HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application RAI Numbers 14.3-172, 14.3-173, 14.3-241 and 14.3-261.**

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) sent by NRC letter dated December 20, 2007 (Reference 1).

Enclosure 1 contains the GEH response to RAIs 14.3-172, 14.3-173, 14.3-241 and 14.3-261. The enclosed changes will be incorporated in the upcoming DCD Revision 5 submittal.

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 5.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

D068

NRO

Reference:

1. MFN 07-718, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 126 Related To ESBWR Design Certification Application*, December 20, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application – 14.3-172, 14.3-173, 14.3-241 and 14.3-261.

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF	0000-0081-3372 – RAI 14.3-241
		0000-0081-5947 – RAI 14.3-172
		0000-0081-7333 – RAI 14.3-261
		0000-0083-0519 – RAI 14.3-173

MFN 08-086, Supplement 30

Enclosure 1

Response to Portion of NRC Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application

RAI Numbers 14.3-172, 14.3-173, 14.3-241 and 14.3-261

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 5.

NRC RAI 14.3-172

NRC Summary:
Update Tier 1, Section 3.3 to include "Minimum Inventory"

NRC Full Text:
DCD Tier 1, Table 2.2.3-4 Item 4 stated that feedwater control system (FWCS) minimum inventory of alarms, displays, and status indications in the main control room are addressed in Section 3.3. However, there is no discussion on minimum inventory in Tier 1 Section 3.3. Update Tier 1 Section 3.3 to include verification of "minimum inventory" or provide correct cross-reference in DCD Tier 1 Table 2.2.3 4.

GEH RESPONSE

The minimum inventory of alarms, displays, and status indications in the main control room is addressed in DCD Tier 1, Table 3.3-1, ITAAC For Human Factors Engineering, Acceptance Criteria column, Item 6, which states: "List of instruments comprising the minimum inventory of HSI and that complies with RG 1.97 and supporting analysis." DCD Tier 1, Table 2.2.3-5, ITAAC For Feedwater Control System, will be revised to provide the correct cross-reference.

DCD IMPACT

DCD Tier 1, Table 2.2.3-5 will be revised as noted in the attached markup to provide correct cross-reference.

Table 2.2.3-~~4~~5

ITAAC For 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 report(s) 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 report(s) 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), test(s) and type test(s) will be performed on the as-built system using simulated signals and manual actions.	Test and type test report(s) 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, and status indications in the main control room are addressed in ~~Section~~ Table 3.3~~.~~-1, Item 6.	See ~~Section~~ Table 3.3~~.~~-1, Item 6.	See ~~Section~~ Table 3.3~~.~~-1, Item 6.
5. Single failure modes of fault tolerant digital controllers (FTDC) are defined in Table 2.2.3-4.	Test(s) will be performed using simulated signals or faults on the FWCS FTDC for the single failure modes defined in Table 2.2.3-4.	Test reports(s) document that FWCS FTDC continues to function as defined for the single failure modes in Table 2.2.3-4.

NRC RAI 14.3-173

NRC Summary:
Update Tier 1 Table 2.2.13-1 SSLC/ESF Functional Arrangement to include safety-related VDU test

NRC Full Text:
In the October 18, 2007, NRC-GEH public meeting on ESBWR DCD Revision 4, Tier 1 changes, the staff commented that DCD Tier 1, Table 2.2.13-1, SSLC/ESF Functional Arrangement, should include an item related to safety-related Video Display Unit (VDU) tests. The VDU tests involve the hardware/software qualification and the human factor engineering evaluation aspects of the VDU design. Update Tier 1 Table 2.2.13-1 SSLC/ESF Functional Arrangement to include safety-related VDU test

GEH RESPONSE

Design Control Document (DCD) Tier 1 will be updated to provide safety-related video display unit (VDU) design and test information.

The Design Description information contained in DCD Tier 1, Section 2.2.13, Engineered Safety Features Safety System Logic and Control, will be updated to include the safety-related video display units (VDUs).

The Safety System Logic and Control for the Engineered Safety Features (SSLC/ESF) VDU function will be added to DCD Tier 1, Table 2.2.13-1, SSLC/ESF Functional Arrangement.

DCD Tier 1, Table 2.2.13-4, ITAAC For Safety System Logic and Control/ESF System, ITAAC 4, 5 and 6 are associated with hardware/software qualification, development and testing of the safety-related VDUs, as well as the other SSLC/ESF structures, systems and components (SSCs).

