CHAPTER II B

BOILING WATER REACTOR (BWR) CONTAINMENTS

DRAFT – AUGUST 2000

BWR Containments

- B1. Mark I Containments
- B2. Mark II Containments
- B3. Mark III Containments
- B4. Common Components

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B1. Mark I Containments

- B1.1 Steel Containments
 - B1.1.1 Steel Elements

B1. Mark I Containments

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively.

System Interfaces

Functional interfaces include the primary containment HVAC system (VII.F3), containment isolation system (V.C), containment spray system (V.A), and containment heat removal system (V.E). Physical interfaces exist with any structure, system, or component that either penetrates the containment wall, such as the main steam system (VIII.B2) and feedwater systems (VIII.D2), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

B BWR Containments

B1 Mark I Containments

BI.	1 Steel Col	ntainments					
	Structure/C	Region of		Environ-	Aging Effect	Aging	
Item	omponent	Interest	Material	ment		Mechanism	References
B1.1.1	Steel	Drywell;	Carbon	Inside or	Loss of	Corrosion	10 CFR 50.55a
	Elements	Torus;	Steel	Outside	Material		ASME, Sect. XI,
		Drywell		Contain-			Subsection IWE
		Head;		ment			
		Embedded					
		Shell and					
		Sand Pocket					
		Regions;					
		Drywell					
		Support					
		Skirt; Torus					
		Ring Girder;					
		Down-					
		comers;					
		ECCS					
		Suction					
		Header.					
		Inspection of					
		supports is					
		addressed by					
		ASME					
		Section XI,					
		Subsection					
		IWF (see					10 CFR Part 50,
		Chapter III					Appendix J
		B1.3)					

B BWR Containments

B1 Mark I Containments

Aging Management Program		Further
(AMP)	Evaluation and Technical Basis	Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE	See Chapter XI.S1 for evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE, except for inaccessible areas when conditions in accessible areas may not indicate the	Yes. Evaluate
	presence of or result in degradation to such inaccessible areas.	plant- specific
		program for inaccessible
		areas when conditions in accessible
		areas may not indicate
		the presence of or result in
		degradation to such
		inaccessible areas.
		N
10 CFR Part 50, Appendix J (Containment Leak Rate Tests)	See Chapter XI.S4 for evaluation of 10 CFR Part 50, Appendix J	No
Protective Coating Monitoring and	See Chapter XI.S8 for evaluation of Protective Coating	No
Maintenance Program	Monitoring and Maintenance Program.	

B BWR Containments

B1 Mark I Containments

Ы.		itainments					
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B1.1	Steel Elements	Torus, Vent Line, Vent Header, Vent Line Bellows, Down- comers (CLB fatigue analysis does not exist)	Stainless Steel, Carbon Steel	Inside or Outside Contain- ment	Cracking	Cyclic Loading	10 CFR 50.55a ASME, Sect. XI, Subsection IWE 10 CFR Part 50, Appendix J
B1.1	Steel Elements	Torus, Vent Line, Vent Header, Vent Line Bellows, Down- comers (CLB fatigue analysis exists)	Stainless Steel, Carbon Steel	Inside or Outside Contain- ment	Cumulative Fatigue Damage	Fatigue	Design Code of Record
B1.1.1	Steel Elements	Vent Line Bellows	Stainless Steel	Inside or Outside Contain- ment	Crack Initiation and Growth	Stress Corrosion Cracking	10 CFR 50.55a ASME, Sect. XI, Subsection IWE 10 CFR Part 50, Appendix J NRC IN 92-20

