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Subject: **Supplemental Response to Portion of NRC Request for Additional Information Letter No. 54 Supplemented by E-mail from Lauren Quinones Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-8 S01**

The purpose of this letter is to supplement GEH's response to RAI 9.1-8 S01 as provided in Reference 1 by re-classifying pressure relief devices provided on the Reactor Building and Fuel Building from nonsafety-related to safety-related.

Note that these pressure relief devices are also discussed in Reference 2.

The GEH supplemental response to RAI 9.1-8 S01 is provided in Enclosure 1. Enclosure 2 contains the DCD markups associated with this supplemental response.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 08-273, Response to Portion of NRC Request for Additional Information Letter No. 54 Supplemented by E-mail from Lauren Quinones Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-8 S01, March 26, 2008
2. MFN 10-084, Transmittal of ESBWR DCD Tier 2, Chapters 6 and 9 Markups Related to GEH Design Development and Clarification in Section 9.1, March 18, 2010

Enclosures:

1. Supplemental Response to Portion of NRC Request for Additional Information Letter No. 54 Supplemented by E-mail from Lauren Quinones Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-8 S01
2. Supplemental Response to Portion of NRC Request for Additional Information Letter No. 54 Supplemented by E-mail from Lauren Quinones Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-8 S01 – DCD Markups

cc:	AE Cubbage	USNRC (with enclosures)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	TL Enfinger	GEH/Wilmington (with enclosures)
	eDRF Section	0000-0122-2983

Enclosure 1

MFN 08-273, Supplement 1

Supplemental Response to Portion of NRC Request for Additional Information Letter No. 54 Supplemented by E-mail from Lauren Quinones Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.1-8 S01

NRC RAI 9.1-8 S01

In its response to RAI 9.1-8, the applicant stated that the steam generated by the spent fuel pool (SFP) is released to the atmosphere through a relief panel in the Fuel Building. The applicant also stated that the water inventory is sufficient to ensure that the core will be covered for 72 hours, and that there are no engineered safety feature atmosphere cleanup systems in the Fuel Building. Please provide the following information:

1. *Discuss under what circumstances are these relief panels expected to open.*

2. *If the relief panels open (under normal or accident conditions), will there be any radioactive releases to the environment? If so, how are these monitored in accordance with GDC 64, and accounted for in the design basis accident?*

3. *Are these relief panels safety-related? How are they tested?*

4. *Verify that the water inventory is sufficient to provide adequate shielding with the SFP loaded to maximum capacity. What is the expected level of water relative to the top of active fuel at 72 hours?*

5. *Discuss the rationale for not providing a safety-related atmospheric cleanup system.*

GEH Supplemental Response

Note: This supplemental response affects the GEH response to Questions 1, 2 and 3. The responses to questions 4 and 5, as provided in MFN 08-273, are unaffected, but provided for completeness. Changes from the original response are identified by underlines for added text and strikethroughs for deleted text.

1. *Discuss under what circumstances are these relief panels expected to open.*

GEH Response:

The relief panels will open to prevent the fuel building from exceeding its maximum design pressure~~ of 14 kPA gauge~~. ~~It does~~ <u>They do</u> not open in response to any design basis accident event described in DCD Chapter 15.

2. *If the relief panels open (under normal or accident conditions), will there be any radioactive releases to the environment? If so, how are these monitored in accordance with GDC 64, and accounted for in the design basis accident?*

GEH Response:

Design basis accidents associated with Fuel Building operations are limited to the Fuel Handling Accident (FHA) and Spent Fuel Cask Drop Accident, which are described in DCD Sections 15.4.1 and 15.4.10, respectively. While the Fuel Building relief panel is designed to open to prevent the fuel building from exceeding its maximum design pressure~~ of 14 kPA gauge~~, it does not open in response to any design basis accident event described in DCD Chapter 15.

The long-term loss of spent fuel pool cooling and fuel pool boil-off event described in DCD Section 9.1.3.3 is a low frequency, low consequence event. As described in DCD Section 9.1.3.3, the Fuel Building relief panel ensures steam generated by boiling of the spent fuel pool is released to the atmosphere. Loss of spent fuel pool cooling requires either equipment failure involving both trains of the Fuel and Auxiliary Pools Cooling System (FAPCS) described in DCD Section 9.1.3, or a Loss of Offsite Power Event (LOOP). Radioactivity releases through an open Fuel Building relief panel during a spent fuel pool boil-off event can be readily estimated based on available spent fuel pool radionuclide concentration. Therefore, a conservative estimate of the dose released to the atmosphere has been made using RADTRAD 3.03 and the following assumptions.

