS, auxiliary condenser/coolers, low-pressure feedwater heaters and into the feedwater tank. The feedwater booster pumps take suction from the open feedwater tank and provide adequate suction head for the reactor FW pumps, which pump feedwater through the high-pressure feedwater heaters to the reactor. The C&FS boundaries extend from the main condenser outlet to (but not including) the seismic interface restraint outside containment. The C&FS is located in the Reactor Building steam tunnel and Turbine Building.

(1) The functional arrangement for the C&FS is as described in Subsection 2.11.2.

(2) The C&FS provides sufficient feedwater flow and volume to mitigate Abnormal Events.

(3) The C&FS limits maximum feedwater flow to mitigate Abnormal Events.

(4) The C&FS, in conjunction with the feedwater control system, provides sufficient feedwater flow after MSIV isolation to mitigate Abnormal Events.

(5) The C&FS, in conjunction with the feedwater control system, limits the maximum feedwater flow for a single pump following a single active component failure or operator error to mitigate Abnormal Events.

(6) The C&FS, in conjunction with the feedwater control system, is designed so that the loss of feedwater heating is limited in the event of a single operator error or equipment failure.

(7) The C&FS, in conjunction with other Power Cycle Systems, provides a nominal full load final feedwater temperature that is consistent with assumptions in Abnormal Event analyses.

(8) The C&FS has a nominal feedwater flow rate at rated conditions that is consistent with inputs and assumptions in Abnormal Event analyses.

(9) a. Valves on lines attached to the RPV system that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV system in the C&FS that require maintenace shall be reconciled to design requirements.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.11.2-1 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the Condensate and Feedwater System.

Table 2.11.2-1

ITAAC For The Condensate and Feedwater System ~~ITAAC~~

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. The C&FS has a nominal feedwater flow rate at rated conditions that is consistent with inputs and assumptions in Abnormal Event analyses.	Testing and/or analysis of the as-built C&FS and feedwater pumps and/or type testing of a single feedwater pump will be performed to confirm the nominal feedwater flow rate at rated conditions.	~~A r~~Report(s) exist~~s~~ and ~~documents~~ conclude that the C&FS has a nominal feedwater flow rate at rated conditions of 2.43×10^3 kg/s (19.3×10^6 lbm/hr) are assumed in Abnormal Events.
9a. Valves on lines attached to the RPV system 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
9b. The as-built location of valves on lines attached to the RPV system in the C&FS that require maintenance shall be reconciled to design requirements.	A reconciliation evaluation 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 a 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 evaluation.

2.13.8 Lighting Power Supply

Design Description

The plant lighting systems furnish the illumination required for safe performance of plant operation, security, shutdown, and maintenance activities. The lighting systems include the Control Room and Remote Shutdown Station (RSS) Emergency Lighting System , normal, standby, and DC self-contained battery operated emergency lighting. The security lighting system is described in separate security documents.

(1) The functional arrangement of Control Room and RSS Emergency Lighting System is as described in the Design Description of this Subsection 2.13.8.

(2) The Control Room and RSS Emergency Lighting System meets Seismic Category I requirements for mountings.

(3) The Control Room and RSS Emergency Lighting System is electrically independent and physically separated. Cables are routed in the respective divisional raceways.

(4) The Control Room and RSS Emergency Lighting system provides illumination levels in the main control room equal to or greater than those recommended by the Illuminating Engineering Society of North America (IESNA) for at least 72 hours following a design basis accident and a loss of all AC power sources.

(5) The DC Self-Contained Battery-Operated Lighting Units system provides illumination levels equal to or greater than those recommended by the IESNA in the remote shutdown rooms and in those areas of the plant required for power restoration and/or recovery from a fire, for at least 8 hours.

(6) Electrical isolation of the nonsafety-related Control Room and RSS emergency lighting circuits from the safety-related Uninterruptible AC power supply is accomplished by the use of two series isolation devices.

(7) The Control Room and Remote Shutdown Station (RSS) Emergency Lighting System shall be capable of being powered by a reliable power source after the first 72 hours of a design basis event.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.13.8-1 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the Control Room and RSS Emergency Lighting Power Supply.

Table 2.13.8-1

ITAAC For ~~The~~ Lighting Power Supply

Design Commitments	Inspections, Tests, Analyses	Acceptance Criteria
7. The Control Room and Remote Shutdown Station (RSS) Emergency Lighting System shall be capable of being powered by a reliable power source after the first 72 hours of a design basis event.	Inspections shall be performed that confirm the capability of powering the Control Room and Remote Shutdown Station (RSS) Emergency Lighting System from a reliable power source that will be available after the first 72-hours of a design basis event.	Report(s) exist and conclude that the capability of powering the Control Room and Remote Shutdown Station (RSS) Emergency Lighting System from a reliable power source that will be available after the first 72-hours of a design basis event.

