GALL REVISION

Chapter II Containment Structures

Enclosure 2

II Containment Structures

A1. PWR Concrete Containments (Reinforced and Prestressed)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A1.1-a	Concrete elements: Dome; wall; basemat; ring girder; buttresses	Concrete	Outside containment	Loss of material (spalling, scaling) and cracking / Freeze-thaw	Chapter XI.S2, "ASME Section XI, Subsection IWL" Accessible Areas: Inspections performed in accordance with IWL will indicate the presence of loss of material (spalling, scaling) and cracking due to freeze-thaw. Inaccessible Areas: Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index>100 day-inch/yr) (NUREG-1557). Documented evidence to confirm that the in-place concrete had the air content between 3% to 6% and the subsequent inspections performed did not exhibit degradations related to freeze-thaw should be considered a part of the evaluation. The weathering index for the continental US is shown in ASTM C33-90, Fig. 1.	No, if the stated conditions are satisfied for inaccessible areas
A1.1-b	Concrete elements: Dome; wall; basemat; ring girder; buttresses	Concrete	Outside containment	Increase in porosity, permeability, and loss of strength/ Leaching of calcium hydroxide	Chapter XI.S2, "ASME Section XI, Subsection IWL" Accessible Areas: Inspections performed in accordance with IWL will indicate the presence of increase in porosity, and permeability due to leaching of calcium hydroxide.	Yes, a plant-specific aging management program is required for inaccessible areas as

II Containment Structures
A1. PWR Concrete Containments (Reinforced and Prestressed)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
					Inaccessible Areas: A plant-specific aging management program is required for below-grade inaccessible areas (basemat and concrete wall), if the concrete is exposed to flowing water (NUREG-1557). An aging management program is not required, even if reinforced concrete is exposed to flowing water, if there is documented evidence that confirms the in-place concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	stated
A1.1-c	Concrete elements: Dome; wall; basemat; ring girder; buttresses	Concrete	Inside or outside containment	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) / Aggressive chemical attack	Chapter XI.S2, "ASME Section XI, Subsection IWL" Accessible Areas: Inspections performed in accordance with IWL will indicate the presence of increase in porosity and permeability, cracking, or loss of material (spalling, scaling) due to aggressive chemical attack. Inaccessible Areas: A plant-specific aging management program is required for below-grade exterior reinforced concrete (basemat, embedded walls), if the below-grade environment is aggressive (pH < 5.5, chlorides > 500 ppm, or sulfates > 1,500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a	Yes, a plant-specific aging management program is required for inaccessible areas as stated

II Containment Structures
A1. PWR Concrete Containments (Reinforced and Prestressed)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
					plant-specific program. Note: Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.	
A1.1-d	Concrete elements: Dome; wall; basemat; ring girders; buttresses	Concrete	Inside or outside containment	Cracking and expansion / Reaction with aggregates	Chapter XI.S2, "ASME Section XI, Subsection IWL" Accessible Areas: Inspections performed in accordance with IWL will indicate the presence of cracking due to reaction with aggregates. Inaccessible Areas: Evaluation is needed if investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54, ASTM C227-50, or ACI 201.2R-77 (NUREG-1557) demonstrate that the aggregates are reactive.	No, if the stated conditions are satisfied for inaccessible areas
A1.1-e	Concrete elements: Dome; wall; basemat; ring girders; buttresses; reinforcing steel	Concrete; carbon steel	Inside or outside containment	Cracking, loss of bond, and loss of material (spalling, scaling) / Corrosion of embedded steel	Chapter XI.S2, "ASME Section XI, Subsection IWL" Accessible Areas: Inspections performed in accordance with IWL will indicate the presence of cracking, loss of bond, and loss of material (spalling, scaling) due to	Yes, a plant-specific aging management program is required for

II Containment Structures
A1. PWR Concrete Containments (Reinforced and Prestressed)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
					corrosion of embedded steel. Inaccessible Areas: A plant-specific aging management program is required for below-grade exterior reinforced concrete (basemat, embedded walls), if the below-grade environment is aggressive (pH < 5.5, chlorides > 500 ppm, or sulfates > 1,500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a plant-specific program. Note: Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.	inaccessible areas as stated

GALL REVISION

Chapter III Structures and Component Supports

III Structures and Component Supports
A1. Group 1 Structures (BWR Reactor Bldg., PWR Shield Bldg., Control Room/Bldg.)