- The volume of water postulated to boil off is 1,690 m^3 (as provided to the NRC in MFN-07-646 dated December 7, 2007). The specific volume is assumed to be approximately 0.001 m^3/kg.
- Spent fuel pool water radionuclide concentrations equal to 1% of DCD Table 11.1-4a, 5a and 7a values, except H-3 (100% of Section 11.1 value) per Section 12.2.1.2.1 of DCD Revision 4. It is conservatively assumed that all of the water flashes to steam making all the activity airborne.
- Assumed instantaneous transport of the steam to the outside atmosphere.
- Control room envelope is assumed to operate in normal mode for the duration of the event. This is a normal unfiltered intake and discharge of 424 cfm (Figure 9.4-1 of the DCD Revision 4).
- EAB and LPZ X/Q values used are consistent with DCD Tier 2, Table 2.0-1. It is recognized that DCD Tier 2, Table 2.0-1 control room X/Q values for a point source release from the Fuel Building have been developed, however, the diffuse source values are higher and more limiting from a dose consequence standpoint.

Therefore, the X/Q values assumed are for a diffuse release from the Fuel Building are as shown below.

Control Room X/Q Values (sec./m^3) for a Diffuse Release from the Fuel Building

Time	X/Q Value (sec./m^3)
0 - 2 hrs	2.80E-03
2 - 8 hrs	2.50E-03
8 - 24 hrs	1.25E-03
1 - 4 days	1.10E-03
4 - 30 days	1.00E-03

Consistent with the 10 CFR 52.47 (a)(2)(iv) regulatory bases, acceptance criteria are stated in terms of a total effective dose equivalent (TEDE). The criterion of 2.5 rem TEDE for off-site dose is consistent with the 2.5 rem TEDE dose limit applied in DCD Table 15.0-5. The main control room dose acceptance criterion is based on 10 CFR 50, Appendix A, General Design Criteria 19, which provides a dose limit of 5 REM TEDE for control room operators. The resulting dose calculated by RADTRAD based on the conservative assumptions is well below the acceptance criteria, as shown below. The results of the most bounding case run for the analysis of the FHA (which clearly bounds this event) are also provided for comparison in the table below. It should be noted that the EAB, LPZ, and Control Room doses following this event are also within the acceptance criteria limits that are applied to Anticipated Operational Occurrences as provided in Table 15.0-4 of the DCD.

Spent Fuel Pool Boiling Event Analysis Results

Location	SFPB Dose (REM TEDE)	SFPB Acceptance Criteria (REM TEDE)	FHA Dose (REM TEDE)	FHA Acceptance Criteria (REM TEDE)
EAB	2.3E-02	2.5	4.13	6.3
LPZ	2.2E-03	2.5	0.39	6.3
Control Room	2.2E-02	5.0	4.82	5.0

The Process Radiation Monitoring System (PRMS) in the Fuel Building is described in DCD Section 11.5.1.1, which addresses design compliance with GDC 64 during normal operation. The Fuel Building relief panels are not normally open or monitored as a potential radioactive release pathway to the environment. During normal operation, the relief panel functions as part of the Fuel Building structure to limit outside air infiltration within the capability of the FBVS to maintain negative pressure inside the building as described in Section 9.4.2.1.

3. Are these relief panels safety-related? How are they tested?

GEH Response:

The panels are ~~nonsafety related~~ <u>safety-related</u>. Operational testing is not practical due to the destructive nature of the tests. Testing will be performed by the manufacturer to demonstrate the panels function within their design parameters. <u>Periodic inspection of the panels as part of the structural walkdowns will ensure functionality is maintained.</u>

4. Verify that the water inventory is sufficient to provide adequate shielding with the SFP loaded to maximum capacity. What is the expected level of water relative to the top of active fuel at 72 hours?

