Response to Action Item 3-49.3

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.3

Question No. 3 (AI 3-49.3): Identification of SSCs Subject to Flood Protection: DCD Tier 2, Section 3.4.1 states the following: *The reactor containment building systems to be protected from flooding are the reactor coolant system (RCS), safety injection system (SIS), reactor coolant gas vent system (RCGVS), and main steam system (MSS). The components to be protected from flooding are the valves and electric instrumentation of these systems.*

a) It is not clear whether all the systems and components in the reactor containment building subject to flood protection are identified in the DCD. For example, feedwater system, auxiliary feedwater system, shutdown cooling system, Class 1E power system, component cooling water system, are not identified in the above system list. Justify the exclusion, or revise the list in the DCD.

Response:
The DCD will be updated to include the complete list of systems that are protected from internal flooding. The added systems include: feedwater system, auxiliary feedwater system, shutdown cooling system, and component cooling water system.

Impact on DCD
DCD Section 3.4.1.3 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

b) It is not clear why pumps in the containment are not identified in the above component list for flood protection. Justify the exclusion, or revise the DCD.

Response:
Pumps are not identified in the DCD because the APR1400 design does not include any safety related pumps in the containment building.

Impact on DCD
There is no impact on the DCD.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

The lowest spaces of each building are designed as an emergency sump to keep flood water within the building where a flooding event could occur. The emergency sump is large enough to accommodate the volume of limiting flooding source.

Additionally, curbs or ramps and sealed penetrations function as flood barriers. Safety-related equipment and components are located at higher elevations so flooding events do not affect them.

Watertight doors are used for internal flood protection. Watertight doors are specified to withstand the static pressure from the maximum flood elevation as determined in the flooding analysis. Sensorsignals of sensors to indicate the status of open and close of the watertight doors are provided to the main control room. Watertight doors are periodically inspected to ensure their functionality.

The areas of concern in APR1400 are as

feedwater system (FWS), auxiliary feedwater system (AFWS), shutdown cooling system (SCS), component cooling water system (CCWS) and main steam system (MSS).

a. Reactor containment building

The reactor containment building systems to be protected from flooding are the reactor coolant system (RCS), safety injection system (SIS), reactor coolant gas vent system (RCGVS), ~~and main steam system (MSS).~~ The components to be protected from flooding are the valves and electric instrumentation of these systems.

b. Auxiliary building

The auxiliary building systems to be protected from flooding are the SIS, shutdown cooling system (SCS), chemical and volume control system (CVCS), containment spray system (CSS), auxiliary feedwater system (AFWS), and component cooling water system (CCWS). The components to be protected from flooding are the motor-driven pumps, valves, electrical equipment and instruments, Class 1E electric/instrumentation components, and cubicle coolers in the relevant system.

c. Emergency diesel generator building

Response to Action Item 3-49.4

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.3

Question No. 4 (AI 3-49.4): Watertight Door Seals: SPR Section 3.4.1, Subsection III.2 provides guidance for the staff to evaluate the adequacy of flood protection features including watertight doors. The penetration seals are periodically inspected to ensure their functionality. The applicant is requested to provide a COL information item addressing the seal maintenance to ensure the water tight doors and sealed penetrations serve their intended flood protection function.

Response:

The DCD will be updated to include a COL item for a periodic inspection of watertight doors and sealed penetrations to ensure their functionality.

Impact on DCD

DCD Section 3.4.1.3 and Table 1.8-2 will be revised as shown in the attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical and Environmental Reports.

The lowest spaces of each building are designed as an emergency sump to keep flood water within the building where a flooding event could occur. The emergency sump is large enough to accommodate the volume of limiting flooding source.

Additionally, curbs or ramps and sealed penetrations function as flood barriers. Safety-related equipment and components are located at higher elevations so flooding events do not affect them.

Watertight doors are used for internal flood protection. Watertight doors are specified to withstand the static pressure from the maximum flood elevation as determined in the flooding analysis. Sensorsignals of sensors to indicate the status of open and close of the watertight doors are provided to the main control room. ~~Watertight doors are periodically inspected to ensure their functionality.~~

The COL applicant is to periodically inspect watertight doors and penetration seals to ensure their functionality (COL 3.4(5)).

The areas of concern in APR1400 are as follows:

a. Reactor containment building

The reactor containment building systems to be protected from flooding are the reactor coolant system (RCS), safety injection system (SIS), reactor coolant gas vent system (RCGVS), and main steam system (MSS). The components to be protected from flooding are the valves and electric instrumentation of these systems.

b. Auxiliary building

The auxiliary building systems to be protected from flooding are the SIS, shutdown cooling system (SCS), chemical and volume control system (CVCS), containment spray system (CSS), auxiliary feedwater system (AFWS), and component cooling water system (CCWS). The components to be protected from flooding are the motor-driven pumps, valves, electrical equipment and instruments, Class 1E electric/instrumentation components, and cubicle coolers in the relevant system.

c. Emergency diesel generator building

3.4.3 Combined License Information

COL 3.4(1) The COL applicant is to provide site-specific information on protection measures for the design basis flood, as required in Subsection 2.4.10.

COL 3.4(2) The COL applicant is to provide flooding analysis with flood protection and mitigation features from internal flooding for the CCW Heat Exchanger Building and ESW Building.

COL 3.4(3) The COL applicant is to confirm that the potential site-specific external flooding events are bounded by design basis flood values or otherwise demonstrate that the design is acceptable.

COL 3.4(4) The COL applicant is to identify any site-specific physical models that could be used to predict prototype performance of hydraulic structures and systems.

COL 3.4(5)
The COL applicant is to periodically inspect watertight doors and the penetration seals to ensure their functionality.

3.4.4 References

1. Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, August 1977.

2. ANSI/ANS 2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites," American Nuclear Society, 1992.

3. Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants," Rev. 1, Nuclear Regulatory Commission," September 1976.

4. ANSI/ANS 56.10-1987, "Subcompartment Pressure and Temperature Transient Analysis in Light Water Reactors," American Nuclear Society, 1987.

5. ANSI/ANS 56.11-1998, "Design Criteria for Protection against the Effects of Compartment Flooding in Light Water Reactor Plants," American Nuclear Society, 1988.