Item	Structure and/or Component	Material	Environment	Aging Effect/ Mechanism	Aging Management Program (AMP)	Further Evaluation
A1.1-a	Concrete: Exterior above and below grade; foundation	Reinforced concrete	Weather exposed	Loss of material (spalling, scaling) and cracking / Freeze-thaw	Chapter XI.S6, "Structures Monitoring Program" Accessible Areas: Inspections performed in accordance with "Structures Monitoring Program" will indicate the presence of loss of material (spalling, scaling) and cracking due to freeze-thaw Inaccessible Areas: Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index>100 day-inch/yr) (NUREG-1557). Documented evidence to confirm that the in-place concrete had the air content between 3% to 6% and the subsequent inspections performed did not exhibit degradations related to freeze-thaw should be considered a part of the evaluation. The weathering index for the continental US is shown in ASTM C33-90, Fig. 1.	No, if within the scope of the applicant's structures monitoring program and the stated conditions are satisfied for inaccessible areas

A1.1-b	Concrete: Exterior above and below grade; foundation	Reinforced concrete	Flowing water	Increase in porosity and permeability, and loss of strength / Leaching of calcium hydroxide	Chapter XI.S6, “Structures Monitoring Program” Accessible Areas: Inspections performed in accordance with “Structures Monitoring Program” will indicate the presence of increase in porosity and permeability due to leaching of calcium hydroxide Inaccessible Areas: A plant-specific aging management program is required for below-grade inaccessible areas (basemat and concrete wall) if the concrete is exposed to flowing water (NUREG-1557). An aging management program is not required, even if reinforced concrete is exposed to flowing water, if there is documented evidence that confirms the in-place concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	No, if within the scope of the applicant’s structures monitoring program and a plant-specific aging management program is required for inaccessible areas as stated

A1.1-c	Concrete: All	Reinforced concrete	Any	Expansion and cracking / Reaction with aggregates	Chapter XI.S6, “Structures Monitoring Program” Accessible Areas: Inspections/evaluations performed in accordance with “Structures Monitoring Program” will indicate the presence of expansion and cracking due to reaction with aggregates. Inaccessible Areas: Evaluation is needed if investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54, ASTM C227-50, or ACI 201.2R-77 (NUREG-1557) demonstrate that the aggregates are reactive.	No, if within the scope of the applicant’s structures monitoring program and the stated conditions are satisfied for inaccessible areas
A1.1-d	Concrete: Interior and above-grade exterior	Reinforced concrete	Exposure to aggressive environment	Cracking, loss of bond, and loss of material (spalling, scaling) / Corrosion of embedded steel	Chapter XI.S6, “Structures Monitoring Program” Accessible Areas: Inspections performed in accordance with “Structures Monitoring Program” will indicate the presence of cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel.	No, if within the scope of the applicant’s structures monitoring program

A1.1-e	Concrete: Below-grade exterior; foundation	Reinforced concrete	Exposure to aggressive environment	Cracking, loss of bond, loss of material (spalling, scaling) / Corrosion of embedded steel	Inaccessible Areas: A plant-specific aging management program is required (may be a part of structures monitoring program) if the below-grade environment is aggressive (pH < 5.5, chlorides >500ppm, or sulfates > 1500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a plant-specific program. Note: Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.	Yes, a plant-specific aging management program is required for inaccessible areas as stated
A1.1-f	Concrete: Interior and above-grade exterior	Reinforced concrete	Exposure to aggressive environment	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) / Aggressive chemical attack	Chapter XI.S6, “Structures Monitoring Program” Accessible Areas: Inspections performed in accordance with “Structures Monitoring Program” will indicate the presence of increase in porosity and permeability, cracking, or loss of material (spalling, scaling) due to aggressive chemical attack.	No, if within the scope of the applicant’s structures monitoring program

A1.1-g	Concrete: Below-grade exterior; foundation	Reinforced concrete	Exposure to aggressive environment	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) / Aggressive chemical attack	Inaccessible Areas: A plant-specific aging management program is required (may be a part of structures monitoring program) if the below-grade environment is aggressive (pH < 5.5, chlorides >500 ppm, or sulfates >1500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a plant-specific program. Note: Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.	Yes, a plant-specific aging management program is required for inaccessible areas as stated

Proposed changes to SRP NUREG-1800 (Table 3.5-1) and GALL NUREG-1801 Vol-1 (Table 5)