- ITAAC 4 addresses design conformance with IEEE Std. 603 requirements for SSLC/ESF SSCs, including the safety-related VDUs.
- ITAAC 5 addresses the Human Factors Engineering (HFE) aspects of the safety-related alarms, displays, and status indication design, which include VDUs. (Find additional information associated with HFE aspects of the VDU design below.)

- ITAAC 6 addresses equipment qualification of SSLC/ESF SSCs, including safety-related VDUs.

HFE aspects of the VDU design, including minimum inventory, are addressed in DCD Tier 1, Section 3.3, Human Factors Engineering, for the Man-Machine Interface System (MMIS) checks.

The Man-Machine interface and HFE design process is described in the following documents:

- Licensing Topical Report (LTR) NEDE-33217P, Revision 3, ESBWR Man Machine Interface System and Human Factors Engineering Implementation Plan.
- The future update to NEDE-33217P described in and submitted via MFN-07-428 and dated October 24, 2007.
- LTR NEDE-33226P, Revision 2, ESBWR I&C Software Management Plan, submitted via MFN-07-384 on July 24, 2007, describes the overall process plan for software development and testing required for the Human-System Interfaces.

In response to RAI 14.3-241, ITAAC 7 will be added to Table 2.2.13-4 to address SSLC/ESF software development and testing. Item 7 will also be added to the Functional Requirements portion of Section 2.2.13, Engineered Safety Features Safety System Logic and Control, to include the SSLC/ESF software development program.

The new ITAAC and Functional Requirement, which will be added as part of the RAI 14.3-241 response, address the safety-related VDU software development and testing process.

DCD IMPACT

DCD Tier 1 will be revised as depicted in the attached markups.

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~~ the safe shutdown function of the Isolation Condenser System (ICS), and controls the safety-related video display units (VDUs) for the Q-DCIS.

Functional Arrangement

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

Functional Requirements

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

(3) 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.

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

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

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

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 receives the inputs from, and sends outputs to interfacing systems as defined in Tables 2.2.13-2 and 2.2.13-3. SSLC/ESF logic is designed to provide a trip initiation by requiring coincident trip of at least two divisions to cause the trip output. Redundant safety-related power supplies are provided for each division. SSLC/ESF uses "energized-to-trip" and "fail-as-is" logic. ADS (SRVs and DPVs), GDCS, and SLC are actuated sequentially and in groups. SSLC/ESF transmits and receives safety-related human system interface (HSI) information as defined in Table 3.3-1, Item 6, to and from the safety-related VDUs.

Table 2.2.13-4

ITAAC For 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.	See Section 3.8.	See Section 3.8.
7. SSLC/ESF software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

NRC RAI 14.3-241

NRC Summary:
X-walk between Chapter 2.2 ITAAC and Chapter 3 ITAAC

NRC Full Text:
At the recent software audit, the GEH representatives identified that x-walk will be incorporated in Chapter 2.2 ITAAC (I&C) and the Chapter 3 Software Program ITAAC

GEH RESPONSE

A cross-walk (x-walk) that connects Tier 1, Section 2.2, I&C subsections with the software development program described in Tier 1, Section 3.2, will be as described below.

DCD Tier 1, Subsections 2.1.2, 2.2.4, 2.2.5, 2.2.6, 2.2.7, 2.2.12, 2.2.13, 2.2.14, 2.3.1, 2.4.1, 2.4.2, 2.7.1, 2.15.7, 2.16.2.1, 2.16.2.2, 2.16.2.3, and 3.7 will be revised to reference Section 3.2 as noted in the attached markup.

DCD Tier 1, Tables 2.1.2-3, 2.2.4-6, 2.2.5-4, 2.2.6-3, 2.2.7-4, 2.2.12-5, 2.2.13-4, 2.2.14-4, 2.3.1-2, 2.4.1-3, 2.4.2-3, 2.7.1-1, 2.15.7-2, 2.16.2-2, 2.16.2-4, 2.16.2-6, and 3.7-1 will be revised to add ITAAC that reference Section 3.2 as noted in the attached markup.

DCD IMPACT

DCD Tier 1 will be revised as shown on the attached mark-ups.

(31) The free volume for each of the following components is within the uncertainty band of the free volume used in the natural circulation flow analysis:

- RPV
- Downcomer
- Core
- Chimney
- Separator/dryer

(32) The hydraulic diameter of the core will be within the uncertainty band of the hydraulic diameter used in the natural circulation flow analysis.