B BWR Containments

B1 Mark I Containments

	Further
Evaluation and Technical Basis	Evaluation
	Yes,
50.55a/ASME Section XI, Subsection IWE and Chapter	Applicant's
XI.S4 for an evaluation of 10 CFR Part 50,	program to
Appendix J.	address
	Attribute (4)
Evaluation of 10 CFR 50.55a/IWE is augmented as follows:	needs to be evaluated
(4) Detection of Aging Effects: VT-3 visual inspection may not detect fine cracks (one option may be to perform VT-1 visual inspections).	
Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See the Standard Review Plan, Section 4.6, "Containment Liner Plate and Penetration Fatigue Analysis" for acceptable methods for meeting the requirements of 10CFR54.21(c).	Yes, TLAA
See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J.	No
Evaluation of 10 CFR 50.55a/IWE is augmented as follows:	
(3) Parameters Monitored or Inspected:	
Stress corrosion cracking (SCC) is a concern for dissimilar metal welds. In the case of bellows assemblies, SCC may cause aging effects particularly if the material is not shielded from a corrosive environment. Subsection IWE covers inspection of these items under examination categories E-B, E-F, and E-P (10 CFR Part 50, Appendix J pressure tests). 10 CFR 50.55a identifies examination categories E-B and E-F as optional during the current term of operation. For the extended period of operation, Examination Categories E-B & E-F, and augmented VT-1 visual examination of bellows assemblies and dissimilar welds are warranted to address this issue.	
(10) Operating Experience: IN 92-20 describes an instance of containment bellows cracking, resulting in loss of leak tightness.	
	XI.S4 for an evaluation of 10 CFR Part 50, Appendix J. Evaluation of 10 CFR 50.55a/IWE is augmented as follows: (4) Detection of Aging Effects: VT-3 visual inspection may not detect fine cracks (one option may be to perform VT-1 visual inspections). Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See the Standard Review Plan, Section 4.6, "Containment Liner Plate and Penetration Fatigue Analysis" for acceptable methods for meeting the requirements of 10CFR54.21(c). See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J. Evaluation of 10 CFR 50.55a/IWE is augmented as follows: (3) Parameters Monitored or Inspected: Stress corrosion cracking (SCC) is a concern for dissimilar metal welds. In the case of bellows assemblies, SCC may cause aging effects particularly if the material is not shielded from a corrosive environment. Subsection IWE covers inspection of these items under examination categories E-B, E-F, and E-P (10 CFR Part 50, Appendix J pressure tests). 10 CFR 50.55a identifies examination categories E-B and E-F as optional during the current term of operation. For the extended period of operation, Examination Categories E-B & E-F, and augmented VT-1 visual examination of bellows assemblies and dissimilar welds are warranted to address this issue. (10) Operating Experience: IN 92-20 describes an instance of containment bellows

B BWR Containments

B1 Mark I Containments

B1.		ntainments		1	1		I
	Structure/C	Region of		Environ-	Aging Effect	Aging	
Item	omponent	Interest	Material	ment		Mechanism	References
B1.1.1	Steel	Drywell	Carbon	Inside or	Fretting or	Mechanical	10 CFR 50.55a
	Elements	Head;	Steel and	Outside	Lockup	Wear	ASME, Sect. XI,
		Down-	Graphite	Contain-	P		Subsection IWE
		comers	Plate	ment			Bubbeetion IVI
		comers	riale	mem			
		Inspection of					
		supports is					
		addressed by					
		ASME					
		Section XI,					
		Subsection					
		IWF (see					
		Chapter III					
		B1.3).					
		Ы.3).					
				1	1		1

B BWR Containments

B1 Mark I Containments

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
0 CFR 50.55a/ASME Section XI,	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/	No.
Subsection IWE	ASME Section XI, Subsection IWE.	110.
		1

II B1-10

B2. Mark II Containments

B2.1 Steel Containments B2.1.1 Steel Elements

- B2.2.1 Concrete Elements
- B2.2.2 Steel Elements
- B2.2.3 Prestressing System

B2. Mark II Containments

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively. In Review Table II B2, Mark II Concrete containments are divided into three elements: concrete, steel, and prestressing system and Mark II Steel containments are divided into two elements: steel and concrete.

System Interfaces

Functional interfaces include the primary containment HVAC system (VII.F3), containment isolation system (V.C), containment spray system (V.A), and containment heat removal system (V.E). Physical interfaces exist with any structure, system, or component that either penetrates the containment wall, such as the main steam system (VIII.B2) and feedwater systems (VIII.D2), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

B BWR Containments

B2 Mark II Containments

Item B2.1.1	Structure/C omponent Steel	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B2.1.1			material				
		Drywell;	Carbon	Inside or	Loss of	Corrosion	10 CFR 50.55a
	Elements	Suppres-	Steel	Outside	Material	CONTODION	ASME, Sect. XI,
	Liements	sion	Breer	Contain-	material		Subsection IWE
		Chamber;		ment			Bubbeetion IVI
		Drywell		ment			
		Head;					
		Embedded					
		Shell and					
		Sand Pocket					
		Regions;					
		Support					
		Skirt;					
		Downcomer					
		Pipes;					
		Region					
		Shielded by					
		Diaphragm					
		Floor					
		-					
		Inspection of					
		supports is					
		addressed by					
		ASME					
		Section XI,					
		Subsection					10 CFR Part 50,
		IWF (see					Appendix J
		Chapter III					
		B1.3).					