Table 1.8-2 (3 of 29)

Item No.	Description
COL 3.4(1)	The COL applicant is to provide site-specific information on protection measures for the design-basis flood, as required in Subsection 2.4.10.
COL 3.4(2)	The COL applicant is to provide flooding analysis with flood protection and mitigation features from internal flooding for the CCW Heat Exchanger Building and ESW Building.
COL 3.4(3)	The COL applicant is to confirm that the potential site-specific external flooding events are bounded by design-basis flood values or otherwise demonstrate that the design is acceptable.
COL 3.4(4)	The COL applicant is to identify any site-specific physical models that could be used to predict prototype performance of hydraulic structures and systems.
COL 3.5(1)	The COL applicant is to provide the procedure for heavy load transfer to strictly limit the transfer route inside and outside containment during plant maintenance and repair periods.
COL 3.5(2)	The [illegible] turbine generator of this [illegible] eration using the eval [illegible] de the low-trajectory turb [illegible]
COL 3.5(3)	The [illegible] al events that may produce more energetic missiles than tornado or hurricane missiles, and provide reasonable assurance that seismic Category I and II structures are designed to withstand these loads.
COL 3.5(4)	The COL applicant is to evaluate the potential for site proximity explosions and missiles due to train explosions (including rocket effects), truck explosions, ship or barge explosions, industrial facilities, pipeline explosions, or military facilities.
COL 3.5(5)	The COL applicant is to provide justification for the site-specific aircraft hazard and an aircraft hazard analysis in accordance with the requirements of NRC RG 1.206.
COL 3.6(1)	The COL applicant is to identify the site-specific SSCs that are safety related or required for safe shutdown that are located near high- and moderate-energy piping systems and that are susceptible to the consequences of piping failures.
COL 3.6(2)	The COL applicant is to provide a list of site-specific high- and moderate-energy piping systems including layout drawings and protection features and the failure modes and effects analysis for safe shutdown due to the postulated HELBs.
COL 3.6(3)	The COL applicant is to confirm that the bases for the LBB acceptance criteria are satisfied by the final as-built design and materials of the piping systems as site-specific evaluations, and is to provide the information including LBB evaluation report for the verification of LBB analyses.
COL 3.6(4)	The COL applicant is to provide the procedure for initial filling and venting to avoid the known causes for water hammer in DVI line.
COL 3.7(1)	The COL applicant is to determine the site-specific SSE and OBE that are applied to the seismic design of the site-specific seismic Category I and II SSCs and the basis for the plant shutdown. The COL applicant is also to verify the appropriateness of the site-specific SSE and OBE.
COL 3.7(2)	The COL applicant is to confirm that the horizontal components of the SSE site-specific ground motion in the free-field at the foundation level of the structure satisfy a peak ground acceleration of at least 0.1 g.

COL 3.4(5)
The COL applicant is to periodically inspect watertight doors and the penetration seals to ensure their functionality.

Response to Action Item 3-49.5

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 5 (AI 3-49.5): Clarification of Layout in Containment: DCD Tier 2, Section 3.4.1.5.1 states that the flood protection in the reactor containment building is to allow flooding sources to flow to the lowest level of the building through the floor openings and stairwells. Section 3.4.1.5.1 also states that water at El.136 ft 6 in., El. 114 ft, and EL. 100 ft flows to the containment annulus area. The flood water level is determined as 2 ft above EL. 100 ft.

a) Why is the upper level water flowing to the containment annulus area instead of to the bottom of the containment? Where is the lowest level of the containment building, the bottom of containment or the annulus?

Response:
Both the bottom of containment and containment annulus are at 100 ft and constitute the lowest level of the containment building. The DCD will be updated to clarify this description.

Impact on DCD
DCD Section 3.4.1.5.1 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

b) Clarify the relationship between the bottom of containment and the annulus with respect to collecting the flood water. Which area does the 2 ft containment flood level apply and why?

Response:
The bottom of the containment and annulus are at 100 ft and are same area with respect to collecting the flood water. The flood level is determined as 2 ft from El.100 ft, which envelops the entire containment area at El.100 ft, including the annulus area.

Impact on DCD
DCD Section 3.4.1.5.1 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

c. Determination of flow rates and flood levels

d. Risk assessment for components affected by a flood event

e. Determination of the need for protection and mitigation measures

3.4.1.5.1 Reactor Containment Building

The APR1400 is designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including LOCAs.

The reactor containment building is not designed to provide divisional separation but it allows flooding sources to flow to the lowest level of the building through the floor openings and stairwells.

i.e., containment annulus area at El. 100 ft 0 in.

a. Water at El. 156 ft 0 in. flows to the lower elevation through four reactor containment fan cooler duct openings, two stairwells, and four safety injection tank openings.

on this floor

b. Water at El. 136 ft 6 in. flows to the lower elevation through the grating ~~in the containment annulus area.~~ Water in the pressurizer cavity flows to the containment annulus area through the wire mesh door.

on this floor

c. Water at El. 114 ft 0 in. flows to the lower elevation through the grating ~~in the containment annulus area.~~ Water in each valve room flows to the containment annulus area through the wire mesh door.

collected

d. Water at El. 100 ft 0 in. flows to the holdup volume tank through the floor opening and then to the IRWST through the spillway. Water in the letdown heat exchanger room and reactor drain tank room flows to the containment annulus area through the wire mesh door.

The worst-case flooding event is a double-ended discharge leg LOCA with the minimum SIP flow, because it results in maximum break flow to the reactor containment building as a flooding source.

Discharged water first fills up the volume below elevation El. 100 ft 0 in. and then spreads the volume above the grade level of the reactor containment building. Water released by a LOCA is collected in the IRWST through the floor opening. It then flows back to the reactor coolant system or is sprayed into the containment and recirculated.

The total discharged volume of double-ended discharge leg break of a LOCA is 425.7 m^3 (15,036 ft^3). The net floodable volume under El. 100 ft 0 in., including volume of air space of IRWST 753 m^3 (26,592 ft^3), holdup volume tank 242.3 m^3 (8,557 ft^3), and normal sump 6.7 m^3 (237 ft^3) is 1,002 m^3 (35,385 ft^3). The total discharged water volume due to LOCA is smaller than the total floodable volume.

The flood water level is determined as 0.61 m (2 ft) ~~above El. 100 ft 0 in~~. The maximum flood level of containment does not affect safety-related equipment. There are no submerged SSCs required for safe shutdown. Table 3.4-1 provides a list and the locations of SSCs inside the reactor containment building that require flood protection. These SSCs are located above the maximum internal flood level.

from the El. 100 ft 0 in. It envelops all flood levels throughout the entire containment area at El. 100 ft 0 in.

3.4.1.5.2 Auxiliary Building

The auxiliary building is designed to provide physical separation to prevent spreading of fluids to the areas housing safety-related equipment and components.

Elevation 55 ft 0 in

The primary means of flood protection is the divisional or quadrant walls, which serve as flood barriers between redundant trains of safe shutdown systems and components. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability.