(33) The heated diameter of the core will be greater than the heated diameter used in the natural circulation flow analysis.

(34) NBS software is developed in accordance with the software development program described in Section 3.2.

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

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.1.2-3 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the NBS.

Table 2.1.2-3

ITAAC For The Nuclear Boiler System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
32. The hydraulic diameter of the core will be within the uncertainty band of the hydraulic diameter used in the natural circulation flow analysis.	As-built dimension inspection and analyses will be performed to determine the hydraulic diameter of the core.	A report exists that documents that the hydraulic diameter of the core is within the uncertainty band of the hydraulic diameter used in the natural circulation flow analysis.
33. The thermal diameter of the core will be greater than the thermal diameter used in the natural circulation flow analysis.	Analyses will be performed to determine the thermal diameter of the core	A report exists that documents that the analyses conclude the thermal diameter of the core is greater than the thermal diameter used in the natural circulation flow analysis.
34. NBS software is developed in accordance with the software development program described in Section 3.2.	Section 3.2.	Section 3.2.

b. Pressure boundary welds in piping identified in Table 2.2.4-4 as ASME Code Section III meet ASME Code Section III requirements.

(12) Pressure boundary integrity

a. The components identified in Table 2.2.4-4 as ASME Code Section III retain their pressure boundary integrity at ~~under internal pressures that will be experienced during service~~their design pressure.

b. The piping identified in Table 2.2.4-4 as ASME Code Section III retains its pressure boundary integrity at its design pressure.

(13) The Seismic Category I equipment identified in Tables 2.2.4-4 and 2.2.4-5 can withstand seismic design basis loads without loss of safety function.

(14) Each of the components identified in Table 2.2.4-4 for which functional capability is required is designed to withstand combined normal and seismic design basis loads without a loss of its functional capability.

(15) Each of the SLC System divisions (or safety-related loads/components) identified in Tables 2.2.4-4 and 2.2.4-5 is powered from its respective safety-related division.

(16) In the SLC System, independence is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.

(17) ~~Each mechanical train of the SLC System is physically separated from the other trains outside of the Containment.~~(Deleted)

(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.

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
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.	An analysis of the as-built system will be performed to determine the equivalent natural boron concentration at cold shutdown conditions for the total solution injection volume.	The equivalent natural boron concentration at cold shutdown conditions for the total solution injection volume is > [1100 ppm].
23. SLC software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

2.2.5 Neutron Monitoring System

Design Description

Design Description

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

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.

(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.

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

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

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 2.2.5-4

ITAAC For The Neutron Monitoring System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. NMS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

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.

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 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.

(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.

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

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

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 report(s) document(s) that the as-built panels are configured as described in Subsection 2.2.6 and defined Table 2.2.6-1.
2. RSS controls are defined in Table 2.2.6-2.	Test(s) and type test(s) will be performed on the controls defined in Table 2.2.6-2.	Test report(s) document(s) that the RSS panels are capable of issuing control signals from the 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.	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.	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.	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.	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.

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.

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

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

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

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.2.7-~~3~~4 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria, which will be performed for the RPS.

Table 2.2.7-4

ITAAC For The Reactor Protection System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. RPS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

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.

Functional Arrangement

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

Functional Requirements

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

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

(4) LD&IS controls, interlocks, and bypasses are defined 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.

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

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

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

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

Inspections, Tests, Analyses and Acceptance Criteria

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

Table 2.2.12-5

ITAAC For Leak Detection and Isolation System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. The containment isolation components that correspond to the isolation functions defined in Table 2.2.12-2 are addressed in Subsection 2.15.1.	See Subsection 2.15.1.	See Subsection 2.15.1.
9. LD&IS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

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~~ the safe shutdown function of the Isolation Condenser System (ICS), and controls the safety-related video display units (VDUs) for the safety-related Distributed Control and Information System (QDCIS).

Functional Arrangement

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

Functional Requirements

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

(3) 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.

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

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

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

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 2.2.13-4

ITAAC For 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.	See Section 3.8.	See Section 3.8.
7. SSLC/ESF software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

2.2.14 Diverse Instrumentation and Controls

Design Description

The ~~diverse~~ Diverse ~~instrumentation~~ Instrumentation and ~~control~~ Control ~~system~~ System (DICS) comprises the Anticipated Transients Without Scram Standby Liquid Control (ATWS/SLC) system and the ~~diverse~~ Diverse ~~protection~~ Protection ~~system~~ System (DPS).