GEH Response:

The SFP is designed with sufficient water inventory to keep the fuel covered for 72 hours following an accident as described in the response to RAI 9.1-18 S02 (MFN 07-646 dated December 7, 2007). In an accident scenario in which the SFP water level is reduced due to boil-off, the FB will be evacuated, and personnel would not be allowed in the area because a minimum shielding level is not guaranteed for the full 72 hours. After this 72-hour period, makeup is credited for reestablishing pool inventory. Pool makeup can be performed from outside of the FB.

5. Discuss the rationale for not providing a safety-related atmospheric cleanup system.

GEH Response:

Design basis accidents associated with Fuel Building operations are limited to the Fuel Handling Accident (FHA) and Spent Fuel Cask Drop Accident, which are described in DCD Sections 15.4.1 and 15.4.10, respectively. Dose consequences for the FHA are calculated assuming instantaneous release of noble gas and iodine radionuclides without credit for atmospheric cleanup. The Spent Fuel Cask Drop Accident does not result in any radionuclide release.

Since no design basis accidents associated with Spent Fuel Building operations are identified that require atmospheric cleanup (filtration) to limit dose consequences within Regulatory Guide 1.183 and GDC 19 limits, safety-related atmospheric cleanup systems are not provided.

DCD Impact

The following DCD subsections and tables will be revised as shown in the attached markups:

- DCD Tier 1, Subsection 2.16.5,
- DCD Tier 1, Table 2.16.5-2,
- DCD Tier 1, Subsection 2.16.7,
- DCD Tier 1, Table 2.16.7-2,
- DCD Tier 2, Table 3.2-1,
- DCD Tier 2, Subsection 6.2.3.2, and
- DCD Tier 2, Subsection 9.1.3.2.

Enclosure 2

MFN 08-273, Supplement 1

Supplemental Response to Portion of NRC Request for Additional Information Letter No. 54 Supplemented by E-mail from Lauren Quinones Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.1-8 S01

DCD Markups

2.16.5 Reactor Building

Design Description

The Reactor Building (RB) houses the reactor system, reactor support and safety systems, concrete containment, essential power supplies and equipment, steam tunnel, and refueling area. On the upper floor of the RB are the new fuel pool and small spent fuel storage area, dryer/separator storage pool, refueling and fuel handling systems, the upper connection to the Fuel Transfer System and the overhead crane. The Isolation Condenser/Passive Containment Cooling System pools are below the refueling floor.

The RB structure is integrated with a reinforced concrete containment vessel (RCCV); the RCCV is located on a common basemat with the RB. The RB is a rigid box type shear wall building. The external walls form a box surrounding a large cylindrical containment. The RB shares a common wall and sits on a large common basemat with the Fuel Building. The RB is a safety-related, Seismic Category I structure. The building is partially below grade. The RB subcompartments are equipped with overpressure protection devices in the event of high-energy line breaks or overpressure of the areas.

The key characteristics of the RB are as follows:

(1) The RB is designed and constructed to accommodate the dynamic, static and thermal loading conditions associated with the various loads and load combinations, which form the structural design basis. The loads are (as applicable) those associated with:

- Natural phenomena—wind, floods, tornados (including tornado missiles), earthquakes, rain and snow.
- Internal events—floods, pipe breaks including LOCA and missiles.
- Normal plant operation—live loads, dead loads, temperature effects and building vibration loads.

(2) The functional arrangement of the RB is as described in the Design Description of this Subsection 2.16.5 and is as shown in Figures 2.16.5-1 through 2.16.5-11.

(3) The critical dimensions used for seismic analyses and the acceptable tolerances are provided in Table 2.16.5-1.

(4) The RB Contaminated Area Ventilation Subsystem (CONAVS) area design provides a holdup volume and delays release of radioactivity to the environment consistent with the LOCA dose analysis maximum exfiltration assumptions.

(5) The RB provides three-hour fire barriers for separation of the four independent safe shutdown divisions.

(6) For external flooding, the RB incorporates structural provisions into the plant design to protect the structures, systems, or components from postulated flood and groundwater conditions. This approach provides:

- Wall thicknesses below flood level designed to withstand hydrostatic loads;

- Water stops in all expansion and construction joints below design basis maximum flood and groundwater levels;
- Waterproofing of external surfaces below design basis maximum flood and groundwater levels;
- Water seals in external walls at pipe and electrical penetrations below design basis maximum flood and groundwater levels; and
- Roofs designed to prevent pooling of large amounts of water in excess of the structural capacity of the roof for design loads.
- Exterior access opening sealed in external walls below flood and groundwater levels.