Table 2.15.1-2

ITAAC For The Containment System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9. The containment system provides the safety-related function of containment isolation for containment boundary integrity.	i.~~)~~ Tests will be performed to demonstrate that containment isolation valves close within the required response times.	i.~~)~~ Report(s) ~~document~~ exist and conclude that the containment isolation valves close within the required response times identified in Table 2.15.1-1d.
	ii.~~)~~ Tests will be performed to demonstrate that remote manual operated containment isolation valves reposition to the required post-accident position using real or simulated containment isolation signals.	ii.~~)~~ Report(s) ~~document~~ exist and conclude that the remote manual operated valves identified in Table 2.15.1-1a as having a containment isolation signal reposition to the required post-accident state after receiving a containment isolation signal.
	iii.~~)~~ Exercise testing of the process actuated check valves identified in Table 2.15.1-1a will be performed under preoperational test pressure, temperature and fluid flow conditions.	iii.~~)~~ Test report(s) ~~document~~ exist and conclude that each as-built process actuated check valve changes position as indicated in Table 2.15.1-1a.

Table 2.15.1-2

ITAAC For The Containment System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	iv.~~vii)~~Testing of the as-built valves will be performed under the conditions of loss of motive power.	iv~~vii.)~~Test report(s) ~~document~~ exist and conclude that after a loss of motive power, each remote manual valve identified in Table 2.15.1-1a assumes the indicated loss of motive power position.
	v. Tests will be performed to demonstrate that the lower drywell equipment and personnel hatches can be closed from outside the drywell, if a LOCA occurs in MODE 5 or 6.	v. Test report(s) exist and conclude that the lower drywell equipment and personnel hatches are able to be closed from outside the lower drywell, and a program in place to track the status of each hatch while open during MODE 5 and 6 operation.
10. Containment electrical penetration assemblies, whose maximum available fault current (including failure of upstream devices) is greater than the continuous rating of the penetration, are protected against currents that are greater than the continuous ratings.	An analysis of the as-built containment electrical penetration assemblies will be performed to demonstrate either (1) the maximum overcurrent of the circuits does not exceed the continuous current rating of the penetration, or (2) circuits whose maximum available fault currents are greater than the continuous current rating of the penetration are provided with redundant overcurrent interrupting devices.	Report(s) ~~document~~ exist and conclude that analysis exists for the as-built containment electrical penetration assemblies and concludes that the penetrations, whose maximum available fault current (including failure of upstream devices) is greater than the continuous rating of the penetration, are protected against currents that are greater than their continuous ratings.

2.15.3 Containment Internal Structures

Design Description

The functions of the containment internal structures include (1) support of the reactor vessel radiation shielding, (2) support of piping and equipment, and (3) formation of the pressure suppression boundary. The containment internal structures consist of the diaphragm floor slab that separates the DW and the WW, vent wall, Gravity-Driven Cooling System (GDCS) pool walls, reactor shield wall, and the Reactor Pressure Vessel (RPV) support bracket.

The Containment Internal Structures are as shown in Figure 2.15.3-1 and the component locations of the Containment System are as shown in Table 2.15.3-1.

(1) The functional arrangement of the Containment Internal Structures is described in the Design Description of subsection 2.15.3.

(2) Containment Internal Structures identified in Table 2.15.3-1 are designed and constructed in accordance with ANSI/AISC N690 requirements.

(3) The Containment Internal Structures identified in Table 2.15.3-1 conform to Seismic Category I requirements and can withstand seismic design basis loads, suppression pool hydrodynamic loads, design basis loss of coolant accident generated loads and annulus pressurization loads without loss of structural integrity and safety function.

(4) (Deleted)

(5) The diaphragm floor and vent wall structures that separate the DW and WW retain their integrity when subjected to the maximum design differential pressure.

(6) (Deleted)

(7) (Deleted)

(8) (Deleted)

(9) The drywell floor drain sump channels prevent molten debris from an accident from entering the drywell sump.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.3-2 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the Containment Internal Structures.

Table 2.15.3-2

ITAAC For The Containment Internal Structure

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	ii) Inspections of the as-built Containment Internal Structures identified in Table 2.15.3-1 will be performed to verify that they are housed in a seismic Category I structure.	ii) A report ~~documents~~ concludes that the as-built Containment Internal Structures identified in Table 2.15.3-1 are housed in a seismic Category I structure..
4. Deleted		
5. The diaphragm floor and vent wall structures that separate the DW and WW retain their integrity when subjected to the maximum design differential pressure.	Part of the containment Structural Integrity Test specified in Tier 1 Table 2.15.1-2 ITAAC # 8 will test the diaphragm floor and vent wall structure with a test pressure equal to 1.0 times the maximum design differential pressure conducted with the DW pressure greater than WW pressure.	A report exists and concludes that ~~of~~ the Structural Integrity Test results demonstrate~~s~~ compliance with ASME Code requirements for the applied test pressure for the containment structures.
6. Deleted		
7. Deleted		
8. Deleted		
9. The drywell floor drain sump channels prevent molten debris from an accident from entering the drywell sump.	Inspections and measurements of the drywell floor drain sump channels are performed.	Report(s) exist and conclude the drywell floor sump channels are sized to preclude debris frompassing to the sump.