Functional Arrangement

(1) DICS functional arrangement is defined in Tables 2.2.14-1 and 2.2.14-2 ~~and Figure 2.2.14-1~~.

Functional Requirements

(2) DICS automatic functions, initiators, and associated interfacing systems are defined in Table 2.2.14-2.

(3) DICS controls, interlocks and bypasses in the ~~main control room (~~MCR~~)~~ are defined in Table 2.2.14-3.

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

(5) The equipment qualification of DICS components defined in Table 2.2.14-1 is addressed in Section 3.8.

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

(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.

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

(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.

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

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 DICS.

Table 2.2.14-4

ITAAC For Diverse Instrumentation and Controls

Design Commitment	Inspections, Tests, Analyses	Acceptance 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.	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 ~~(which address NUREG/CR-6303 Type 1-3 failures)~~ for the RPS and SSLC/ESF safety-related platforms have been addressed in the DPS design scope. {{DAC}}
10. DICS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

2.3 RADIATION MONITORING SYSTEMS

The following subsections describe the major radiation monitoring systems for the ESBWR.

2.3.1 Process Radiation Monitoring System

Design Description

The Process Radiation Monitoring System (PRMS) monitors and provides for indication of radioactivity levels in process and effluent gaseous and liquid streams, initiates protective actions, and activates alarms in the Main Control Room (MCR) on high radiation signals. Alarms are also activated when a monitor becomes inoperative or goes upscale/downscale. The PRMS safety-related channel trip signals are provided as inputs to the Safety System Logic and Control (SSLC) for generation of protective action signals.

(1) The functional arrangement of the PRMS is as described in the Design Description of this Subsection 2.3.1 and Figure 2.3.1-1 in conjunction with Table 2.3.1-1.

(2) a. The safety-related PRMS subsystems as identified in Table 2.3.1-1 are powered from uninterruptible safety-related power sources.

b. The safety-related PRMS subsystems identified in Table 2.3.1-1 have electrical divisional separation.

(3) The safety-related process radiation monitors listed in Table 2.3.1-1 are seismic Category I and can withstand seismic design basis loads without loss of safety function.

(4) Safety-related PRMS subsystems provide the following:

a. Indications in MCR for radiation levels

b. Indications on SCUs for radiation levels

c. Alarms in MCR on radiation level exceeding setpoint

d. Indications on SCUs on radiation level exceeding setpoint.

e. Alarms in MCR on upscale/downscale or inoperative conditions.

f. Initiation of protective actions as noted in Table 2.3.1-1

(5) The nonsafety-related process monitors listed in Table 2.3.1-1 are provided.

(6) Safety-related PRMS subsystems initiate preventive actions to isolate and/or terminate plant processes or effluent releases as described in Table 2.3.1-1.

(7) Nonsafety-related PRMS subsystems provide the following:

a. Indications in MCR for radiation levels

b. Alarms in MCR on radiation level exceeding setpoint

c. Alarms in MCR on upscale/downscale or inoperative conditions.

(8) PRMS subsystem software is developed in accordance with the software development program described in Section 3.2.

Table 2.3.1-2

ITAAC For The Process Radiation Monitoring System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. The nonsafety-related PRNM subsystem monitors which perform active/automatic control functions in order to control offsite doses below 10 CFR 20 limits provide the following: a. Indications in MCR for radiation levels b. Alarms in MCR on radiation level exceeding setpoint c. Alarms in MCR on upscale/downscale or inoperative conditions	a. Tests will be conducted by using a standard radiation source or portable calibration unit that exceeds a setpoint value that is preset for the testing. b. Inspections will be conducted to confirm that the as-built indication, alarm, and automatic initiation functions are met.	Test/inspection reports exist and document that the as-built indication, alarm, and automatic initiation functions are met.
8. PRMS subsystem software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

The ICS passively removes sensible and core decay heat from the reactor with minimal loss of coolant inventory from the reactor, when the normal heat removal system is unavailable following any of the following events.

- Sudden reactor isolation at power operating conditions
- During station blackout (i.e., unavailability of all AC power)
- Anticipated Transient Without Scram (ATWS)
- Loss of Coolant Accident (LOCA)

The ICs are sized to remove post shutdown reactor decay heat with 3 of 4 ICs operating and to reduce reactor pressure and temperature to safe shutdown conditions, with occasional venting of noncondensable gases to the suppression pool. Because the heat exchangers (ICs) are independent of plant AC power, they function whenever normal heat removal systems are unavailable, to maintain reactor pressure and temperature below the SRV setpoints.