(7) Protective features used to mitigate or eliminate the consequences of internal flooding are:

- Structural enclosures or barriers
- Curbs and sills
- Leakage detection components
- Drainage systems

(8) The internal flooding protection features prevent flood water in one division from propagating to other division(s) and ensure equipment necessary for safe shutdown is located above the maximum flood level for that location or is qualified for flood conditions by:

- Divisional walls
- Sills
- Watertight doors

(9) a. The RB is protected against pressurization effects associated with postulated rupture of pipes containing high-energy fluid that occur in subcompartments of the RB.
b. The RB structure in the refuel floor area is equipped with overpressure protection devices in the event of overpressure of this area.

(10) The Reactor Building CONAVS area volume meets design assumptions for the mixing of fission products following a LOCA.

(11) RTNSS equipment in the RB is located above the maximum flood level for that location or is qualified for flood conditions.

(12) The buffer pool is a reinforced concrete structure with a stainless steel liner that is equipped with embedments designed to Seismic Category I requirements.

(13) Doors that connect the RB with the EB galleries are watertight for flooding of the galleries up to the ground level elevation.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.16.5-2 provides a definition of the inspections, tests and analyses, together with associated acceptance criteria for the RB.

Table 2.16.5-2

ITAAC For The Reactor Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. Protective features used to mitigate or eliminate the consequences of internal flooding are: • Structural enclosures or barriers • Curbs and sills • Leakage detection components • Drainage systems	Inspections of the as-built RB flood protection features will be conducted.	The following flood protection features specified in the Design Description 2.16.5 are in place in the as-built RB to mitigate or eliminate the consequences of internal flooding: • Structural enclosures or barriers • Curbs and sills • Leakage detection components • Drainage systems
8. The internal flooding protection features prevent flood water in one division from propagating to other division(s) and ensure equipment necessary for safe shutdown is located above the maximum flood level for that location or is qualified for flood conditions by: • Divisional walls • Sills • Watertight doors	Inspections of the as-built RB flood protection features will be conducted.	The following flood protection features specified in the Design Description 2.16.5 are in place in the as-built RB to prevent flood water in one division from propagating to other division(s) and to ensure equipment necessary for safe shutdown not located above the maximum flood level for that location is qualified for flood conditions: • Divisional walls • Sills • Watertight doors
9a. The RB is protected against pressurization effects associated with postulated rupture of pipes containing high-energy fluid that occur in subcompartments of the RB.	Inspections of the RB subcompartments that rely on overpressure protection devices will be conducted.	The as-built RB subcompartments which rely on overpressure protection devices are equipped with over pressure protection devices specified in the Design Description 2.16.5.

Table 2.16.5-2

ITAAC For The Reactor Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9b. The RB structure in the refuel floor area is equipped with overpressure protection devices in the event of overpressure of this area.	Inspection and analysis of the as-built RB structure overpressure protection devices will be performed.	The as-built RB structure overpressure protection devices specified in the Design Description 2.16.5 can relieve excessive positive pressure generated by steam buildup during auxiliary pool design boiling conditions.
10. The Reactor Building CONAVS area volume meets design assumptions for the mixing of fission products following a LOCA.	Inspections of the as-built dimensions of the areas in the RB credited in the design basis mixing analysis will be performed. The results will be compared to the calculation of the total mixing volume to verify that the results match the assumptions.	The as-built RB CONAVS area volume meets design assumptions for the mixing of fission products following a LOCA.
11. RTNSS equipment in the RB is located above the maximum flood level for that location or is qualified for flood conditions.	Inspections of the as-built RTNSS equipment in the RB will be conducted.	The as-built RTNSS equipment in the RB is located above the maximum flood level for that location or is qualified for flood conditions.
12. The buffer pool is a reinforced concrete structure with a stainless steel liner that is equipped with embedments designed to Seismic Category I requirements.	Inspection and analysis of the as-built buffer pool will be performed.	The as-built buffer pool is a reinforced concrete structure with a stainless steel liner that is equipped with embedments and can withstand seismic dynamic loads without loss of structural integrity.