2.16.3.1 Fire Barriers

Design Description

A Fire Barrier is a continuous vertical or horizontal fire-resistance rated construction assembly designed and constructed to limit the spread of heat and fire and to restrict the movement of smoke. Fire dampers protect ventilation duct openings in fire barriers.

(1) Fire barriers of 3-hour fire resistance rating are provided that separate:

- Safety-related systems from any potential fires in nonsafety-related areas that could affect the ability of safety-related systems to perform their safety function.
- Redundant divisions or trains of safety-related systems from each other to prevent damage that could adversely affect a safe shutdown function from a single fire.
- Components within a single safety-related electrical division that present a fire hazard to components in another safety-related division.
- Electrical circuits (safety-related and nonsafety-related) whose fire-induced failure could cause a spurious actuation that could adversely affect a safe shutdown function.

(2) Penetrations through fire barriers are sealed or closed to provide fire resistance ratings at least equal to that of the barriers.

(3) Fire dampers protect ventilation duct openings in fire barriers.

(4) Exposed structural steel protecting areas containing safety-related ~~shutdown~~ equipment is fireproofed with material with a fire rating of up to 3 hours as determined from the FHA.

(5) The exposure of the distributed control and information system (Q-DCIS and N-DCIS) equipment to heat and smoke caused by a fire in a single fire area does not cause spurious actuations that could adversely affect safe shutdown.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.3.1-1 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the Fire Barriers.

Table 2.16.3.1-1

ITAAC For Fire Barriers

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. The exposure of the distributed control and information system (Q-DCIS and N-DCIS) equipment to heat and smoke caused by a fire in a single fire area does not cause spurious actuations that could adversely affect safe shutdown.	Inspections, tests and /or analyses will be performed to show that the exposure of the distributed control and information system (Q-DCIS and N-DCIS) equipment to smoke and heat caused by a fire in a single fire area does not cause spurious actuations that could adversely affect safe shutdown.	Report(s) exist and conclude that the exposure of the distributed control and information system (Q-DCIS and N-DCIS) equipment to smoke and heat caused by a fire in a single fire area does not cause spurious actuations that could adversely affect safe shutdown.

(There are some exceptions involving industry standards, such as the ASME Code and the Code of Federal Regulations. Specific versions of code editions are identified in Tier 2 rather than Tier 1. This provides for specific requirements that are acceptable, yet allows the code to be updated via the change process in the design certification rule. However, due to the provisions of 10 CFR 52.63 and the rule certifying the design, updates to codes and standards in 10 CFR 50.55a would not necessarily be requirements for the certified design.) If various sources contain technical information of sufficient safety significance to warrant Tier 1 treatment, the information has been extracted from the source and included directly in the appropriate system design description. This approach is appropriate because it is unambiguous and it avoids potential questions regarding how much of a referenced document is encompassed in, and becomes part of the Tier 1.

(12) Selection of the technical terminology to be used in Tier 1 was guided by the principle that the terminology should be as consistent as possible with that used in Tier 2 and the body of regulatory requirements and industrial standards applicable to the nuclear industry. This approach is intended to minimize problems in interpreting the intent of Tier 1 commitments.

Selection Methodology — Using the criteria listed above, Tier 1 description material was developed for each system by reviewing Tier 2 material relating to that system. Tier 1 utilizes a system-by-system report structure that is different than the structure of Tier 2. Consequently, developing the Tier 1 design description entry for any one system was based on review of the multiple Tier 2 chapters having technical information related to that system.

Because the safety significance of the ESBWR systems varies, application of the criteria listed above results in a graded treatment of the systems. This leads to considerable variations in the scope of the design description entries. Table 14.3-1 lists the types of ESBWR systems, and is a summary of the overall consequences of this graded treatment. Table 14.3-1a lists the ESBWR systems and denotes which ones have ITAAC in Tier 1. In addition, Tables 14.3-1b and 1c provide a list of key design features for the ESBWR that were considered in developing the content of Tier 1, including the information that supports the related ITAAC.

For safety-related systems, application of the above criteria resulted in design description entries that include the following information (as applicable) described briefly, focusing the content on ITAAC, and relying on figures where appropriate:

- System name and scope;
- System purpose;
- System safety-related modes of operation;
- System classification (i.e., safety-related, seismic category, and ASME Code Class);
- System location;
- Functional arrangement of the portions of the system that are safety significant, including any components located in that portion of the system (usually shown by means of a figure);
- Type of electrical power provided for the system;