The portions of the ICS steam supply (P-1), condensate return (P-2) and purge lines (including isolation valves), which are located inside the containment and out to and including the IC flow restrictors, are designed to ASME Code Section III, Class 1, Quality Class A. Other portions of the ICS including the vent lines are ASME Code Section III, Class 2, Quality Class B. The IC/PCC pools are safety-related and Seismic Category I.

Safety Requirements:

The ICS performs the following safety-related functions:

- Automatically limit pressure within the reactor coolant pressure boundary below the SRV septoints following any abnormal event that results in containment isolation.
- In event of a LOCA, ICS provides additional liquid inventory upon opening of the condensate return valves.. The ICS also provides an initial depressurization of the reactor on loss of feedwater flow.
- With an intact RCPB, the ICS in conjunction with the water in the RPV, conserve sufficient reactor coolant volume to avoid automatic depressurization caused by low reactor water level.
- Remove reactor decay heat produced during and following an abnormal event, which involve reactor scram and containment isolation. The abnormal events include Station Blackout and Anticipated Transient Without Scram (ATWS).

ICS software is developed in accordance with the software development program described in Section 3.2.

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
27. ICS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

(9) The GDCS squib valve used in the injection and equalization open as designed.

(10) a. Check valves designated in Figure 2.4.2-1 as having an active safety-related function open, close, or both open and also close under system pressure, fluid flow, and temperature conditions.

~~(10)~~b. The GDCS injection line check valves meet the criterion for maximum fully open flow coefficient in the reverse flow direction.

(11) Control Room indications and controls are provided for the GDCS.

(12) GDCS squib valves maintain RPV backflow leak tightness and maintain reactor coolant pressure boundary integrity during normal plant operation.

(13) Each GDCS injection line includes a nozzle flow limiter to limit break size. [N491]

(14) Each GDCS equalizing line includes a nozzle flow limiter to limit break size. [N492]

(15) Each of the GDCS divisions is powered from their respective safety-related power divisions.

(16) Each mechanical division of the GDCS outside the drywell is physically separated from the other divisions with the exception of divisions B and C connected to pool B/C as shown in Figure 2.4.2-1.

(17) The GDCS pools A, B/C, and D are sized to hold a minimum drainable water volume.

(18) The GDCS pools A, B/C, and D are of sized for holding a specified minimum water level.

(19) The minimum elevation change between minimum water level of GDCS pools and the centerline of GDCS injection line nozzles is sufficient to provide gravity-driven flow.

(20) The minimum drainable volume from the suppression pool to the RPV is sufficient to meet long-term post-LOCA core cooling requirements.

(21) The long-term GDCS minimum equalizing driving head is based on RPV Level 0.5.

(22) The GDCS Deluge squib valves open as designed.

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

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 Gravity-Driven Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
21. The long-term GDCS minimum equalizing driving head is based on RPV Level 0.5.	An analysis of the minimum equalizing driving head will be performed.	Analysis confirms the minimum equalizing driving head is 1 meter (3.28 ft).
22. The GDCS Deluge squib valves open as designed.	A vendor type test will be performed on a squib valve to open as designed.	Records of vendor type test concludes GDCS Deluge squib valves used open as designed.
23. GDCS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

2.7 CONTROL PANELS

The following subsections describe the different types of control panels and systems for the ESBWR.

2.7.1 Main Control Room Panels

Design Description

The main control room (MCR) is comprised of an integrated set of operator interface panels.

(1) The functional arrangement of the MCR Panels is as described in this Section 2.7.1.

(2) The safety-related MCR Panels conform to seismic Category I requirements and are housed in a seismic Category I structure.a.Independence is provided between safety-related divisions.

b. Separation is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.

(4) Human factors engineering principles are incorporated into all aspects of the MCR design.

(5) MCR Panel software is developed in accordance with the software development program described in Section 3.2.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.7.1-1 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the MCRP.