On the divisional wall, penetrations are sealed and no doors are provided up to El. 64 ft 0 in., which is the potential flood level from the bottom elevation. Watertight doors are

Response to Action Item 3-49.6

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 6 (AI 3-49.6): Flood Areas and Flood Heights in Containment: DCD Tier 2 Table 6.2.1-1 identifies potential pipe breaks in the steam generator subcompartment, pressurizer subcompartment, pressurizer spray valve room, regenerative heat exchanger room, letdown heat exchanger room, and letdown heat exchanger valve room. These subcompartments are confined inside containment. Explain why there are no flood analyses for these subcompartments. Are there any other subcompartments being missed for flood protection?

The staff's audit of Calculation No. 1-035-N385-001, Sheet 4 of 41 found flood areas including Valve Rooms, Regenerative HX Rm, Pressurizer Cavity, Refueling Pool Area, Operating Areas with different flood height for each area. There are areas (e.g., Room Nos.116-C03, 116-C04, 130-C01, 136-C01A, and 136-C01B) where flood heights are higher than 2 ft. Why those areas are not discussed in the DCD? Explain the difference between the flood level and flood heights. Why is the flood level not bounding all the flood heights in the calculation?

Response:
The subcompartments noted inside containment have different areas, (and therefore different volumetric capacities), are located at elevations greater than El.100', and communicate with the containment area. Pipe breaks in these subcompartments may result in different flood heights within the specific subcompartment. Flood water from these subcompartments flows into the containment annulus area which has a maximum flood level of 2 ft above El 100 ft. All equipment required for safe shutdown located in these subcompartments are designed to be installed above the flood height. Table 3.4-1 will be updated to clarify the flood height in these subcompartments.

Impact on DCD
DCD Section 3.4.1.5.1 and Table 3.4-1 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

The worst-case flooding event is a double-ended discharge leg LOCA with the minimum SIP flow, because it results in maximum break flow to the reactor containment building as a flooding source.

Discharged water first fills up the volume below elevation El. 100 ft 0 in. and then spreads the volume above the grade level of the reactor containment building. Water released by a LOCA is collected in the IRWST through the floor opening. It then flows back to the reactor coolant system or is sprayed into the containment and recirculated.

The total discharged volume of double-ended discharge leg break of a LOCA is 425.7 m^3 (15,036 ft^3). The net floodable volume under El. 100 ft 0 in., including volume of air space of IRWST 753 m^3 (26,592 ft^3), holdup volume tank 242.3 m^3 (8,557 ft^3), and normal sump 6.7 m^3 (237 ft^3) is 1,002 m^3 (35,385 ft^3). The total discharged water volume due to LOCA is smaller than the total floodable volume.

The flood water level is determined as 0.61 m (2 ft) above El. 100 ft 0 in. The maximum flood level of containment does not affect safety-related equipment. There are no submerged SSCs required for safe shutdown. Table 3.4-1 provides a list and the locations of SSCs inside the reactor containment building that require flood protection. These SSCs are located above the maximum internal flood level.

The flood levels in the separately compartmentalized areas located above the bottom and annulus area are independently determined by taking account of flows in and out of these areas.

3.4.1.5.2 Auxiliary Building

The auxiliary building is designed to provide physical separation to prevent spreading of fluids to the areas housing safety-related equipment and components.

Elevation 55 ft 0 in

The primary means of flood protection is the divisional or quadrant walls, which serve as flood barriers between redundant trains of safe shutdown systems and components. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability.

On the divisional wall, penetrations are sealed and no doors are provided up to El. 64 ft 0 in., which is the potential flood level from the bottom elevation. Watertight doors are

Table 3.4-1 (1 of 3)

Reactor Containment Building Components Protected from Internal Flooding

Item No.	Equipment No.	Equipment Description	Location	Building	Floor Elevation	~~SSC level from the Flood Elevation EL.102'-0"~~ SSC Level Relative to Flood Height	Flood Height above Floor m (ft)
1	1-431-J-LT-110A	PRESSURIZER LEVEL TRANSMITTER	100-C01	RCB	100'-0"	above	0.61 (2.0)
2	1-431-J-LT-110B	PRESSURIZER LEVEL TRANSMITTER	100-C01	RCB	100'-0"	above	
3	1-491-V-001	RCS HOT LEG SAMPLE CTMT ISOLATION VALVE	100-C01	RCB	100'-0"	above	
4	1-441-V-0653	SHUTDOWN COOLING SUCTION ISOLATION VALVE	100-C01	RCB	100'-0"	above	
5	1-441-V-0654	SHUTDOWN COOLING SUCTION ISOLATION VALVE	100-C01	RCB	100'-0"	above	
6	1-451-V-0515	LETDOWN ISOLATION VALVE	100-C02A	RCB	100'-0"	above	
7	1-451-V-0516	LETDOWN ISOLATION VALVE	100-C02A	RCB	100'-0"	above	
8	1-431-J-TE-132HA	RCS HOT LEG LOOP 1 TEMPERATURE ELEMENT	100-C02A	RCB	100'-0"	above	
9	1-431-J-TE-132HB	RCS HOT LEG LOOP 1 TEMPERATURE ELEMENT	100-C02A	RCB	100'-0"	above	
10	1-431-J-TE-142CA	RCS COLD LEG LOOP 1 TEMPERATURE ELEMENT	100-C02A	RCB	100'-0"	above	
11	1-431-J-TE-142CB	RCS COLD LEG LOOP 1 TEMPERATURE ELEMENT	100-C02A	RCB	100'-0"	above	
12	1-441-V-0651	SHUTDOWN COOLING SUCTION ISOLATION VALVE	100-C02A	RCB	100'-0"	above	
13	1-433-V-414	REACTOR VESSEL VENT ISOLATION VALVE	100-C02B	RCB	100'-0"	above	
14	1-433-V-415	REACTOR VESSEL VENT ISOLATION VALVE	100-C02B	RCB	100'-0"	above	
15	1-433-V-416	REACTOR VESSEL VENT ISOLATION VALVE	100-C02B	RCB	100'-0"	above	
16	1-433-V-417	REACTOR VESSEL VENT ISOLATION VALVE	100-C02B	RCB	100'-0"	above	
17	1-431-J-TE-133HA	RCS HOT LEG LOOP 2 TEMPERATURE ELEMENT	100-C02B	RCB	100'-0"	above	
18	1-431-J-TE-133HB	RCS HOT LEG LOOP 2 TEMPERATURE ELEMENT	100-C02B	RCB	100'-0"	above	
19	1-431-J-TE-143CA	RCS COLD LEG LOOP 2 TEMPERATURE ELEMENT	100-C02B	RCB	100'-0"	above	
20	1-431-J-TE-143CB	RCS COLD LEG LOOP 2 TEMPERATURE ELEMENT	100-C02B	RCB	100'-0"	above	
21	1-441-V-0652	SHUTDOWN COOLING SUCTION ISOLATION VALVE	100-C02B	RCB	100'-0"	above	
22	1-541-J-LT-1113A	STEAM GENERATOR 1 LEVEL TRANSMITTER (WIDE)	114-C01A	RCB	114'-0"	above	0.25 (0.83)
23	1-541-J-LT-1113B	STEAM GENERATOR 1 LEVEL TRANSMITTER (WIDE)	114-C01A	RCB	114'-0"	above	