Table 14.3-1a

ITAAC Screening Summary

Structure/System/Equipment Description	ITAAC Table
Reactor Pressure Vessel and Internals	2.1.1-3
Nuclear Boiler System	2.1.2-3
Rod Control and Information System	2.2.1-6
Control Rod Drive System	2.2.2-7
Feedwater Control System	2.2.3-4
Standby Liquid Control System	2.2.4-6
Neutron Monitoring System	2.2.5-4
Remote Shutdown System	2.2.6-3
Reactor Protection System	2.2.7-4
Plant Automation System (nonsafety-related)	-
Steam Bypass and Pressure Control System	2.2.9-3
Distributed Control and Information System (safety-related)	2.2.10-1
Distributed Control and Information System (nonsafety-related)	2.2.11-1
Leak Detection and Isolation System	2.2.12-5
Safety System Logic and Control System	2.2.13-4
Diverse Instrumentation and Controls	2.2.14-4
Process Radiation Monitoring System	2.3.1-2
Area Radiation Monitoring System	2.3.2-2
Isolation Condenser System	2.4.1-3
Emergency Core Cooling System — Gravity-Driven Cooling System	2.4.2-3
Fuel Service Equipment	-
Miscellaneous Service Equipment	-
Reactor Pressure Vessel Servicing Equipment	-
RPV Internals Servicing Equipment	-
Refueling Equipment	2.5.5-1
Fuel Storage Facility	2.5.6-1

Table 14.3-1a

ITAAC Screening Summary

Structure/System/Equipment Description	ITAAC Table
Under-Vessel Servicing Equipment	-
FMCRD Maintenance Area	-
Fuel Cask Cleaning	-
Fuel Transfer System	2.5.10-1
Reactor Water Cleanup/Shutdown Cooling System	2.6.1-2
The Fuel and Auxiliary Pools Cooling System	2.6.2-2
Main Control Room Panels	2.2.13-1
Radwaste Control Panels	-
Local Control Panels and Racks	2.2.6-1 2.3.2-1 2.5.10-1
Liquid Waste Management System	2.10.1-2
Solid Waste Management System	2.10.2-2
Gaseous Waste Management System	2.10.3-1
Turbine Main Steam System	2.11.1-1
Condensate and Feedwater System	2.11.2-1
Condensate Purification System	-
Main Turbine	2.11.4-1
Turbine Gland Seal System	2.11.5-1
Turbine Bypass System	2.11.6-1
Main Condenser	2.11.7-1
Circulating Water System	-
Power Cycle Auxiliary Systems	-
Makeup Water System	2.12.1-1 *
Condensate Storage and Transfer System	-
Reactor Component Cooling Water System	2.12.3-1
Turbine Component Cooling Water System	-

Table 14.3-1a

ITAAC Screening Summary

Structure/System/Equipment Description	ITAAC Table
Chilled Water System	2.12.5-1
Oxygen Injection System	-
Plant Service Water System	2.12.7-1
Service Air System	2.12.8-1 *
Instrument Air System	-
High Pressure Nitrogen Supply System	2.12.10-1 *
Auxiliary Boiler System	-
Potable and Sanitary Water	-
Hydrogen Water Chemistry System	-
Process Sampling System	-
Zinc Injection System	-
Freeze Protection	-
Station Water System	-
Electrical Power Distribution System	2.13.1-2
Direct Current Power Supply	2.13.3-3
Standby On-site AC Power Supply	2.13.4-2
Uninterruptible AC Power Supply	2.13.5-2
Communication System	-
Lighting Power Supply	2.13.8-1
Power Transmission	-
Containment System	2.15.1-2
Containment Vessel	-
Containment Internal Structures	2.15.3-2
Passive Containment Cooling System	2.15.4-2
Containment Inerting System	2.15.5-2
Drywell Cooling System	-
Containment Monitoring System	2.15.7-2

Table 14.3-1a

ITAAC Screening Summary

Structure/System/Equipment Description	ITAAC Table
Passive Autocatalytic Recombiner	2.15.8-1
Cranes, Hoists and Elevators	2.16.1-1
Reactor Building HVAC	2.16.2-2
Control Building Habitability HVAC Subsystem	2.16.2-4
Emergency Filter Units	2.16.2-5
Turbine Building Ventilation System	2.16.2-7
Fuel Building HVAC System	2.16.2-9
Radwaste Building HVAC System	-
Electrical Building Ventilation System	2.16.2-10
Other Building HVAC Systems	-
Fire Protection	2.16.3-2
Fire Barriers	2.16.3.1-1
Equipment and Floor Drain System	2.16.4-1
Reactor Building	2.16.5-2
Control Building	2.16.6-2
Fuel Building	2.16.7-2
Turbine Building	2.16.8-1
Radwaste Building	2.16.9-1
Service Building	2.16.10-1
Ancillary Diesel Building	2.16.11-1
Fire Water Service Complex	2.16.12-1
Electrical Building	2.16.13-1
Service Water Building	2.16.14-1
Other Buildings and Structures	-
Intake and Discharge Structure	-
Oil Storage and Transfer Systems	-
What is Site Security	-
Plant Security	2.19-1

Table 14.3-1a

ITAAC Screening Summary

Structure/System/Equipment Description	ITAAC Table
Plant Service Water System	Interface Material
Off-site Electrical Power	Interface Material

* For these systems, the only ITAAC relate to containment isolation valves. Refer to Table 2.15-1.

\- ITAAC not selected for these systems.