Table 2.7.1-1

ITAAC For Main Control Room Panels

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3a) Independence is provided between safety-related divisions.	Tests will be performed on the as-built safety-related MCR Panels by providing a test signal in only one safety-related division at a time and checking for ~~voltage~~ a test signal in all divisions.	Test report(s) document that a test signal exists only in the as-built safety-related division under test in the MCR Panels.
b) Separation or electrical isolation is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.	Inspection of the as-built safety-related MRC Panels will be performed.	Inspection report(s) document that, for the as-built safety-related MCR Panels, physical separation or electrical isolation exists between safety -related divisions. Physical separation or electrical isolation exists between safety-related divisions and nonsafety-related equipment.
4. Human factors engineering principles are incorporated into the MCR Panel design	See Tier 1 Section 3.3.	See Tier 1 Section 3.3.
5. MCR Panel software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

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:

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

(1) The functional arrangement for the CMS is as described in the Design Description in this Section 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 an ECCS initiation signal for post-accident monitoring of oxygen and hydrogen content in the containment.

(5) In each CMS Suppression Pool Temperature Monitoring (STPM) division, signals from the CMS STPM temperature and the CMS suppression pool water narrow range transmitters are provided for the divisional Safety System Logic and Control (SSLC)/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.

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

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

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

Table 2.15.7-2

ITAAC For The Containment Monitoring System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9. CMS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

2.16.2 Heating, Ventilating and Air-Conditioning Systems

2.16.2.1 Reactor Building HVAC

Design Description

The Reactor Building HVAC System (RBVS) serves the Reactor Building. The RBVS consists of three subsystems. The Reactor Building Clean Area HVAC Subsystem (CLAVS) serves the clean (non-radiologically controlled) areas of the Reactor Building and is shown in Figure 2.16.2-1. The Reactor Building Contaminated Area HVAC Subsystem (CONAVS) serves the potentially contaminated areas of the Reactor Building and is shown in Figure 2.16.2-2. The Reactor Building Refueling and Pool Area HVAC Subsystem (REPAVS) serves the refueling area of the Reactor Building and is shown in Figure 2.16.2-3.

The RBVS automatically isolates the Reactor Building boundary during accidents. The isolation dampers and ducting penetrating the Reactor Building boundary, and associated controls that provide the isolation signal are safety-related. Safety-related components for the RBVS are listed in Table 2.16.2-1.

The remaining portion of the RBVS is nonsafety-related.

(1) The basic configuration of the RBVS is as described in Subsection 2.16.2.1 and is as shown in Figures 2.16.2-1, 2.16.2-2 and 2.16.2-3.

(2) The RBVS isolation dampers automatically close upon receipt of a high radiation signal or loss of AC power.

(3) The safety-related components identified in Table 2.16.2-1 can withstand Seismic Category I loads without loss of safety-related function.

(4) The RBVS maintains the hydrogen concentration levels in the battery rooms below 2% by volume.

(5) CONAVS maintains served areas of the reactor building at a slightly negative pressure relative to surrounding clean areas to minimize the exfiltration of potentially contaminated air.

(6) REPAVS maintains served areas of the reactor building at a slightly negative pressure relative to surrounding clean areas to minimize the exfiltration of potentially contaminated air.

(7) The RBVS provides post 72-hour cooling for DCIS, CRD and RWCU pump rooms.Indications and controls for safety-related components of the RBVS as indicated in Table 2.16.2-1 are available in the main control room (MCR).

(9) Independence is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.

(10) RBVS software that controls the safety-related RBVS components is developed in accordance with the software development program described in Section 3.2.

b. The CRHA heat sink is maintained at or below 25.56°C (78°F).

(5) Independence is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.

(6) CRHA isolation damper and EFU operational status (Open/Closed) indication is provided in the MCR.

(7) The free air volume of the control room envelope is greater than or equal to the volume assumed in safety analyses.

(8) Normal operation intake flow rate is greater than or equal to the flow rate assumed in the safety analyses.

(9) CRHAVS software that controls the safety-related CRHAVS components is developed in accordance with the software development program described in Section 3.2.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.2-4 provides definitions of the inspections, test and/or analyses, together with associated acceptance criteria for the Control Building HVAC.

2.16.2.3 Emergency Filter Units

Design Descriptions

The Emergency Filter Units (EFU) supply pressurized breathing air to the Control Room Habitability Area (CRHA) during isolation of the CRHA boundary envelope. The EFUs are safety-related and maintain habitable conditions in the CRHA to ensure the safety of the control room operators. An EFU is automatically initiated upon CRHA isolation to provide breathing air and pressurization of the CRHA to minimize infiltration. There are two independent, redundant EFU trains capable of supplying sufficient air and CRHA pressurization for up to 21 operators for 72 hours. The EFUs are part of the CRHAVS, and a simplified system diagram is provided in Figure 2.16.2-4. Design information on safety-related equipment is provided in Table 2.16.2-5.