B BWR Containments

B2 Mark II Containments

Aging Management Program		Further
(AMP)	Evaluation and Technical Basis	Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE	See Chapter XI.S1 for evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE, except for inaccessible areas when conditions in accessible areas may not indicate the	Yes. Evaluate
	presence of or result in degradation to such inaccessible areas.	plant- specific program for
		inaccessible areas when conditions
		in accessible areas may not indicate
		the presence of or result in
		degradation to such inaccessible
		areas.
10 CFR Part 50, Appendix J (Containment	See Chapter XI.S4 for evaluation of 10 CFR Part 50,	No
Leak Rate Tests)	Appendix J	
Protective Coating Monitoring and Maintenance Program	See Chapter XI.S8 for evaluation of Protective Coating Monitoring and Maintenance Program.	No

B BWR Containments

B2 Mark II Containments

BZ		ontainments					
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B2.1.1	Steel Elements	Suppres- sion Pool Shell, Unbraced Down- comers (CLB fatigue analysis does not exist)	Carbon Steel	Inside or Outside Contain- ment	Cracking	Cyclic Loading	10 CFR 50.55a ASME, Sect. XI, Subsection IWE 10 CFR Part 50, Appendix J
B2.1.1	Steel Elements	Suppres- sion Pool Shell, Unbraced Down- comers (CLB fatigue analysis exists)	Carbon Steel	Inside or Outside Contain- ment	Cumulative Fatigue Damage	Fatigue	Design Code of Record
B2.1.1	Steel Elements	Drywell Head; Downcomer Pipes Inspection of supports is addressed by ASME Section XI, Subsection IWF (see Chapter III B1.3).	Carbon Steel	Inside or Outside Contain- ment	Fretting or Lockup	Mechanical Wear	10 CFR 50.55a ASME, Sect. XI, Subsection IWE

B BWR Containments

B2 Mark II Containments

B2.1 Steel Containments		
Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	 See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J. Evaluation of 10 CFR 50.55a/IWE is augmented as follows: (4) Detection of Aging Effects: VT-3 visual inspection may not detect fine cracks (one option may be to perform VT-1 visual inspections). 	Yes, Applicant's program to address Attribute (4) needs to be evaluated
Components have been designed or evaluated for fatigue for a 40 year design life based on postulated cycles, according to the requirements of the code of record or later approved codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See the Standard Review Plan, Section 4.6, "Containment Liner Plate and Penetration Fatigue Analysis" for acceptable methods for meeting the requirements of 10CFR54.21(c).	Yes, TLAA
10 CFR 50.55a/ASME Section XI, Subsection IWE	See Chapter XI for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE	No.

B BWR Containments

B2 Mark II ContainmentsB2.2 Concrete Containments

B2 .	2 Concret	e Containm	ents				
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B2.2.1	Concrete Elements	Contain- ment; Basemat	Concrete	Outside Contain- ment	Increase in Porosity, Permea- bility	Leaching of Calcium Hydroxide	10 CFR 50.55a ASME, Sect. XI, Subsection IWL
B2.2.1	Concrete	Contain-	Concrete	Inside or	Increase in	Aggressive	10 CFR 50.55a
D&. &. 1	Elements	ment; Basemat	Concrete	Outside Contain- ment	Porosity and Permea- bility, Cracking, Loss of Material (spalling, scaling)	Chemical Attack	ASME, Sect. XI, Subsection IWL

B BWR Containments

B2 Mark II Containments

DZ.Z Concrete Containment		1
Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.

B BWR Containments

B2 Mark II Containments

D۵	BZ.Z Concrete Containments							
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References	
B2.2.1	Concrete Elements	Contain- ment; Basemat	Concrete	Inside or Outside Contain- ment	Expansion & Cracking	Reaction with Aggregates	10 CFR 50.55a ASME, Sect. XI, Subsection IWL	
B2.2.1	Concrete Elements	Contain- ment; Basemat; Reinforcing Steel	Concrete; Carbon Steel	Inside or Outside Contain- ment	Cracking, Loss of Bond, and Loss of Material (spalling, scaling)	Corrosion of Embedded Steel	10 CFR 50.55a ASME, Sect. XI, Subsection IWL	

B BWR Containments

B2 Mark II Containments

10 CFR 50.55a/ASME Section XI. See Chapter XI.52 for an evaluation of 10 CFR No. Subsection IWL 50.55a/ASME Section XI, Subsection IWL No. 10 CFR 50.55a/ASME Section XI. See Chapter XI.52 for an evaluation of 10 CFR Yes. Subsection IWL 50.55a/ASME Section XI, Subsection IWL Yes. 10 CFR 50.55a/ASME Section XI. See Chapter XI.52 for an evaluation of 10 CFR Yes. Subsection IWL 50.55a/ASME Section XI, Subsection IWL evaluate the presence of or result in degradation to such inaccessible areas. Evaluate plant-specific program for inaccessible areas may not indicate the presence of or result in degradation to such inaccessible areas. Evaluate areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
Subsection IWL50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.Evaluate plant- specificProgram for inaccessible 	10 CFR 50.55a/ASME Section XI,	See Chapter XI.S2 for an evaluation of 10 CFR	
		50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to	Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible

B BWR Containments

B2 Mark II Containments

Dwa	BZ.Z Concrete Containments							
T .	Structure/C	Region of		Environ-	Aging Effect	Aging	D.(
Item B2.2.1	omponent Concrete Elements	All	Material Concrete	ment Inside or Outside Contain- ment	Cracks; Distortion; Increase in Compo- nent Stress Level	Mechanism Settlement	References 10 CFR 50.55a ASME, Sect. XI, Subsection IWL ACI349.3R-96	
B2.2.1	Concrete Elements	Foundation	Concrete	Flowing Water Under Foundation	Reduction in Founda- tion Strength	Erosion of Porous Concrete Subfounda- tion	NRC IN 97-11 NRC IN 98-26	
B2.2.1	Concrete Elements	Contain- ment; Concrete Fill in Annulus; Basemat	Concrete	Inside or Outside Contain- ment	Loss of Strength and Modulus	Elevated Tempera- ture (>150°F general; >200°F local)	10 CFR 50.55a ASME, Sect. XI, Subsection IWL	

B BWR Containments

B2 Mark II Containments

Aging Management Program	Evaluation and Tachnical Pacia	Further
(AMP) Plant-Specific Program	Evaluation and Technical Basis The initial Licensing Basis for some plants included a	Evaluation Yes.
	program to monitor settlement. If no settlement was evident during the first decade or so, the NRC may have given the licensee approval to discontinue the program. However, if a de-watering system is relied upon for control of settlement, then the licensee needs to ensure proper functioning of the de-watering system through the period of extended operation.	If applicable
Plant-Specific Program	Erosion of cement from porous concrete subfoundations beneath containment basemats is described in IN 97-11. IN	Yes.
	98-26 proposes Maintenance Rule Structures Monitoring for managing this aging effect, if applicable. See Chapter XI.S6 for evaluation of Structures Monitoring Program.	If applicable
	If a de-watering system is relied upon for control of erosion of cement from porous concrete subfoundations, then the licensee needs to ensure proper functioning of the de- watering system through the period of extended operation.	
Plant-Specific Program	The implementation of 10 CFR 50.55a and IWL would not	Yes.
. U	be able to identify the loss of strength and modulus due to elevated temperature. Thus, for any portions of concrete containment that exceed specified temperature limits, further evaluations are warranted. Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long- term period. The temperatures shall not exceed 150 °F except for local areas, such as around penetrations, which are not allowed to exceed 200 °F.	If applicable

B BWR Containments

B2 Mark II Containments B2.2 Concrete Containments

	Structure/C	Region of		Environ-	Aging Effect	Aging	
Item	omponent	Interest	Material	ment		Mechanism	References
B2.2.2	Steel	Drywell,	Carbon	Inside or	Loss of	Corrosion	10 CFR 50.55a
	Elements	Suppres-	Steel	Outside	Material		ASME, Sect. XI,
		sion		Contain-			Subsection IWE
		Chamber		ment			
		and					
		Basemat					
		Liners; Liner					
		Anchors;					
		Drywell					
		Head;					
		Downcomer					
		Pipes					
		Inspection of					
		supports is					
		addressed by					
		ASME					
		Section XI,					
		Subsection					
		IWF (see					
		Chapter III					
		B1.3).					
							10 CFR Part 50,
							Appendix J

B BWR Containments

B2 Mark II Containments

B2.2 Concrete Containment		_
Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE	See Chapter XI.S1 for evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.
10 CFR Part 50, Appendix J (Containment Leak Rate Tests)	See Chapter XI.S4 for evaluation of 10 CFR Part 50, Appendix J	No
Protective Coating Monitoring and Maintenance Program	See Chapter XI.S8 for evaluation of Protective Coating Monitoring and Maintenance Program.	No

B BWR Containments

B2 Mark II Containments

	B2.2 Concrete Containments								
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References		
B2.2.2	Steel Elements	Suppres- sion Chamber Liner (Interior Surface)	Stainless Steel	Inside or Outside Contain- ment	Crack Initiation and Growth	Stress Corrosion Cracking	10 CFR 50.55a ASME, Sect. XI, Subsection IWE 10 CFR Part 50, Appendix J		
B2.2.2	Steel Elements	Vent Header, Down- comers (CLB fatigue analysis does not exist)	Carbon Steel	Inside or Outside Contain- ment	Cracking	Cyclic Loading	10 CFR 50.55a ASME, Sect. XI, Subsection IWE 10 CFR Part 50, Appendix J		
B2.2.2	Steel Elements	Vent Header, Down- comers (CLB fatigue analysis exists)	Carbon Steel	Inside or Outside Contain- ment	Cumulative Fatigue Damage	Fatigue	Design Code of Record		