2.16.7 Fuel Building

Design Description

The Fuel Building (FB) contains the spent fuel pool, cask loading area, fuel handling systems and storage areas, lower connection to the Fuel Transfer System, overhead crane, and other plant systems and equipment. The FB is a Seismic Category I structure except for the penthouse that houses HVAC equipment. The penthouse is a Seismic Category II structure. The FB is a rectangular reinforced concrete box type shear wall structure consisting of walls and slabs and is supported on a foundation mat. The FB is integrated with the RB, sharing a common wall between the RB and FB as well as a large common foundation mat. The building is partially below grade.

There is no safety-related component in the FB that could be affected by internal flooding in this structure. Flooding in the FB could not affect the RB because the connection points in the lower elevation are watertight. To protect the FB against external flooding, penetrations in the external walls below flood level are provided with watertight seals.

The key characteristics of the FB are as follows:

(1) The FB is designed and constructed to accommodate the dynamic, static, and thermal loading conditions associated with the various loads and load combinations, which form the structural design basis. The loads are those associated with:

- Natural phenomena—wind, floods, tornadoes (including tornado missiles), earthquakes, rain and snow;
- Internal events—floods;
- Normal plant operation—live loads, dead loads and temperature effects; and
- Loads from spent fuel storage racks.

(2) The functional arrangement of the FB is as described in the Design Description of this Subsection 2.16.7 and is as shown in Figures 2.16.7-1 through 2.16.7-6.

(3) The critical dimensions and acceptable tolerances for the FB are as described in Table 2.16.7-1.

(4) The walls forming the boundaries of the FB and penetrations through these walls have three-hour fire ratings.

(5) The FB external flooding protection features are:

- Exterior access openings are sealed in external walls below flood and groundwater levels;
- Wall thickness below flood level designed to withstand hydrostatic loads;
- Water seals at pipe and electrical penetrations are installed in external walls below flood and groundwater levels;
- Water stops in all expansion and construction joints below design basis maximum flood and groundwater levels; and

- Roofs designed to prevent pooling of large amounts of water in excess of the structural capacity of the roof for design loads.

(6) Internal flooding analysis of the FB is performed using ANSI/ANS 56.11-1988 guidelines to ensure protection of RTNSS equipment.

(7) RTNSS equipment in the FB is located above the maximum flood level for that location or is qualified for flood conditions.

(8) The spent fuel pool is a reinforced concrete structure with a stainless steel liner that is equipped with embedments designed to Seismic Category I requirements.

(9) The gates that connect the SFP to adjacent pools are designed to Seismic Category I requirements, and are designed so that the bottom of the gate is at least 3.05 m (10.0 ft) above TAF.

(10) The FB structure above the spent fuel pool is equipped with overpressure protection devices in the event of overpressure of this area.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.16.7-2 provides a definition of the inspections, test and analyses, together with associated acceptance criteria for the Fuel Building.

Table 2.16.7-2

ITAAC For The Fuel Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. RTNSS equipment in the FB is located above the maximum flood level for that location or is qualified for flood conditions.	Inspection of the as-built RTNSS equipment in the FB will be conducted.	The as-built RTNSS equipment in the FB is located above the maximum flood level for that location or is qualified for flood condition.
8. The spent fuel pool is a reinforced concrete structure with a stainless steel liner that is equipped with embedments designed to Seismic Category I requirements.	Inspection or analysis of the as-built spent fuel pool will be performed.	The as-built spent fuel pool is a reinforced concrete structure with a stainless steel liner that is equipped with embedments and can withstand seismic dynamic loads without loss of structural integrity.
9. The gates that connect the SFP to adjacent pools are designed to Seismic Category I requirements, and are designed so that the bottom of the gate is at least 3.05 m (10.0 ft) above TAF.	Inspection of the as-built spent fuel pool will be performed.	The gates that connect the SFP to adjacent pools can withstand seismic dynamic loads without loss of structural integrity, and are built so that the bottom of the gate is at least 3.05 m (10.0 ft) above TAF.
10. The FB structure above the spent fuel pool is equipped with overpressure protection devices in the event of overpressure of this area.	Inspection and analysis of the as-built FB structure overpressure protection devices will be performed.	The as-built FB structure overpressure protection devices specified in the Design Description 2.16.7 can relieve excessive positive pressure generated by steam buildup during SFP design boiling conditions.