AI 3-49.6

Attachment (3/4)

Table 3.4-1 (2 of 3)

Item No.	Equipment No.	Equipment Description	Location	Building	Floor Elevation	~~SSC level from the Flood Elevation EL.102'-0"~~ SSC Level Relative to Flood Height	Flood Height above Floor m (ft)
24	1-491-V-003	PZR SURGE LINE SAMPLE CTMT ISOLATION VALVE	114-C01B	RCB	114'-0"	above	
25	1-491-V-005	PZR STEAM SPACE SAMPLE CTMT ISOLATION VALVE	114-C01B	RCB	114'-0"	above	0.25(0.83)
26	1-541-J-LT-1123A	STEAM GENERATOR 2 LEVEL TRANSMITTER (WIDE)	114-C01B	RCB	114'-0"	above	
27	1-541-J-LT-1123B	STEAM GENERATOR 2 LEVEL TRANSMITTER (WIDE)	114-C01B	RCB	114'-0"	above	
28	1-451-V-0203	PRESSURIZER AUXILIARY SPRAY VALVE	116-C04	RCB	116'-0"	above	0.76(2.5)
29	1-431-J-PT-102A	PRESSURIZER PRESSURE TRANSMITTER	136-C01A	RCB	136'-0"	above	
30	1-441-V-0614	SIT 4 OUTLET ISOLATION VALVE	136-C01A	RCB	136'-0"	above	
31	1-441-V-0644	SIT 1 OUTLET ISOLATION VALVE	136-C01A	RCB	136'-0"	above	0.64(2.1)
32	1-431-J-PT-102B	PRESSURIZER PRESSURE TRANSMITTER	136-C01B	RCB	136'-0"	above	
33	1-441-V-0624	SIT 2 OUTLET ISOLATION VALVE	136-C01B	RCB	136'-0"	above	
34	1-441-V-0634	SIT 3 OUTLET ISOLATION VALVE	136-C01B	RCB	136'-0"	above	
35	1-431-V-130	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	
36	1-431-V-131	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	
37	1-431-V-132	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	
38	1-431-V-133	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	0.51(1.7)
39	1-431-V-134	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	
40	1-431-V-135	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	
41	1-431-V-136	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	
42	1-431-V-137	SAFETY DEPRESSURIZATION AND VENT VALVE (POSRV)	136-C02	RCB	136'-0"	above	
43	1-433-V-410	PRESSURIZER VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
44	1-433-V-411	PRESSURIZER VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
45	1-433-V-412	PRESSURIZER VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
46	1-433-V-413	PRESSURIZER VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	0.15(0.5)
47	1-441-V-0605	SIT 4 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
48	1-441-V-0606	SIT 2 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	

AI 3-49.6

Attachment (4/4)

Table 3.4-1 (3 of 3)

Item No.	Equipment No.	Equipment Description	Location	Building	Floor Elevation	~~SSC level from the Flood Elevation EL.102'-0"~~ SSC Level Relative to Flood Height	Flood Height above Floor m (ft)
49	1-441-V-0607	SIT 3 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	0.15 (0.5)
50	1-441-V-0608	SIT 1 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
51	1-441-V-0613	SIT 4 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
52	1-441-V-0623	SIT 2 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
53	1-441-V-0633	SIT 3 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
54	1-441-V-0643	SIT 1 VENT ISOLATION VALVE	156-C01	RCB	156'-0"	above	
55	1-521-J-PT-1013A	STEAM GENERATOR 1 PRESSURE TRANSMITTER	156-C01	RCB	156'-0"	above	
56	1-521-J-PT-1013B	STEAM GENERATOR 1 PRESSURE TRANSMITTER	156-C01	RCB	156'-0"	above	
57	1-521-J-PT-1023A	STEAM GENERATOR 2 PRESSURE TRANSMITTER	156-C01	RCB	156'-0"	above	
58	1-521-J-PT-1023B	STEAM GENERATOR 2 PRESSURE TRANSMITTER	156-C01	RCB	156'-0"	above	

Response to Action Item 3-49.8

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 8 (AI 3-49.8): Worst Case Determination: In DCD Tier 2, Section 3.4.1.5, the applicant states that for flooding analysis, the single worst-case piping rupture for non-seismically analyzed piping is assumed for each analyzed area.

a) Clarify which non-seismically pipes were considered in containment.

Response:
The DCD will be updated to clarify that all piping inside containment is seismically analyzed and, therefore, the containment flooding analysis does not include rupture of a non-seismic pipe.

Impact on DCD
DCD Section 3.4.1 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

b) Explain how the case of non-seismically analyzed piping, which could have a long lasting flood source, is evaluated for the flood protection analysis, and why this case is less severe than the worst case LOCA in containment.

Response:
For worst cast flooding inside containment, all possible sources were considered; including those that have the potential to be long lasting, such as the fire protection system. However, ruptures in systems that have the potential to provide a long lasting supply of water will be isolated by plant operators based indications that are provided in the control room including: containment sump level indication and alarms, sump pump start indications and alarms, and fire pump start indication and alarms. The volume of water that would flow into containment prior to isolation, accounting for sufficient time for operator identification and isolation, is bounded by the volume of water that results from a LOCA. Therefore, the worst case internal flooding source has been established as a LOCA and not from long lasting sources such as from the fire protection system. The DCD will be updated to explain why LOCA event is selected as the limiting source.

Impact on DCD
DCD Section 3.4.1.5.1 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

3.4.1.5 Evaluation of Internal Flooding

The internal flooding analysis demonstrates that plant nuclear safety functions are protected from the effects of internal flooding that are the result of a postulated failure or operation of the plant fire protection system. The safety-related SSCs that must be protected against an internal flood and flood conditions are described in Section 7.4. Potential flooding sources are as follows:

a. High- and moderate-energy piping failures

b. Full-circumferential ruptures in non-seismic moderate-energy piping

c. Postulated failures of non-seismic and non-tornado-protected tanks and vessels

d. Pump mechanical seal failures

e. Operation of the fire protection system

Criteria and assumptions described in Subsection 3.6.2 are used for the internal flooding analysis. Subsection 3.6.2 provides the criteria used to define break and crack locations and configurations for high- and moderate-energy piping failures.