B BWR Containments

B2 Mark II Containments

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J.	No.
10 CFR 50.55a/ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J. Evaluation of 10 CFR 50.55a/IWE is augmented as follows: (4) Detection of Aging Effects: VT-3 visual inspection may not detect fine cracks (one option may be to perform VT-1 visual inspections).	Yes, Applicant's program to address Attribute (4) needs to be evaluated
Components have been designed or evaluated for fatigue for a 40 year design life based on postulated cycles, according to the requirements of the code of record or later approved codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See the Standard Review Plan, Section 4.6, "Containment Liner Plate and Penetration Fatigue Analysis" for acceptable methods for meeting the requirements of 10CFR54.21(c).	Yes, TLAA

B BWR Containments

B2 Mark II Containments B2.2 Concrete Containments

B2 .	z Concret	e Containm	ents				
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B2.2.2	Steel Elements	Drywell Head; Downcomer Pipes Inspection of supports is addressed by ASME Section XI, Subsection IWF (see Chapter III B1.3).	Carbon Steel	Inside or Outside Contain- ment	Fretting or Lockup	Mechanical Wear	10 CFR 50.55a ASME, Sect. XI, Subsection IWE
B2.2.2	Prestress-ing System	Tendons and Anchorage Compo- nents	Carbon Steel	Inside or Outside Contain- ment	Loss of Material	Corrosion of Tendons/ Anchorage Components	10 CFR 50.55a ASME, Sect. XI, Subsection IWL NUREG-1522 IN 99-10

B BWR Containments

B2 Mark II Containments

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE	No.
10 CFR 50.55a/ASME Section XI Subsection IWL (Does not apply to bonded post-tensioning systems)	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL The staff notes, as documented in NUREG-1522 and IN 99- 10, detrimental conditions exist in some tendon access galleries that are conducive to corrosion of tendon anchorage components. Because excessive moisture and humidity can significantly accelerate the corrosion of tendon anchorage components, managing the condition and environment in the tendon access gallery is a prudent way to manage the degradation of bearing plates and other vertical tendon anchorage components.	No

B BWR Containments

B2 Mark II ContainmentsB2.2 Concrete Containments

B2.		e Containm	01105		I		
	Structure/C	Region of		Environ-	Aging Effect	Aging	
Item	omponent	Interest	Material	ment		Mechanism	References
B2.2.3	Prestress-ing	Tendons	Carbon	Inside or	Loss of	Relaxation;	10 CFR 50.55a
	System	and	Steel	Outside	Prestress	Shrinkage;	ASME, Sect. XI,
	Bystem		Breer	Contain-	110501055	Creep;	
		Anchorage					Subsection IWL
		Compo-		ment		Elevated	Regulatory Guide
		nents				Temperature	1.35.1
							1

B BWR Containments

B2 Mark II Containments

Aging Management Program		Further
(AMP)	Evaluation and Technical Basis	Evaluation
loss Of Tendon Prestress is a TLAA.	Loss of tendon prestress is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See the Standard Review Plan, Section 4.5, "Concrete Containment Tendon Prestress" for acceptable methods for meeting the requirements of 10CFR54.21(c)(1)(i) and (ii). See Chapter X of this report for meeting the requirements of 10CFR54.21(c)(1)(iii).	Yes, TLAA
	For periodic monitoring of prestress, see Chapter XI.S2.	

B3. Mark III Containments

- B3.1 Steel ContainmentsB3.1.1 Steel ElementsB3.1.2 Concrete Elements
- B3.2 Concrete ContainmentsB3.2.1 Concrete ElementsB3.2.2 Steel Elements

II B3-2

B3. Mark III Containments

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively. In Review Table II B3, Mark III Concrete containments are divided into two elements: concrete and steel; and Mark III Steel containments are divided into two elements: steel and concrete.