Table 3.5-1. Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of the GALL Report (continued)

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended
BWR/PWR	Concrete elements: Foundation, wall, dome	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Yes, a plant-specific aging management program is required for inaccessible areas as stated (see Subsection 3.5.2.2.1.1)
BWR/PWR	Concrete elements: foundation, dome, and wall	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	No, if stated conditions are satisfied for inaccessible areas
Class I Structures				
BWR/PWR	All Groups except Group 6: accessible interior/exterior concrete & steel components	All types of aging effects	Structures Monitoring	No, if within the scope of the applicant's structures monitoring program and a plant-specific aging management program is required for inaccessible areas as stated (see Subsection 3.5.2.2.2.1)
BWR/PWR	Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant-specific	Yes, a plant-specific aging management program is required for inaccessible areas as stated (see Subsection 3.5.2.2.2.2)

TABLE 5. SUMMARY OF AGING MANAGEMENT PROGRAMS FOR THE STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN CHAPTERS II AND III OF THE GALL REPORT (CONTINUED)

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	GALL Item Number
PWR Concrete (Reinforced and Prestressed) and Steel Containment BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment					
BWR/ PWR	Concrete elements: foundation, dome, and wall	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Yes, a plant-specific aging management program is required for inaccessible areas as stated	II.A1.1-b, II.A1.1-c, II.A1.1-e, II.A2.2-b, II.A2.2-c, II.A2.2-e, II.B2.2.1-a, II.B2.2.1-b, II.B2.2.1-d, II.B3.1.2-a, II.B3.1.2-b, II.B3.1.2-d, II.B3.2.1-b, II.B3.2.1-c, II.B3.2.1-e.
BWR/ PWR	Concrete elements: foundation, dome, and wall	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	No, if stated conditions are satisfied for inaccessible areas	II.A1.1-a, II.A1.1-d, II.A2.2-a, II.A2.2-d, II.B2.2.1-c, II.B3.1.2-c, II.B3.2.1-a, II.B3.2.1-d.
Class I Structures					
BWR/ PWR	All Groups except Group 6: accessible interior/exterior concrete and steel components	All types of aging effects	Structures monitoring	No, if within the scope of the applicant's structures monitoring program and a plant-specific aging management program is required for inaccessible areas as stated	III.A1.1-a, III.A1.1-b, III.A1.1-c, III.A1.1-d, III.A1.1-f, III.A1.2-a, III.A2.1-a, III.A2.1-b, III.A2.1-c, III.A2.1-d, III.A2.1-f, III.A2.2-a, III.A3.1-a,

TABLE 5. SUMMARY OF AGING MANAGEMENT PROGRAMS FOR THE STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN CHAPTERS II AND III OF THE GALL REPORT (CONTINUED)

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	GALL Item Number
					III.A3.1-b, III.A3.1-c, III.A3.1-d, III.A3.1-f, III.A3.2-a, III.A4.1-a, III.A4.1-b, III.A4.1-d, III.A4.2-a, III.A4.2-b, III.A5.1-a, III.A5.1-b, III.A5.1-c, III.A5.1-d, III.A5.1-f, III.A5.2-a, III.A7.1-a, III.A7.1-b, III.A7.1-c, III.A7.1-d, III.A7.1-f, III.A7.2-a, III.A8.1-a, III.A8.1-b, III.A8.1-c, III.A8.2-a, III.A9.1-a, III.A9.1-b, III.A9.1-c, III.A9.1-d, III.A9.1-f.
BWR/ PWR	Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation	Aging of inaccessible concrete areas due to aggressive chemical attack and corrosion of embedded steel	Plant Specific	Yes, a plant-specific aging management program is required for inaccessible areas as stated	III.A1.1-e, III.A1.1-g, III.A2.1-e, III.A2.1-g, III.A3.1-e, III.A3.1-g, III.A5.1-e, III.A5.1-g, III.A7.1-e, III.A7.1-g, III.A8.1-e,

TABLE 5. SUMMARY OF AGING MANAGEMENT PROGRAMS FOR THE STRUCTURES AND COMPONENT SUPPORTS EVALUATED IN CHAPTERS II AND III OF THE GALL REPORT (CONTINUED)

Type	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	GALL Item Number
					III.A8.1-g, III.A9.1-e, III.A9.1-g.