For flooding analysis, the single worst-case piping rupture for non-seismically analyzed piping is assumed for each analyzed area. Also, only one break at a time is postulated for non-seismic Category I or II piping as the result of a seismic event in the internal flooding analysis. All piping inside the reactor containment building and auxiliary building are seismically designed. Therefore, no breaks are postulated during a seismic event in these buildings. The discharge volume through the ruptured area is calculated in accordance with the formula given in ANSI/ANS 56.10-1987, Section 3 (Reference 4). The released steam flow rate is conservatively assumed to be completely condensed to result in a higher flood level.

The discharge flow rate from a high-energy line break is obtained by one of the following critical flow correlations.

a. Moody model for two-phase mixture and saturated steam conditions

The worst-case flooding event is a double-ended discharge leg LOCA with the minimum SIP flow, because it results in maximum break flow to the reactor containment building as a flooding source.

Non-seismically designed pipes are excluded as flood sources because all piping inside the reactor containment building is seismically designed.

Discharged water first fills the volume above the grade level of the reactor containment building. Water released by a LOCA is collected in the IRWST through the floor opening. It then flows back to the reactor coolant system or is sprayed into the containment and recirculated.

The total discharged volume of double-ended discharge leg break of a LOCA is 425.7 m^3 (15,036 ft^3). The net floodable volume under El. 100 ft 0 in., including volume of air space of IRWST 753 m^3 (26,592 ft^3), holdup volume tank 242.3 m^3 (8,557 ft^3), and normal sump 6.7 m^3 (237 ft^3) is 1,002 m^3 (35,385 ft^3). The total discharged water volume due to LOCA is smaller than the total floodable volume.

The flood water level is determined as 0.61 m (2 ft) above El. 100 ft 0 in. The maximum flood level of containment does not affect safety-related equipment. There are no submerged SSCs required for safe shutdown. Table 3.4-1 provides a list and the locations of SSCs inside the reactor containment building that require flood protection. These SSCs are located above the maximum internal flood level.

3.4.1.5.2 Auxiliary Building

The auxiliary building is designed to provide physical separation to prevent spreading of fluids to the areas housing safety-related equipment and components.

Elevation 55 ft 0 in

The primary means of flood protection is the divisional or quadrant walls, which serve as flood barriers between redundant trains of safe shutdown systems and components. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability.

On the divisional wall, penetrations are sealed and no doors are provided up to El. 64 ft 0 in., which is the potential flood level from the bottom elevation. Watertight doors are

Response to Action Item 3-49.9

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 9 (AI 3-49.9): Flood Height Determination: In DCD Tier 2, Section 3.4.1.5, the applicant states that the flood level of the reactor containment building is determined by dividing the accumulated volume of discharged water for 50 seconds by the total floodable area at El. 100 ft. The flood level in containment is determined to be 2 ft.

a) Explain how the “50 seconds” limit was determined and justify its adequacy.

Response:
For a postulated LOCA event, most of the water is released into containment within the first 50 seconds based on analysis. For conservatism, the entire volume released is taken to accumulate at El 100 ft of containment with no drainage to the HVT at a lower elevation. This volume corresponds to a flood level in containment of 2 ft. After 50 seconds, the outflow rate of water is greater than the inflow rate such that 2 ft is the maximum flood level height.

Impact on DCD
DCD Section 3.4.1.5.1 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

b) What is the floodable area at EL. 100 ft?

Response:
Total floodable area is the total containment floor area that can be flooded from the flood water. Areas that cannot be flooded, such as the primary shield wall, are excluded from the floodable area.

Impact on DCD
There is no impact on DCD.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical and Environmental Reports.

c) Explain how the “2 ft” is determined. Is it applicable to all containment areas including annulus and areas outside annulus at EL. 100 ft.

Response:

The 2 ft is based on the volume of water from the LOCA up to 50 seconds applied to containment bottom area at El.100 ft 0 in which includes the annulus area. The flood level areas outside the annulus, but inside containment building are shown in the drawing below.

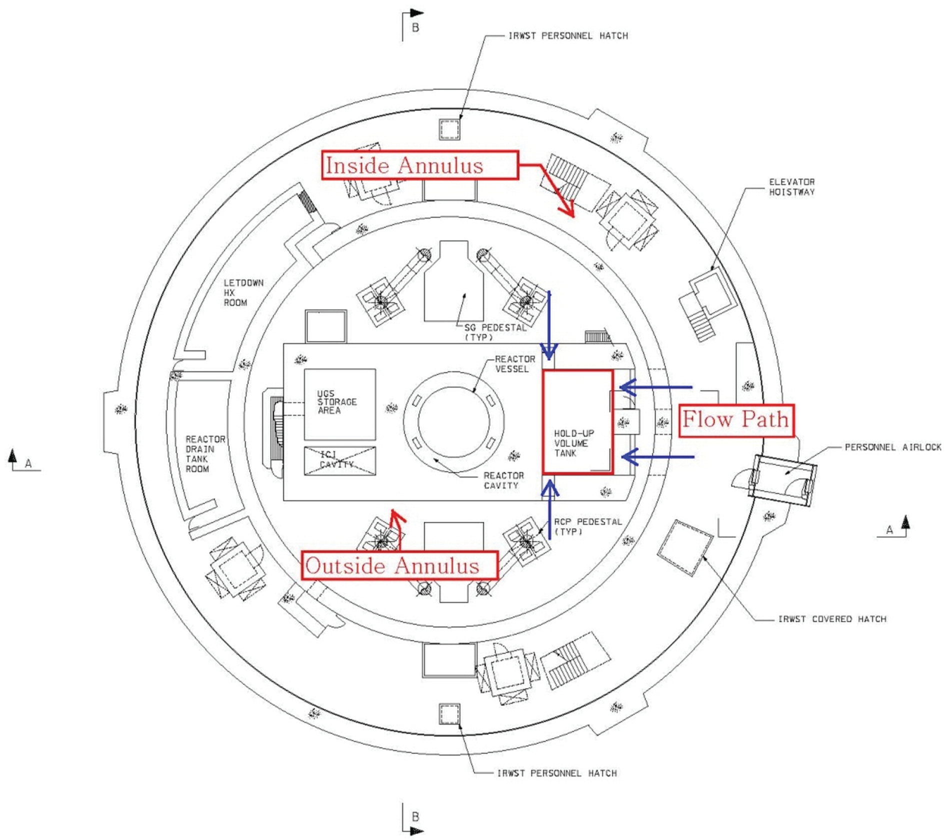

Figure 1.2-5 General Arrangement Reactor Containment Building El. 100′-0″

Impact on DCD

Changes to the DCD as a result of similar questions encompass the changes that would be made as a result of the above response. Therefore, no new changes are proposed.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

b. Henry-Fauske model for subcooled liquid

A LOCA that results in the largest discharge volume to the reactor containment is assumed as a flooding source in the flooding analysis of reactor containment building. The flood level of the reactor containment building is determined by dividing the accumulated volume of discharged water for 50 seconds by the total floodable area at El. 100 ft 0 in. No outflow to the ~~lowest elevation~~ HVT for the early discharge period of 50 seconds is also assumed to result in conservative flood level, although fluid flow to the lower elevation will actually be established when broken flow arrives at the openings to the lower elevation.