System Interfaces

Functional interfaces include the primary containment HVAC system (VII.F3), containment isolation system (V.C), containment spray system (V.A), and containment heat removal system (V.E). Physical interfaces exist with any structure, system, or component that either penetrates the containment wall, such as the main steam system (VIII.B2) and feedwater systems (VIII.D2), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

B BWR Containments

B3 Mark III Containments

B3.		ntainments	•	_	–		l
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B3.1.1	Steel Elements	Contain- ment Shell; Suppres- sion Chamber Shell; Basemat Liner; Liner Anchors	Carbon Steel	Inside or Outside Contain- ment	Loss of Material	Corrosion	10 CFR 50.55a ASME, Sect. XI, Subsection IWE
							10 CFR Part 50, Appendix J

B BWR Containments

B3 Mark III Containments

Aging Management Program		Further
(AMP)	Evaluation and Technical Basis	Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE	See Chapter XI.S1 for evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.
10 CFR Part 50, Appendix J (Containment Leak Rate Tests)	See Chapter XI.S4 for evaluation of 10 CFR Part 50, Appendix J	No
Protective Coating Monitoring and Maintenance Program	See Chapter XI.S8 for evaluation of Protective Coating Monitoring and Maintenance Program.	No

B BWR Containments

B3 Mark III Containments

B 3.		ontainments					
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B3.1.1	Steel Elements	Suppres- sion Chamber Shell (Interior Surface)	Stainless Steel	Inside or Outside Contain- ment	Crack Initiation and Growth	Stress Corrosion Cracking	10 CFR 50.55a ASME, Sect. XI Subsection IWE 10 CFR Part 50, Appendix J
B3.1.2	Concrete Elements	Basemat	Concrete	Outside Contain- ment	Increase in Porosity, Permea- bility	Leaching of Calcium Hydroxide	10 CFR 50.55a ASME, Sect. XI Subsection IWL

B BWR Containments

B3 Mark III Containments

Aging Management Program		Further
(AMP)	Evaluation and Technical Basis	Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J.	No
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.

B BWR Containments

B3 Mark III Containments

B3.	Structure/C	Region of		Environ-	Aging Effect	Aging	
Item	omponent	Interest	Material	ment	Aging Ellect	Mechanism	References
B3.1.2	Concrete Elements	Basemat	Concrete	Inside or Outside Contain- ment	Increase in Porosity and Permea- bility, Cracking, Loss of Material (spalling, scaling)	Aggressive Chemical Attack	10 CFR 50.55a ASME, Sect. XI Subsection IWL
B3.1.2	Concrete Elements	Basemat; Concrete Fill in Annulus	Concrete	Inside or Outside Contain- ment	Expansion & Cracking	Reaction with Aggregates	10 CFR 50.55a ASME, Sect. XI Subsection IWL
B3.1.2	Concrete Elements	Basemat and Reinforcing Steel	Concrete; Carbon Steel	Inside or Outside Contain- ment	Cracking, Loss of Bond, and Loss of Material (spalling, scaling)	Corrosion of Embedded Steel	10 CFR 50.55a ASME, Sect. XI Subsection IWL

B BWR Containments

B3 Mark III Containments

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL	No.
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.

B BWR Containments

B3 Mark III Containments

B3.	-	ntainments		—			1
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B3.1.2	Concrete Elements	Basemat	Concrete	Inside or Outside Contain- ment	Cracks; Distortion; Increase in Compo- nent Stress Level	Settlement	10 CFR 50.55a ASME, Sect. XI Subsection IWL ACI 349.3R-96
B3.1.2	Concrete Elements	Foundation	Concrete	Flowing Water Under Foundation	Reduction in Founda- tion Strength	Erosion of Porous Concrete Subfounda- tion	NRC IN 97-11 NRC IN 98-26
B3.1.2	Concrete Elements	Basemat; Concrete Fill in Annulus	Concrete	Inside or Outside Containment	Loss of Strength and Modulus	Elevated Tempera- ture (>150°F general; >200°F local)	10 CFR 50.55a ASME, Sect. XI Subsection IWL

B BWR Containments

B3 Mark III Containments

Aging Management Program		Further
(AMP) Plant-Specific Program	Evaluation and Technical Basis The initial Licensing Basis for some plants included a	Evaluation Yes.
1 U	program to monitor settlement. If no settlement was evident during the first decade or so, the NRC may have given the licensee approval to discontinue the program. However, if a de-watering system is relied upon for control of settlement, then the licensee needs to ensure proper functioning of the de-watering system through the period of extended operation.	If applicable.
Plant-Specific Program	Erosion of cement from porous concrete subfoundations beneath containment basemats is described in IN 97-11. IN	Yes.
	98-26 proposes Maintenance Rule Structures Monitoring for managing this aging effect, if applicable. See Chapter XI.S6 for evaluation of Structures Monitoring Program.	If applicable.
	If a de-watering system is relied upon for control of erosion of cement from porous concrete subfoundations, then the licensee needs to ensure proper functioning of the de- watering system through the period of extended operation.	
		V
Plant-Specific Program	The implementation of 10 CFR 50.55a and IWL would not be able to identify the loss of strength and modulus due to elevated temperature. Thus, for any portions of concrete containment that exceed specified temperature limits, further evaluations are warranted. Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long- term period. The temperatures shall not exceed 150 °F except for local areas, such as around penetrations, which are not allowed to exceed 200 °F.	Yes. If applicable.