Table 3.2-1

Classification Summary

Principal Components[1]	Safety Class.[2]	Location[3]	Quality Group[4]	Safety-Related Classification[5]	Seismic Category[6]	Notes
U63 Firewater Service Complex Structure	N	FWSC	—	S	I	(5) c, (5) e, (5) h
U64 Firewater Service Complex HVAC System	N	FWSC	—	S	II	(5) c, (5) e
U65 Other Building Structures						
1. (Deleted)						
2. Other buildings	N	OO, OL	—	N	NS	
U66 Access Tunnel Structures	N	OL	—	S	II	(5) c
U67 Radwaste Tunnel	N	OL	—	S	NS	(5) d Structural acceptance and material criteria for the Radwaste Tunnel are in accordance with RG 1.143, Safety Classification RW-IIa.
U68 Ancillary Diesel Building Structure	N	ADB	—	S	II	(5) c, (5) h
U69 Ancillary Diesel Building HVAC System	N	ADB	—	S	II	(5) c, (5) h
U71 Reactor Building Structure						
1. Main building	3	RB	—	Q	I	
2. Stair towers, equipment removal access shaft and elevator shafts	N	RB	—	S	II	(5) c
3. Equipment storage pool, reactor well and buffer pool liners, and pool gates	3	RB	—	Q	I	
4. Reactor Building pressure relief devices	3	RB	—	Q	I	

Table 3.2-1

Classification Summary

Principal Components[1]	Safety Class.[2]	Location[3]	Quality Group[4]	Safety-Related Classification[5]	Seismic Category[6]	Notes
U91 Administration Building Structure	N	OL	—	N	NS	
U93 Training Center	N	OL	—	N	NS	
U95 Hot Machine Shop	N	OO	—	N	NS	
U97 Fuel Building Structure						
1. Main building	3	FB	—	Q	I	
2. HVAC penthouse, stair towers and elevator shaft	N	FB	—	S	II	(5) c
3. Spent fuel pool liner and pool gates	3	FB	—	Q	I	
4. Fuel Building pressure relief devices	3	FB	—	Q	I	
U98 Fuel Building HVAC						
1. Building isolation dampers	3	FB	—	Q	I	
2. Ducting penetrating fuel building boundary	3	FB	—	Q	I	
3. Controls associated with the isolation dampers	3	FB	—	Q	I	
4. Other system components	N	FB	—	S	II	(5) c, (5) i – for RTNSS equipment
W INTAKE STRUCTURE AND SERVICING EQUIPMENT						
W12 Intake and Discharge Structures	N	OO	—	N	NS	
W24 Cooling Tower	N	OO	—	N	NS	
W32 Screen Cleaning Facility	N	OO	—	N	NS	
W33 Screens, Racks, and Rakes	N	OO	—	N	NS	
W41 Intake Structure Power Supply	N	OO	—	N	NS	
Y YARD STRUCTURES AND EQUIPMENT						
Y12 Roads and Walkways	N	OO	—	N	NS	

6.2.3.1 Design Bases

The RB is designed to meet the following safety design bases:

- The RB maintains its integrity during the environmental conditions postulated for a DBA.
- The Reactor Building HVAC System (RBVS) subsystems (CONAVS and REPAVS) automatically isolates upon detection of high radiation levels in their respective ventilation exhaust system.
- Openings through the RB boundary, such as personnel and equipment doors, are closed during normal operation and after a DBA by interlocks or administrative control. These doors are provided with position indicators and alarms that are monitored in the control room.
- Detection and isolation capability for high-energy pipe breaks within the RB is provided.
- The compartments within the RB are designed to withstand the maximum pressure due to a High Energy Line Break (HELB). Each line break analyzed is a double-ended break. In this analysis, the rupture producing the greatest blowdown of mass and enthalpy in conjunction with worst-case single active component failure is considered. Blowout panels between compartments provide flow paths to relieve pressure.
- The RB is capable of periodic testing to assure that the leakage rates assumed in the radiological analyses are met. The radiological analyses assume the RB CONAVS served areas form this boundary.