NOTE: Tier 1 contains non-system based ITAAC for the following:

- Design of Piping Systems and Components Table 3.1-1
- Software Development Table 3.2-1
- Human Factors Engineering Table 3.3-1
- Radiation Protection Table 3.4-1
- Design Reliability Assurance Program Table 3.6-1
- Post Accident Monitoring Instrumentation Table 3.7-1
- Equipment Qualification of Mechanical and Electrical Equipment Table 3.8-1

Table 14.3-1b

Design Basis Accident Analysis Critical Parameters

References		Design Feature
Tier 2	Tier 1	
Reactor Power		
Table 15.2-1	Table 2.2.15-2(1)	APRM High Flux Scram
Table 15.2-1	Table 2.2.15-2(1)	APRM High STP Scram
Table 15.2-1	Section 1.1.2.5(2)	Thermal Power Level
Reactor Water Level		
Table 15.2-1	Table 2.2.15-2(1)	Low Level Scram (L3)
Table 15.2-1	Table 2.2.15-2(1)	High Level Scram (L8)
Table 15.2-1	Table 2.2.15-2(1)	Water Level Trips (L2, L1, L0.5)
Reactor Pressure		
Table 15.2-1	Table 2.2.15-2(1)	High Pressure Scram
MSIV Closure		
Table 15.2-1	Table 2.2.15-2(1)	MSIV Closure Scram (Position of 2 or more MSIVs)
Table 15.2-1	Table 2.1.2-3	MSIV Closure Time Minimum/Maximum
Suppression Pool Temperature		
Table 15.2-1	Table 2.2.15-2(1)	High SP Temperature Scram
Table 15.2-1	Table 2.6.2-2	Initiate FAPCS
TSV Closure		
Table 15.2-1	Table 2.2.15-2(1)	TSV Closure Scram, (Position of 2 or more TSV)
TCV Closure		
Table 15.2-1	Table 2.2.15-2(1)	TCV Fast Closure SCRAM Trip
Control Rod Drive Scram Time		
Table 15.2-2	Table 2.2.2-7 and Table 2.2.2-2	Maximum Scram Time of all rods below 7.481 MPaG
Table 15.2-3	N/A(3)	Scram Times between 7.481 and 8.618 MPaG after de-energization

Table 14.3-1b

Design Basis Accident Analysis Critical Parameters

References		Design Feature
Tier 2	Tier 1	
Overpressure Protection		
Subsection 15.5.1.3	T2.1.2-3	Ten SRVs and eight SVs are included in the ESBWR design.
Table 15.2-1 and Table 15.5-3	Table 2.1.2-3	Analytical Limit Setpoint: 8.618 MPaG (SRV) 8.756 MPaG (SV)
Table 15.2-1	Table 2.1.2-3	SRV Capacity @ 8.618 MPa
Table 15.2-1	Table 2.1.2-3	SRV Capacity @ 8.765 MPa
Table 15.2-1	Table 2.1.2-3	DPV Capacity @ 7.481 MPa
Isolation Condenser		
Table 6.3-1	Table 2.4.1-3	Initiation Signals MSIV Closure High Dome Pressure Low Water Level Loss of Gen Power
Table 15.2-1	Table 2.4.1-3	Minimum capacity (each) 4 IC, MW / % NBR
Table 15.2-1	N/A(4)	Minimum Initial Temperature
Table 15.2-1	Table 2.4.1-3	Injection valve stroke
Table 6.3-1	Table 2.4.1-3	IC Volume (4 units) minimum drainable liquid volume per unit
Main Steam		
Table 15.2-1	Table 2.11.1-1	Total Steamline Volume (vessel to TSVs/TBVs)
Table 15.2-1	Table 2.11.6-1	TBV Total Capacity
Table 15.2-1	Table 2.11.6-1	Delay Response Time from TSV or TCV to 80% of Total Bypass Valve Capacity
Table 15.2-1	Table 2.11.6-1 and Table 2.11.7-1	TBV Sustained Operation on loss of preferred power

Table 14.3-1b

Design Basis Accident Analysis Critical Parameters

References		Design Feature
Tier 2	Tier 1	
Section 15.2.2	Table 2.11.6-1	Upon closure of the TSVs or fast closure of TCVs, to prevent an increase in system pressure, sufficient bypass capacity is provided to pass steam flow diverted from the turbine.
Table 15.2-1	Table 2.11.4-1	TSV closing stroke time
Table 15.2-1	Table 2.11.4-1	TCV closing stroke time (fast)
Table 15.2-1	Table 2.11.4-1	TCV closure stroke time (minimum servo)
Table 15.2-1	Table 2.11.4-1	% rated through 3 TCVs
Table 5.2-6	Table 2.1.2-3	MSIV Isolation on: L2 Water Level + Time Delay L1 Water Level Low Turbine Inlet Pressure Low Condenser Vacuum
Core Flow		
Reference 4.4-12	N/A(5)	Core Flow measurement accuracy
Feedwater		
Section 7.7.3	Table 2.2.15-2(1)	L 0.5 Equalization Line Trip
Table 15.2-1	Table 2.11.2-1	Runout Capacity (3 pumps)
Table 15.2-1	Table 2.11.2-1	Runout Capacity (1 pump)
Table 15.2-1	Table 2.11.2-1	Feedwater Temperature (rated)
Table 15.2-1	Table 2.11.2-1	Feedwater heater temperature loss (Δ)
Table 15.2-1	Table 2.2.1-6	Loss of feedwater heating setpoint (Δ) (SCCRRI/SRI Initiation)
Ref. 4.4-12	Table 2.2.3-4	Feedwater flow measurement (1 σ)
Anticipated Transient Without Scram		
Table 15.5-3	Table 2.2.3-4	Feedwater runback on ATWS signal