Most of the water is discharged during 50 seconds. The calculated outflow rate with water level height of 2 ft is greater than inflow rate at or after 50 seconds.

Indoor hydrants that could reach the area or zone where a fire occurs are contributed to internal flooding sources when a fire occurs ... hydrants is assumed to be 0.044 m^3/s (700 gpm) ...

The lowest level of the auxiliary building is designed to function as an emergency sump to collect flooding sources when a flood event occurs. The flood level of the emergency sump is determined by dividing the maximum volume of flooding sources by the floodable area of the emergency sump. The flood level, except for the lowest elevation, is determined based on the level established by the difference between the inflow rate of the postulated flooding source and the outflow rate through drains or openings in steady-state condition.

Fluid flow rates through stairwells, floor openings, and under door gaps are determined in accordance with the formulae given in ANSI 56.11-1988 (Reference 5). The fluid flow rate through a stairwell or a floor opening is calculated using equation 5.2-1, and the flow rate under a door is calculated using equation 5.2-3 in Reference 5. For each storage tank, it is assumed that the total inventory of the tank is spilled out. No credit is taken for operation of sump pumps to mitigate the flooding consequences.

The internal flooding analysis is performed on a floor-by-floor and room-by-room basis.

Flooding analysis consists of the following steps:

a. Identification of safety-related SSCs

b. Identification of potential flooding sources

The worst-case flooding event is a double-ended discharge leg LOCA with the minimum SIP flow, because it results in maximum break flow to the reactor containment building as a flooding source.

Discharged water first fills up the volume below elevation El. 100 ft 0 in. and then spreads the volume above the grade level of the reactor containment building. Water released by a LOCA is collected in the IRWST through the floor opening. It then flows back to the reactor coolant system or is sprayed into the containment and recirculated.

The total discharged volume of double-ended discharge leg break of a LOCA is 425.7 m^3 (15,036 ft^3). The net floodable volume under El. 100 ft 0 in., including volume of air space of IRWST 753 m^3 (26,592 ft^3), holdup volume tank 242.3 m^3 (8,557 ft^3), and normal sump 6.7 m^3 (237 ft^3) is 1,002 m^3 (35,385 ft^3). The total discharged water volume due to LOCA is smaller than the total floodable volume.

~~The flood water level is determined as 0.61 m (2 ft) above El. 100 ft 0 in.~~ The maximum flood level of containment does not affect safety-related equipment. There are no submerged SSCs required for safe shutdown. Table 3.4-1 provides a list and the locations of SSCs inside the reactor containment building that require flood protection. These SSCs are located above the maximum internal flood level.

The flood level of the bottom area of the reactor containment building is determined to be 0.61 m (2 ft) above El. 100 ft 0 in.

3.4.1.5.2 Auxiliary Building

The auxiliary building is designed to provide physical separation to prevent spreading of fluids to the areas housing safety-related equipment and components.

Elevation 55 ft 0 in

The primary means of flood protection is the divisional or quadrant walls, which serve as flood barriers between redundant trains of safe shutdown systems and components. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability.

On the divisional wall, penetrations are sealed and no doors are provided up to El. 64 ft 0 in., which is the potential flood level from the bottom elevation. Watertight doors are

Response to Action Item 3-49.13

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 13 (AI 3-49.13): Clarification: In DCD Tier 2, Section 3.4.1.5 (page 3.4-7), the applicant states that for each storage tank, it is assumed that the total inventory of the tank is spilled out. What are the tanks being referred in this statement? Is IRWST included? Is safety injection tank included? If not, why?

Response: The tanks which are included to have inventory spilled out are the IRWST and the Safety Injection Tank. The DCD will be clarified to be more specific.

Impact on DCD
DCD Section 3.4.1.5 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

b. Henry-Fauske model for subcooled liquid

A LOCA that results in the largest discharge volume to the reactor containment is assumed as a flooding source in the flooding analysis of reactor containment building. The flood level of the reactor containment building is determined by dividing the accumulated volume of discharged water for 50 seconds by the total floodable area at El. 100 ft 0 in. No outflow to the lowest elevation for the early discharge period of 50 seconds is also assumed to result in conservative flood level, although fluid flow to the lower elevation will actually be established when broken flow arrives at the openings to the lower elevation.

Indoor hydrants that could reach the area or zone where a fire occurs are contributed to internal flooding sources when a fire occurs. The discharge flow rate from indoor hydrants is assumed to be 0.044 m^3/s (700 gpm).

The lowest level of the auxiliary building is designed to function as an emergency sump to collect flooding sources when a flood event occurs. The flood level of the emergency sump is determined by dividing the maximum volume of flooding sources by the floodable area of the emergency sump. The flood level, except for the lowest elevation, is determined based on the level established by the difference between the inflow rate of the postulated flooding source and the outflow rate through drains or openings in steady-state condition.

Fluid flow rates through stairwells, floor openings, and under door gaps are determined in accordance with the formulae given in ANSI 56.11-1988 (Reference 5). The fluid flow rate through a stairwell or a floor opening is calculated using equation 5.2-1, and the flow rate under a door is calculated using equation 5.2-3 in Reference 5. ~~For each storage tank, it~~ It is assumed that the total inventory of the ~~tank is~~ IRWST and SI tanks are spilled out. The total water volume in the IRWST is considered as a limiting flood source in auxiliary building only as a result of a pipe rupture. No credit is taken for operation of sump pumps to mitigate the flooding consequences.

The internal flooding analysis is performed on a floor-by-floor and room-by-room basis.

Flooding analysis consists of the following steps:

a. Identification of safety-related SSCs

b. Identification of potential flooding sources

Response to Action Item 3-49.14

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 14 (AI 3-49.14): Proper Reference: In DCD Tier 2, Section 3.4.1.5.1, the applicant states that the total discharged volume of double-ended discharge leg break of a LOCA is 425.7 m^3 (15,036 ft^3). Provide the proper referenced data in the DCD for the determination of this volume.

Response:
The DCD Tier 2 Section 3.4.1.5.1 will be updated to provide the reference to the data.