6.2.3.2 Design Description

The RB is a reinforced concrete structure that forms an envelope completely surrounding the containment (except the basemat). The boundary of the clean areas and the RB are shown in Figure 6.2-17.

During normal operation, the RB potentially contaminated areas are maintained at a slightly negative pressure relative to adjoining areas by the CONAVS portion of the RBVS (Subsection 9.4.6). This assures that any leakage from these areas is collected and treated before release. Airflow is from clean to potentially contaminated areas. RB effluents are monitored for radioactivity by RB/Fuel Buidling (FB) stack radiation monitors. If the radioactivity level rises above set levels, the discharge can be routed through RB HVAC online purge Exhaust Filter Unit system for treatment before further release.

Penetrations through the RB envelope are designed to minimize leakage. All piping and electrical penetrations are sealed for leakage. The RBVS is designed with safety-related isolation dampers and tested for isolation under various accident conditions.

HELBs in any of the RB compartments do not require the building to be isolated. These breaks are detected and the broken pipe is isolated by the closure of system isolation valves (Subsection 7.4.3). There is no significant release of radioactivity postulated from these types of accidents because reactor fuel is not damaged.

The RB is equipped with safety-related passively acting pressure relief devices that allow the refuel floor to vent to the environment if cooling is lost to the auxiliary pools during an outage.

The primary design function of FAPCS is to cool and clean pools located in the containment, RB and FB (refer to Table 9.1-1) during normal plant operation. FAPCS provides flow paths for filling and makeup of these pools during normal plant operation and during post-accident conditions, as necessary.

FAPCS is also designed to provide the following accident recovery functions in addition to the Spent Fuel Pool cooling function:

- Suppression pool cooling (SPC);
- Drywell spray;
- Low pressure coolant injection (LPCI) of suppression pool water into the Reactor Pressure Vessel (RPV); and
- Alternate Shutdown Cooling.

In addition to its accident recovery function, the SPC mode is also designed to automatically initiate during normal operation in response to a high temperature signal from the suppression pool.

A crosstie to the Reactor Water Cleanup/Shut Down Cooling (RWCU/SDC) System is provided in the suppression pool suction and discharge headers such that this system may be used as an alternative for post-accident decay heat removal. For details regarding the crosstie, refer to Subsection 5.4.8.

Redundancy and physical separation are provided in accordance with SECY-93-087 for active components in lines dedicated to LPCI and SPC modes.

During normal plant operation, at least one FAPCS cooling and cleanup train is available for continuous operation to cool and clean the water of the Spent Fuel Pool, while the other train can be placed in standby or other mode for cooling the GDCS pools and suppression pool. If necessary during a refueling outage, both trains may be used to provide maximum capacity for cooling the Spent Fuel Pool. The water treatment units can be bypassed when necessary, and will be bypassed automatically on a high temperature signal downstream of the heat exchangers.

Each FAPCS cooling and cleanup train has sufficient flow and cooling capacity to maintain Spent Fuel Pool bulk water temperature below 48.9°C (120°F) under normal Spent Fuel Pool heat load conditions (normal heat load condition is defined as irradiated fuel in the Spent Fuel Pool resulting from 20 years of plant operations). During the maximum Spent Fuel Pool heat load conditions of a full core offload plus irradiated fuel in the Spent Fuel Pool resulting from 20 years of plant operations, both FAPCS cooling and cleanup trains are needed to maintain the bulk temperature below 60°C (140°F).

During a loss of the FAPCS cooling trains, cooling of the Spent Fuel Pool, buffer pool and IC/PCCS pools is accomplished by allowing the water to heat and boil. The Reactor Building (RB) and Fuel Building (FB) are equipped with safety-related normally closed pressure relief devices that open passively to relieve excessive positive pressure generated by steam buildup during pool boiling. The pressure set point is equivalent to the full tornado pressure drop described in Section 3.3.2.2. The Spent Fuel Pool ~~is maintained at a water level of at least~~normal water level is 14.35 m (47 ft). ~~and a~~A minimum free volume ~~above the TAF~~ of ~~at least 169~~1760 m^3 (~~597~~62200 ft^3)~~.~~ is required above the top of the irradiated fuel assemblies to accommodate a