Table 14.3-1b

Design Basis Accident Analysis Critical Parameters

References		Design Feature
Tier 2	Tier 1	
Standby Liquid Control		
Section 15.5.4	Table 2.2.4-6	System Initiation High RPV Press + SRNM not downscale for 3 min L2 + SRNM not downscale for 3 min SRNM not downscale for 3 min with manual ARI / FMCRD run-in
Section 9.3.5	Table 2.2.4-6	Boron concentration
Section 9.3.5	Table 2.2.4-6	Total Volume
Section 9.3.5; Table 15.5-2	Table 2.2.4-6	Average flowrate: first half of volume second half of volume
Section 9.3.5	Table 2.2.4-6	RPV injection pressure
Containment		
Table 6.2-1	Table 2.15.1-3	Design Pressure
Table 6.2-1	Table 2.15.1-3	Design Temperature
Table 6.2-1	Table 2.15.1-3	Maximum Differential Pressure
Table 6.2-1	Table 2.15.1-3	Maximum DP (DW>WW)
Table 6.2-1	Table 2.15.1-3	Leakage Rate
Table 6.2-1; Table 6.2-8	Table 2.15.1-3	Vacuum Breakers (DW>WW) – 3 each Opening DP (WW - DW) Closing DP (WW - DW) Loss Coefficient (K/A2)
Table 6.2-3	Table 2.15.1-3	Containment Volume Upper DW free gas volume Lower DW free gas volume Wetwell free gas space volume Suppression Pool Volume

Table 14.3-1b

Design Basis Accident Analysis Critical Parameters

References		Design Feature
Tier 2	Tier 1	
Table 6.2-3	Table 2.15.1-3	Suppression Pool Volume Pool surface only Vertical vents SP depth (High level) SP depth (Nominal level) SP Depth (Low level)
Table 6.2-4	Table 2.15.1-3	Vertical Vents Total Number Inside diameter
Table 6.2-4	Table 2.15.1-3	Horizontal Vents Vents (per vertical vent) Total number Inside Diameter Submergence Top Row (CL) Middle Row (CL) Bottom Row (CL)
PCCS		
Table 6.2-10	Table 2.15.4-2	Number of PCCS Condensers
Table 6.2-10	Table 2.15.4-2	Heat Removal Capacity (per Condenser)
Table 6.2-10	Table 2.15.4-2	Assumed Pool temperature
Table 6.2-10	Table 2.15.4-2	Design Pressure
Table 6.2-10	Table 2.15.4-2	Design Temperature
Emergency Core Cooling System		
Table 6.3-1	Table 2.2.15-2(1)	ECCS Initiation Signal (L1 water level)
Table 6.3-1	Table 2.2.15-2(1)	GDCS Initiation Signal
Table 6.3-1	Table 2.4.2-3	GDCS line loss coefficient
Table 6.3-2	Table 2.4.2-3	GDCS Divisions
Table 6.3-2	Table 2.4.2-3	Injection Lines / Division

Table 14.3-1b

Design Basis Accident Analysis Critical Parameters

References		Design Feature
Tier 2	Tier 1	
Table 6.3-2	Table 2.4.2-3	Injection line RPV Nozzles (per Division)
Table 6.3-2	Table 2.4.2-3	Equalizing line RPV Nozzles (per Division)
Table 6.3-2	Table 2.4.2-3	Minimum drainable inventory
Table 6.3-2	Table 2.4.2-3	Min. Elevation of GDCS pool above RPV nozzles
Table 6.3-2	Table 2.4.2-3	Minimum flow through deluge lines
Table 6.3-2	Table 2.4.2-3	Minimum GDCS equalizing line head

Notes:

(5) System limits that are based on process analytical limits are verified in Tier 1 by system functionality requirements in combination with the requirements for a control system setpoint control program.

(6) Rated reactor power is included in Tier 1 content, but is not verified through an ITAAC.

(7) Control Rod SCRAM times vary with reactor pressure; therefore, this key parameter cannot be verified prior to fuel load and is not addressed by an ITAAC.

(8) The minimum initial IC temperature is a conservatively assumed value that is equivalent to the minimum reactor building ambient temperature (Tier 2, Table 9.4-8) even though the lines are physically located inside the drywell and the ICII event is assumed to occur at normal power operating conditions. This is an operational parameter limit that cannot be verified by ITAAC prior to fuel load.

(9) The total core flow is calculated by the heat balance core flow methodology. This is a critical parameter that cannot be verified prior to fuel load, thus there is no ITAAC requirement associated with this parameter. This parameter is met provided the input values for the heat balance (e.g. reactor pressure, feedwater flow and temperature) are within their required accuracy ranges.