Impact on DCD
The DCD Section 3.4.1.5.1 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

The worst-case flooding event is a double-ended discharge leg LOCA with the minimum SIP flow, because it results in maximum break flow to the reactor containment building as a flooding s

The discharge volume is calculated using the integrated release mass for the double-ended discharge leg break LOCA as described in Table 6.2.1-7.

Discharged water first fills up the volume below elevation El. 100 ft 0 in. and then spreads the volume above the grade level of the reactor containment building. Water released by a LOCA is collected in the IRWST through the floor opening. It then flows back to the reactor coolant system or is sprayed into the containment and recirculated.

The total discharged volume of double-ended discharge leg break of a LOCA is 425.7 m^3 (15,036 ft^3). The net floodable volume under El. 100 ft 0 in., including volume of air space of IRWST 753 m^3 (26,592 ft^3), holdup volume tank 242.3 m^3 (8,557 ft^3), and normal sump 6.7 m^3 (237 ft^3) is 1,002 m^3 (35,385 ft^3). The total discharged water volume due to LOCA is smaller than the total floodable volume.

The flood water level is determined as 0.61 m (2 ft) above El. 100 ft 0 in. The maximum flood level of containment does not affect safety-related equipment. There are no submerged SSCs required for safe shutdown. Table 3.4-1 provides a list and the locations of SSCs inside the reactor containment building that require flood protection. These SSCs are located above the maximum internal flood level.

3.4.1.5.2 Auxiliary Building

The auxiliary building is designed to provide physical separation to prevent spreading of fluids to the areas housing safety-related equipment and components.

Elevation 55 ft 0 in

The primary means of flood protection is the divisional or quadrant walls, which serve as flood barriers between redundant trains of safe shutdown systems and components. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability.

On the divisional wall, penetrations are sealed and no doors are provided up to El. 64 ft 0 in., which is the potential flood level from the bottom elevation. Watertight doors are

Response to Action Item 3-49.15

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 15 (AI 3-49.15): Additional Information on the Configuration: In DCD Section 3.4.1.5.2, it states that the worst case of flooding in the auxiliary building EL 55 ft, the lowest elevation being analyzed, is the water source in the IRWST. The maximum water level is 2.74 m (9 ft) with some margin. The released water volume is contained within the affected quadrant. Provide the information of the height of the divisional walls in the DCD to demonstrate that walls are sufficiently high to contain the released water within the affected quadrant.

Response:
The divisional wall heights are 13 ft and therefore have sufficient margin to contain the released water volume. The DCD will be updated to provide the necessary information to demonstrate that the walls are sufficiently high to contain the released water within the affected quadrant.

Impact on DCD
DCD Section 3.4.1.5.2 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

The worst-case flooding event is a double-ended discharge leg LOCA with the minimum SIP flow, because it results in maximum break flow to the reactor containment building as a flooding source.

Discharged water first fills up the volume below elevation El. 100 ft 0 in. and then spreads the volume above the grade level of the reactor containment building. Water released by a LOCA is collected in the IRWST through the floor opening. It then flows back to the reactor coolant system or is sprayed into the containment and recirculated.

The total discharged volume of double-ended discharge leg break of a LOCA is 425.7 m^3 (15,036 ft^3). The net floodable volume under El. 100 ft 0 in., including volume of air space of IRWST 753 m^3 (26,592 ft^3), holdup volume tank 242.3 m^3 (8,557 ft^3), and normal sump 6.7 m^3 (237 ft^3) is 1,002 m^3 (35,385 ft^3). The total discharged water volume due to LOCA is smaller than the total floodable volume.

The flood water level is determined as 0.61 m (2 ft) above El. 100 ft 0 in. The maximum flood level of containment does not affect safety-related equipment. There are no submerged SSCs required for safe shutdown. Table 3.4-1 provides a list and the locations of SSCs inside the reactor containment building that require flood protection. These SSCs are located above the maximum internal flood level.

3.4.1.5.2 Auxiliary Building

The auxiliary building is designed to provide physical separation to prevent spreading of fluids to the areas housing safety-related equipment and components.

The heights of the divisional walls at El. 55 ft 0 in. are 13 ft (El. 68 ft 0 in) as shown in Figures 1.2−11 and 1.2−12. The divisional walls are sufficiently high to contain total water volume in the affected quadrant.

El

The primary means of flood protection is the divisional or quadrant walls, which serve as flood barriers between redundant trains of safe shutdown systems and components. Flood barriers provide separation between the quadrants, while maintaining equipment removal capability.

On the divisional wall, penetrations are sealed and no doors are provided up to El. 64 ft 0 in., which is the potential flood level from the bottom elevation. Watertight doors are

Response to Action Item 3-49.16

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 16 (AI 3-49.16): Clarification: As stated in DCD Section 3.4 (page 3.4-1), the failures of non-seismic and "non-tornado" protected tanks are analyzed for flood protection.

a) Expand tornado-protected tank to high-wind (including tornado and hurricane) protected tanks being subject to flood protection. Revise DCD accordingly.

Response:
The DCD will be updated to expand tornado-protected tanks to high-wind (including tornado and hurricane) protected tanks.

Impact on DCD
DCD Section 3.4 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specification
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Report
There is no impact on any Technical, Topical and Environmental Reports.

b) Identify the external tanks, vessels, and piping being referenced above in DCD Section 3.4. Are the service water piping, circulating water piping, raw water tank considered?

Response:
The raw water tank and connected pipes located in the yard are not considered as flood source in the internal flood analysis. Service water piping and circulating water piping are also not considered as internal flood source.

Impact on DCD
There is no impact on DCD.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

3.4 Water Level (Flood) Design

All seismic Category I structures, systems, and components (SSCs) are designed to withstand the effects of flooding due to natural phenomena or onsite equipment failures without loss of the capability to perform their safety-related functions.

The potential causes of external flooding include probable maximum precipitation, potential dam failures, and high groundwater and outdoor tank failures, and extreme sea waves such as storm surges, seiches, tsunamis, high tides, etc., as described in Section 2.4.

This analysis includes a site description and elevations of safety-related structures and equipment; evaluations of penetrations in seismic Category I structures; and the effects of flooding due to postulated pipe failures, operation of fire protection systems, and failures of non-seismic and ~~non-tornado protected~~ non-high-wind (including tornado and hurricane) protected tanks, vessels, and piping.

3.4.1 Flood Protection and Evaluation

3.4.1.1 Design Bases

The design basis flood level at the reactor site will be determined in accordance with NRC RG 1.59 (Reference 1) and ANSI/ANS 2.8 (Reference 2). Because the design basis flood level of the APR1400 standard design is at least 0.3 m (1 ft) below the plant grade as specified in Table 2.0-1, all safety-related SSCs located on the dry site as defined in NRC RG 1.102 (Reference 3) are protected from an external flood event.