B BWR Containments

B3 Mark III Containments **B3.2** Concrete Containments

B 3.	.~ concret	<u>e Containm</u>	ents				
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Outside Contain- ment	Loss of Material (spalling, scaling) and Cracking	Freeze/ Thaw	10 CFR50.55a ASME, Sect. XI, Subsection IWL
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Outside Contain- ment	Increase in Porosity, Permea- bility	Leaching of Calcium Hydroxide	10 CFR50.55a ASME, Sect. XI, Subsection IWL
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Inside or Outside Contain- ment	Increase in Porosity and Permea- bility, Cracking, Loss of Material (spalling, scaling)	Aggressive Chemical Attack	10 CFR50.55a ASME, Sect. XI, Subsection IWL

B BWR Containments

B3 Mark III Containments

B3.2 Concrete Containments

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL	No
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.

B BWR Containments

B3 Mark III ContainmentsB3.2 Concrete Containments

	B3.2 Concrete Containments							
	Structure/C	Region of		Environ-	Aging Effect	Aging		
Item	omponent	Interest	Material	ment		Mechanism	References	
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Inside or Outside Contain- ment	Expansion & Cracking	Reaction with Aggregates	10 CFR50.55a ASME, Sect. XI, Subsection IWL	
B3.2.1	Concrete Elements	Dome, Wall, Basemat, Reinforcing Steel	Concrete; Carbon Steel	Inside or Outside Contain- ment	Cracking, Loss of Bond, and Loss of Material (spalling, scaling)	Corrosion of Embedded Steel	10 CFR50.55a ASME, Sect. XI, Subsection IWL	

B BWR Containments

B3 Mark III Containments

B3.2 Concrete Containments

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL	No.
10 CFR 50.55a/ASME Section XI, Subsection IWL	See Chapter XI.S2 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWL, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.

B BWR Containments

B3 Mark III ContainmentsB3.2 Concrete Containments

τ.	Structure/C	Region of	N6 / 13	Environ-	Aging Effect	Aging	Dí
Item B3.2.1	omponent Concrete Elements	All	Material Concrete	ment Inside or Outside Contain- ment	Cracks; Distortion; Increase in Compo- nent Stress Level	Mechanism Settlement	References 10 CFR50.55a ASME, Sect. XI, Subsection IWL ACI 349.3R-96
B3.2.1	Concrete Elements	Foundation	Concrete	Flowing Water Under Foundation	Reduction in Founda- tion Strength	Erosion of Porous Concrete Subfounda- tion	NRC IN 97-11 NRC IN 98-26
B3.2.1	Concrete Elements	Dome, Wall, Basemat	Concrete	Inside or Outside Contain- ment	Loss of Strength and Modulus	Elevated Tempera- ture (>150°F general; >200°F local)	10 CFR50.55a ASME, Sect. XI, Subsection IWL

B BWR Containments

B3 Mark III Containments

B3.2 Concrete Containments

Aging Management Program	Evaluation and Technical Resis	Further Evaluation
(AMP) Plant-Specific Program	Evaluation and Technical Basis The initial Licensing Basis for some plants included a program to monitor settlement. If no settlement was	Evaluation Yes.
	evident during the first decade or so, the NRC may have given the licensee approval to discontinue the program. However, if a de-watering system is relied upon for control of settlement, then the licensee needs to ensure proper functioning of the de-watering system through the period of extended operation.	If applicable
Plant-Specific Program	Erosion of cement from porous concrete subfoundations beneath containment basemats is described in IN 97-11. IN 98-26 proposes Maintenance Rule Structures Monitoring for managing this aging effect, if applicable. See Chapter XI.S6 for evaluation of Structures Monitoring Program. If a de-watering system is relied upon for control of erosion of cement from porous concrete subfoundations, then the licensee needs to ensure proper functioning of the de- watering system through the period of extended operation.	Yes. If applicable
Plant-Specific Program	The implementation of 10 CFR 50.55a and IWL would not be able to identify the loss of strength and modulus due to elevated temperature. Thus, for any portions of concrete containment that exceed specified temperature limits, further evaluations are warranted. Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long- term period. The temperatures shall not exceed 150 °F except for local areas, such as around penetrations, which are not allowed to exceed 200 °F.	Yes. If applicable

B BWR Containments

B3 Mark III ContainmentsB3.2 Concrete Containments

Itom	Structure/C	Region of	Motori-1	Environ-	Aging Effect	Aging Machanism	Defense
Item	omponent	Interest	Material	ment Inside or	T C	Mechanism	References
B3.2.2	Steel Elements	Contain- ment Liner, Suppres- sion Chamber Liner, Basemat Liner, Liner	Carbon Steel	Outside of Outside Contain- ment	Loss of Material	Corrosion	10 CFR50.55a ASME, Sect. XI, Subsection IWE
		Anchors					
							10 CFR Part 50, Appendix J