Table 14.3-1c

PRA and Severe Accident Insights

Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
FAPCS, internal and external, injection capability provide adequate core cooling for transients given successful DPV or ADS valve operation, even if containment pressure is at the ultimate containment pressure.	Subsection 9.1.3.2	2.6.2 Table 2.6.2-2 Item 7b
The DPS cabinet is assumed to be located in a separate fire area in the control building. A preliminary fire PRA analysis model with DPS cabinet located inside room 3301 shows that the fire risk in fire area F3301 would be the dominant contributor to all fire risks due to the high failure probability of common cause failure of software for the safety – related system, the failure of DPS, and multiple nonsafety-related systems impacted by a fire in room 3301. With a separate fire area for the proposed DPS cabinet in the detailed design, the fire risk can be significantly reduced.	Section 1.0, Figure 1.2-4	2.2.14 Table 2.2.14-4 Item 11
The exposure of the distributed control and information system (Q-DCIS and N-DCIS) equipment to heat and smoke caused by a fire in a single fire area does not cause spurious actuations that could adversely affect safe shutdown.	Subsection 9.5.1.12	2.16.3.1 Table 2.2.15-2 Item 5
The communication links between the main control room (MCR) and the Q-DCIS and N-DCIS rooms do not include any copper or other wire conductors that could potentially cause fire-induced spurious actuations that could adversely affect safe shutdown.	Subsection 9.5.1.12	2.2.15 Table 2.2.15-2 Items 10a and 10b
Doors that connect the Control and Reactor Buildings with the Electrical Building galleries are watertight, for flooding of the galleries up to the ground level elevation.	Subsection 3.4.1.4.3	2.16.5, 2.16.6 Table 2.16.5-2, Item 8 Table 2.16.6-2, Item 5

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PRA and Severe Accident Insights

Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
The Drywell Floor Drain Sump channels, which allow leakage on the lower drywell floor to flow into the sump, will prevent any molten debris, which reaches the inlet, from entering the sump.	Subsection 6.2.1.1.10.2	2.15.3 Table 2.15.3-2, Item 9(v)
Closure of both the equipment hatch and the personnel hatch can be performed from outside the lower drywell/containment.	Section 1.0, Figure 1.2-2	2.15.1 Table 2.15.1-2, Item 9 (iv)
The IC/PCCS Pool valves that provide make-up water from the equipment storage pool are powered from a reliable source of power, which is capable of long-term support.	Subsection 5.4.6.2.2	2.4.1 Table 2.4.1-3, Item 24
Control logic cabinets for each of the containment vacuum breaker isolation valves must be located in separate fire zones.	Subsection 6.2.1.1.2	2.15.1 Table 2.2.14-4, Item 8(iv)
Because of the high consequence of a RWCU/SDC line break outside containment this system is designed with an additional diverse, nonsafety-related valve that is used for line isolation. This valve is controlled by the nonsafety-related DCIS system and closes on the same signals that provide the safety-related isolation.	Subsection 5.4.8.1.2	2.6.1 Table 2.6.1-2, Item 1
Power operated equipment and valves on lines attached to the RPV that require maintenance have maintenance valves installed such that freeze seals will not be required.	Subsection 5.2.3.1.1 Cryogenic Conditions	2.2.2 CRD Table 2.2.2-3 2.2.4 SLCS 2.4.2 GDCS, Item 28 2.4.1 ICS 2.6.1 RWCU 2.6.2 FAPCS 2.11.1 TMSS 2.11.2 CFW

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PRA and Severe Accident Insights

Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
A pneumatic accumulator and check valve are required to support the remote-manual and ADS-activated functions of the valve. The accumulator and check valve ensures that the valve opens via the pneumatic operator following a failure of the pneumatic pressure source.	Subsection 5.2.2.2.2	Table 2.1.2-3, Item 23
The lower drywell water level is monitored to indicate any increases in water level that may occur in the lower drywell following a LOCA condition.	Subsection 7.5.2.1 and Table 7.3-5	2.15.7 Table 2.15.7-2, Item 1
BiMAC temperature indication: Temperature sensors in the BiMAC device provide the actuation signal to open the squib valves from the GDCS pool deluge headers.	Subsections 19.3.2.5 and 19.3.2.6	2.4.2 Table 2.4.2-3, Item 25 Table 2.4.2-3, Item 26
RTNSS Functions		
DPS – ARI Actuation	Subsection 19A.8.4.1	2.2.14 Table 2.2.14-4, Item 8
DPS – FWRB Actuation	Subsection 19A.8.4.1	2.2.14 Table 2.2.14-4, Item 8
DPS – ADS Inhibit	Subsection 19A.8.4.1	2.2.14 Table 2.2.14-4, Item 8
DPS – GDCS Injection	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
DPS – ADS Actuation	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8

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PRA and Severe Accident Insights

Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
DPS – Open IC/PCCS Pool Cross-Connect Valves	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
DPS – Isolation RWCU/SDC Valves	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4 Item 8
DPS – Scram	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
DPS – MSIV Closure	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
DPS – SRV Actuation	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
DPS- FMCRD Actuation	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
DPS – ICS Actuation	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
DPS – SLC Actuation LOCA	Subsection 19A.8.4.3	2.2.14 Table 2.2.14-4, Item 8
FPS Diesel Driven Pump	Subsection 19A.8.4.2	2.16.3 Table 2.16.3-2, Item 7a
FPS Motor Driven Pump	Subsection 19A.8.4.2	2.16.3 Table 2.16.3-2, Item 5
FPS to FAPCS Connection Piping	Subsection 19A.8.4.2	2.16.3 Table 2.16.3-2, Item 7c

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PRA and Severe Accident Insights

Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
Passive Autocatalytic Recombiners	Subsection 19A.8.4.10	2.15.8 Table 2.15.8-1
PCCS Vent Fans	Subsection 19A.8.4.10	2.15.4 Table 2.15.4-2 Item 11
Emergency Lighting – Post 72 Hour	Subsection 19A.8.4.4	2.13.8 Table 2.13.8-1, Item 4 Table 2.13.8-1, Item 7
FAPCS (LPCI, SPC Modes)	Subsection 19A.8.4.7	2.6.2 Table 2.6.2-2, Item 7
BiMAC Device	Subsection 19.3.2.5 19.3.2.6 19A.8.4.5	2.4.2 Table 2.4.2-3, Item 29
GDCS Deluge Valves	Subsection 19A.8.4.5	2.4.2 Table 2.4.2-3, Item 27
Reactor Building HVAC Purge Exhaust Filters	Subsection 19A.8.4.11	2.16.2 Table 2.16.2-2, Item 11
FPS Water Tank	Subsection 19A.8.4.2	2.16.3 Table 2.16.3-2, Item 4
FPS Diesel Fuel Oil Tank	Subsection 19A.8.4.2	2.16.3 Table 2.16.3-2, Item 7b
Ancillary Diesel Generators	Subsection 19A.8.4.8	2.13.4 Table 2.13.4-2, Item 5

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PRA and Severe Accident Insights

Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
Ancillary AC Power Buses	Subsection 19A.8.4.8	2.13.4 Table 2.13.4-2, Item 5
Ancillary DG Fuel Oil Tank	Subsection 19A.8.4.8	2.13.4 Table 2.13.4-2, Item 5
Ancillary DG Fuel Oil Transfer Pump	Subsection 19A.8.4.8	2.13.4 Table 2.13.4-2, Item 5
N-DCIS	Subsection 19A.8.4.6	2.2.11 Table 2.2.11-1
6.9 kV PIP Buses	Subsection 19A.8.4.8	2.13.1 Table 2.13.1-2, Item 6
Standby Diesel Generators	Subsection 19A.8.4.8	2.13.4 Table 2.13.4-2, Item 2
Standby DG Auxiliaries	Subsection 19A.8.4.8	2.13.4 Table 2.13.4-2, Item 2
RCCWS	Subsection 19A.8.4.9	2.12.3 Table 2.12.3-1, Item 2
Nuclear Island Chilled Water	Subsection 19A.8.4.9	2.12.5 Table 2.12.5-1, Item 2
PSWS	Subsection 19A.8.4.9	2.12.7 Table 2.12.7-1, Item 1
Electrical Building HVAC Area Cooling	Subsection 19A.8.4.9	2.16.2.7 Table 2.16.2-10, Item 2

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Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
Fuel Building HVAC Local Cooling	Subsection 19A.8.4.9	2.16.2.5 Table 2.16.2-9, Item 5
Reactor Building HVAC Local Cooling	Subsection 19A.8.4.9	2.16.2.1 Table 2.16.2-2, Item 7
Turbine Building HVAC Local Cooling	Subsection 19A.8.4.9	2.16.2.4 Table 2.16.2-7, Item 2
CRHAVS Air Handling Units	Subsection 19A.8.4.4	2.16.2.2 Table 2.16.2-6, Item 12
CRHAVS Air Handling Unit auxiliary heaters and coolers	Subsection 19A.8.4.4	2.16.2.2 Table 2.16.2-6, Item 10
RTNSS Structures		
Fire Pump Enclosure	Subsection 19A.8.3	2.16.3 T2.16.3-2, Item 1
Ancillary DG Building	Subsection 19A.8.3	2.16.11 Table 2.16.11-1
Reactor Building	Subsection 19A.8.3	2.16.2.1 Table 2.16.5-2, Item 1
Control Building	Subsection 19A.8.3	2.16.2.2 Table 2.16.2-2 Item 1
Electrical Building	Subsection 19A.8.3	2.16.13 Table 2.16.13-1
Turbine Building	Subsection 19A.8.3	2.16.8 Table 2.18.8-1

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Design Feature	DCD Tier 2 Reference	DCD Tier 1 Reference
Fuel Building	Subsection 19A.8.3	2.16.2.5 T2.16.2-7, Item 1
Service Water Structure	Subsection 19A.8.3	2.16.14 Table 2.16.14-1