(1) The basic configuration of the EFU is as described in Subsection 2.16.2.3 and is as shown in Figure 2.16.2-4.

(2) The selected redundant EFU dampers open upon receipt of a control room habitability envelope isolation signal.

(3) The safety-related EFU components identified in Table 2.16.2-5 can withstand Seismic Category I loads without loss of safety-related function.

(4) Independence for the EFU trains is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.

(5)

a. EFUs maintain the CRHA at a minimum positive pressure of 31 pascals (0.125 inch water gauge) with respect to the surrounding areas at the required air addition flow rate of 200 l/s (424 cfm).

b. The in-leakage does not exceed the unfiltered in-leakage assumed by control room operator dose analysis.

(6) The powered EFU dampers can be remotely operated from the MCR.

(7) EFUs meet the in-place leakage testing requirements of ASME AG-1 and RG 1.52.

(8) Indications and controls for the safety-related components of the EFU system as indicated in Table 2.16.2-5 are available in the MCR.

(9) The dedicated portable AC generator(s), available on site, is capable of providing post 72-hour power to the EFU fan system.

(10) EFUs are tested to meet RG 1.52 requirements for HEPA and carbon filter efficiency.

(11) The standby EFU starts on a low flow signal from the operating EFU.

(12) EFUs maintain habitable conditions in the CRHA for 72 hours.

(13) EFU software that controls the safety-related EFU components is developed in accordance with the software development program described in Section 3.2.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.2-6 provides the design commitments, inspections, tests, analyses and acceptance criteria for the EFUs.

2.16.2.4 Turbine Building HVAC System

Design Description

The Turbine Building Ventilation System (TBVS) is nonsafety-related. The TBVS includes the Turbine Building supply air fans and associated AHUs, and the Turbine Building exhaust fans and associated filter trains.

The Turbine Building Ventilation System is designed to minimize exfiltration of air to adjacent areas by maintaining a slightly negative pressure in the Turbine Building (by exhausting more air than is supplied) relative to adjacent areas.

(1) The basic configuration of the Turbine Building Ventilation System (TBVS) is as described in Subsection 2.16.2.4.

(2) The TBVS provides post 72-hour cooling for DCIS in the Turbine Building and room cooling for the Nuclear Island Chilled Water System and RCCW pumps.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.2-7 provides the design commitments, inspections, tests, analyses and acceptance criteria for the Turbine Building HVAC System.

2.16.2.5 Fuel Building HVAC System

Design Description

The Fuel Building HVAC system (FBVS) does not perform any safety-related functions, except for automatic isolation of the Fuel Building ventilation systems to mitigate the consequences of fuel handling accidents with significant radiological releases. The Fuel Building HVAC

Table 2.16.2-2

ITAAC For The Reactor Building HVAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9. Independence is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.	a) Tests will be performed on the RBVS dampers by providing a test signal in only one safety-related division at a time. b) Inspection of the as-built safety-related divisions in the system will be performed.	a) Test reports document that the test signal exists only in the safety-related division under test in the as-built RBVS damper. b) Physical separation or electrical isolation exists between as-built RBVS dampers. Physical separation or electrical isolation exists between safety-related divisions and nonsafety-related equipment.
10. RBVS software that controls the safety-related RBVS components is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

Table 2.16.2-4

ITAAC For The Control Building Habitability HVAC Subsystem

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. Normal operation intake flow rate is greater than or equal to the flow rate assumed in the safety analyses.	Inspections will be performed to verify the normal operation intake flow rate.	A report exists and concludes that the flow rate ≥ 200 l/s (424 cfm).
9. CRHAVS software that controls the safety-related CRHAVS components is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

Table 2.16.2-6

ITAAC For Emergency Filter Units

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. EFUs are tested to meet RG 1.52 requirements for HEPA and carbon filter efficiency.	a. Each charcoal adsorber will be tested in accordance with ASME AG-1, Section FE; and Regulatory Guide 1.40. b. HEPA filters will be tested in accordance with ASME AG-1, Section FC.	a. Test report(s) document that the as-built EFU filter efficiency meet the acceptance criteria for in-place testing in accordance with ASME AG-1.
11. The standby EFU starts on a low flow signal from the operating EFU.	Testing will be performed to verify that the operating EFU is isolated and the standby EFU is automatically started on a low flow signal from the operating EFU.	Test report(s) document that a low flow test signal from the operating EFU will start the standby EFU.
12. EFUs maintain habitable conditions in the CRHA for 72 hours.	Testing will ensure that the filtered air supply will not be reduced below the required 424 cfm when the CRHA is isolated and being maintained at a positive pressure of >31 pascals (0.125 in. wg) with respect to the surrounding adjacent areas.	Test report(s) document that the as-built EFUs provide 424 cfm of filtered air when the CRHA is isolated and being maintained at a positive pressure of >31 pascals (0.125 in. wg) with respect to the surrounding adjacent areas.
13. EFU software that controls the safety-related EFU components is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