The COL applicant is to provide site-specific information on protection measures for the design basis flood, as described in Subsection 2.4.10 (COL 3.4(1)).

All seismic Category I structures are designed to withstand the static and dynamic forces due to the maximum groundwater level, which is 0.61 m (2 ft) below the plant grade as provided in Table 2.0-1.

Response to Action Item 3-49.18

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 18 (AI 3-49.18): Clarification: On page 3.4-7, second paragraph mentions "Indoor hydrants." There is no mention of "indoor hydrants," in section 9.5.1, "Fire Protection Program," or Appendix 9.5A, "Fire hazard Analysis." Please describe what an indoor hydrant is.

Response:
Reference to indoor hydrants on page 3.4-7 should be replaced with fire hose stations as that was the intent. The DCD will be updated to revise the terminology.

Impact on DCD
DCD Section 3.4.1.5 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

b. Henry-Fauske model for subcooled liquid

A LOCA that results in the largest discharge volume to the reactor containment is assumed as a flooding source in the flooding analysis of reactor containment building. The flood level of the reactor containment building is determined by dividing the accumulated volume of discharged water for 50 seconds by the total floodable area at El. 100 ft 0 in. No outflow to the lowest elevation for the early discharge period of 50 seconds is also assumed to result in conservative flood level, although fluid flow to the lower elevation will actually be established when broken flow arrives at the openings to the lower elevation.

Fire hose stations

fire hose stations

Indoor hydrants that could reach the area or zone where a fire occurs are contributed to internal flooding sources when a fire occurs. The discharge flow rate from indoor hydrants is assumed to be 0.044 m^3/s (700 gpm).

The lowest level of the auxiliary building is designed to function as an emergency sump to collect flooding sources when a flood event occurs. The flood level of the emergency sump is determined by dividing the maximum volume of flooding sources by the floodable area of the emergency sump. The flood level, except for the lowest elevation, is determined based on the level established by the difference between the inflow rate of the postulated flooding source and the outflow rate through drains or openings in steady-state condition.

Fluid flow rates through stairwells, floor openings, and under door gaps are determined in accordance with the formulae given in ANSI 56.11-1988 (Reference 5). The fluid flow rate through a stairwell or a floor opening is calculated using equation 5.2-1, and the flow rate under a door is calculated using equation 5.2-3 in Reference 5. For each storage tank, it is assumed that the total inventory of the tank is spilled out. No credit is taken for operation of sump pumps to mitigate the flooding consequences.

The internal flooding analysis is performed on a floor-by-floor and room-by-room basis.

Flooding analysis consists of the following steps:

a. Identification of safety-related SSCs

b. Identification of potential flooding sources

Response to Action Item 3-49.20

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 20 (AI 3-49.20): Clarification: Confirm that the main control room (MCR) does not have an automatic sprinkler system so that the possibility of flooding from fire protection system inside MCR is eliminated. The fire protection system line failure is postulated in the corridor outside the main control room. How is the main control room protected such that water will not enter into the room?

Response:
The MCR does not have an automatic sprinkler system. The MCR is protected from flooding sources outside the main control room with curbs and a steel hole panel installed at the entrance of the MCR.

Impact on DCD
DCD Section 3.4.1.5.2 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

A rupture of a feedwater system line is the worst case of flooding for the main steam valve room. The cross-section area of the break is based on 0.09 m^2 (1.0 ft^2), as defined in Standard Review Plan, Branch Technical Position 3-3 (Reference 6). In addition, a main feedwater pump is assumed to operate at the maximum flow rate. An emergency flood relief path is installed to drain out at each room. The potential flood level is 1.82 m (6 ft) above El. 137 ft 6 in. and the safety valves are located above the flood level, so these valves are not flooded.

In other areas except the main steam valve room, the fire suppression system is considered a flooding source. The flood water is drained to lower elevations through the drain system and openings. The potential flood level at this elevation is assumed as 0.15 m (6 in).

The safety-related equipment and components are elevated above the flood level. Therefore, the Class 1E motor control center, switchgear, and remote shutdown panel are not flooded.

Elevation 156 ft 0 in

Flood water above El. 156 ft 0 in drains to the lower elevation through the floor drain and stairwells.

The equipment to be protected from flooding at El. 156 ft 0 in includes I&C equipment, cubicle coolers, and the console in main control room. The main control room area is protected from flooding in that no water lines are routed above or through the control room or computer room. Water lines routed to HVAC air handling units around the control room are contained in rooms with curbs that preclude the potential for water leakage from entering the control room or computer room.

The MCR is also protected from the flooding sources outside the main control room with curbs and a steel hole panel installed at the entrance of the MCR.

The following potential flooding sources are considered:

a. A postulated pipe failure of a moderate-energy line is considered.

b. A high-energy line break is not considered because there is no piping break in this area.

Response to Action Item 3-49.21

CLARIFYING QUESTIONS, DCD SECTION 3.4.1.5

Question No. 21 (AI 3-49.21): Editorial Comment: On page 3.4-4, edit in third paragraph, need space between words

Sensorsignals of sensors to indicate

Response:
A space will be added between the words ‘sensor’ and ‘signals’ on page 3.4-4.

Impact on DCD
DCD Section 3.4.1.2 will be revised as shown in the attachment.

Impact on PRA
There is no impact on the PRA.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical and Environmental Reports.

The lowest spaces of each building are designed as an emergency sump to keep flood water within the building where a flooding event could occur. The emergency sump is large enough to accommodate the volume of limiting flooding source.

Additionally, curbs or ramps and sealed penetrations function as flood barriers. Safety-related equipment and components are located at higher elevations so flooding events do not affect them.

Sensor signals

Watertight doors are used for internal flood protection. Watertight doors are specified to withstand the static pressure from the maximum flood elevation as determined in the flooding analysis. ~~Sensorsignals~~ of sensors to indicate the status of open and close of the watertight doors are provided to the main control room. Watertight doors are periodically inspected to ensure their functionality.

The areas of concern in APR1400 are as follows:

a. Reactor containment building

   The reactor containment building systems to be protected from flooding are the reactor coolant system (RCS), safety injection system (SIS), reactor coolant gas vent system (RCGVS), and main steam system (MSS). The components to be protected from flooding are the valves and electric instrumentation of these systems.

b. Auxiliary building

   The auxiliary building systems to be protected from flooding are the SIS, shutdown cooling system (SCS), chemical and volume control system (CVCS), containment spray system (CSS), auxiliary feedwater system (AFWS), and component cooling water system (CCWS). The components to be protected from flooding are the motor-driven pumps, valves, electrical equipment and instruments, Class 1E electric/instrumentation components, and cubicle coolers in the relevant system.

c. Emergency diesel generator building