- Testability
- Direct measurement
- Control of access
- Maintenance and repair
- Auxiliary supporting features
- Portable instruments
- Documentation of Design Criteria

Qualification criteria

- Type A variables
- Type B variables
- Type C variables
- Type D variables
- Type E variables
- Portable instruments
- Post Event operating time
- Documentation of qualification criteria

Display criteria

- Information characteristics
- Human factors
- Anomalous indications
- Continuous vs. on-demand display
- Trend or rate information
- Display identification
- Type of monitoring channel display
- Display location
- Information ambiguity
- Recording
- Digital display signal validation
- Display criteria documentation

PAMS software is developed in accordance with the software development program described in Section 3.2.

Table 3.7-1

ITAAC For The Post Accident Monitoring Instrumentation

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The post accident monitoring instrumentation is designed with the requirements (variables, types, performance criteria, design criteria, qualification criteria, display criteria, and quality assurance) as described in Section 3.7.	Inspections tests and/or analysis will be performed to verify that the post accident monitoring instrumentation is designed in conformance with the requirements as described in Section 3.7. {{DAC}}	Report(s) exists and conclude(s) that the post accident monitoring instrumentation is designed in conformance with the requirements as described in Section 3.7.
2. PAMS software is developed in accordance with the software development program described in Section 3.2.	See Section 3.2.	See Section 3.2.

NRC RAI 14.3-261

NRC Summary:
Add functional description and Interface Diagram

NRC Full Text:
The following functions were removed from Revision 4 of the functional description in Revision 3. These along with the interface diagram needs to be added to make a safety evaluation.

1) *Processing of manual demands for nuclear system isolation*
2) *The logic functions of ECCS, CRHS, LDIS and the ICS*

GEH Response

The RAI discussion addresses DCD Tier 1, Section 2.2.13, Engineered Safety Features Safety System Logic and Control (SSLC/ESF).

The information removed from DCD Tier 1 Revision 3 is provided in different sections of DCD Tier 1 Revision 4.

The manual demands for nuclear system isolation, namely Containment Isolation Valve (CIV) and Main Steam Isolation Valve (MSIV) controls, are addressed in Section 2.2.12, Leak Detection and Isolation System (LD&IS), and Section 2.15.1, Containment System.

Figure 2.2.13-2, Safety System Logic and Control Interface Diagram was removed and replaced with Table 2.2.13-2, SSLC/ESF Automatic Functions, Initiators, and Associated Interfacing Systems.

The logic functions of ECCS are described in Section 2.2.13 and Table 2.2.13-2.

The logic functions of CRHS are described in Section 2.16.2.2, Control Building HVAC System, and in Section 2.2.13.

Section 2.2.12 describes the LD&IS logic functions.

Section 2.4.1 describes the ICS logic functions.

The interfacing system information listed in DCD Tier 1 Table 2.2.13-2 is incorrect and will be updated to reflect the correct interfacing systems.

DCD IMPACT

DCD Tier 1 Table 2.2.13-2, SSLC/ESF Automatic Functions, Initiators, and Associated Interfacing Systems, will be updated to reflect the correct interfacing systems as shown in the attached markups.

Table 2.2.13-2

SSLC/ESF Automatic Functions, Initiators, and Associated Interfacing Systems

Function	Initiator	Interfacing System
ADS	RPV reactor water level low (Level 1)	~~RPS~~NBS
GDCS Injection	RPV reactor water level low (Level 1)	NBS, ~~RPS~~GDCS
GDCS Equalizing Lines	RPV reactor water level low (Level 1)	NBS, ~~RPS~~GDCS
ICS	RPV reactor water level low (Level 1)	NBS, ~~RPS~~ICS
SLC	RPV reactor water level low (Level 1)	NBS, ~~RPS~~SLC, ATWS/SLC
CRHAVS emergency filtration mode	CRHA inlet air supply radiation high from PRMS	PRMS, CRHAVS
CRHAVS isolation	Smoke detectors	FPS, CRHAVS