B BWR Containments

B3 Mark III Containments

B3.2 Concrete Containments

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ASME Section XI, Subsection IWE	See Chapter XI.S1 for evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE, except for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in degradation to such inaccessible areas.	Yes. Evaluate plant- specific program for inaccessible areas when conditions in accessible areas may not indicate the presence of or result in
		degradation to such inaccessible areas.
10 CFR Part 50, Appendix J (Containment Leak Rate Tests)	See Chapter XI.S4 for evaluation of 10 CFR Part 50, Appendix J	No
Protective Coating Monitoring and Maintenance Program	See Chapter XI.S8 for evaluation of Protective Coating Monitoring and Maintenance Program.	

B BWR Containments

B3 Mark III ContainmentsB3.2 Concrete Containments

	Structure/C	Region of		Environ-	Aging Effect	Aging	
Item	omponent	Interest	Material	ment		Mechanism	References
33.2.2	Steel	Suppres-	Stainless	Inside or	Crack	Stress	10 CFR50.55a
	Elements	sion	Steel	Outside	Initiation	Corrosion	ASME, Sect. XI,
		Chamber		Contain-	and Growth	Cracking	Subsection IWE
		Liner		ment		8	10 CFR Part 50,
		(Interior		mome			Appendix J
		Surface)					Appendix 5
		Sunace)					
							1

B BWR Containments

B3 Mark III Containments

B3.2 Concrete Containments

Aging Management Program		Further
(AMP) 10 CFR 50.55a/ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	Evaluation and Technical Basis See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J.	Evaluation No

B4. Common Components

- B4.1 Penetration Sleeves, Penetration Bellows, Dissimilar Metal Welds
- B4.2 Personnel Airlock, Equipment Hatch, Control Rod Drive (CRD) Hatch
- B4.3 Seals, Gaskets, and Moisture Barriers

II B4-2

B4. Common Components

Systems, Structures, and Components

Review Table II B addresses the elements of BWR containment structures. Mark I containments, Mark II containments, and common components are discussed separately under subheadings B1, B2, B3, and B4, respectively. Common components in Review Table II B4 include penetation sleeves and bellows; dissimilar metal welds; personnel airlock; equipment hatch; CRD hatch; seals, gaskets, and moisture barriers.

System Interfaces

Functional interfaces include the primary containment HVAC system (VII.F3), containment isolation system (V.C), containment spray system (V.A), and containment heat removal system (V.E). Physical interfaces exist with any structure, system, or component that either penetrates the containment wall, such as the main steam system (VIII.B2) and feedwater systems (VIII.D2), or is supported by the containment structure. The containment structure basemat may provide support to the NSSS components and containment internal structures.

B BWR ContainmentsB4 Common Components

B4		n Compone	iits				
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
B4.1	omponent Penetration Sleeves	All	Material Carbon Steel, Dissimilar Metal Welds	ment Inside or Outside Contain- ment	Loss of Material	Corrosion	References 10 CFR50.55a ASME, Sect. XI, Subsection IWE
							10 CFR Part 50, Appendix J

B BWR Containments

B4 Common Components

B4 Common Components		<u> </u>
Aging Management Program		Further
(AMP)	Evaluation and Technical Basis	Evaluation
10 CFR 50.55a/ASME Section XI,	See Chapter XI.S1 for evaluation of 10 CFR 50.55a/ASME	No
Subsection IWE	Section XI, Subsection IWE.	
10 CFR Part 50, Appendix J (Containment	See Chapter XI.S4 for evaluation of 10 CFR Part 50,	No
Leak Rate Tests)	Appendix J	
Protective Coating Monitoring and	See Chapter XI.S8 for evaluation of Protective Coating	No
Maintenance Program	Monitoring and Maintenance Program.	110

B BWR ContainmentsB4 Common Components

<u>B4</u>	Commo	n Compone	nts		-		
	Structure/C	Region of		Environ-	Aging Effect	Aging	5.0
Item	omponent	Interest	Material	ment		Mechanism	References
B4.1	Penetration	All	Carbon	Inside or	Cumulative	Fatigue	Design Code of
	Sleeves,		Steel,	Outside	Fatigue		Record
	Penetration		Stainless	Contain-	Damage		
	Bellows		Steel,	ment	0		
			Dissimilar				
			Metal Welds				
			weius				
B4.1	Penetration	All	Stainless	Inside or	Crack	Stress	10 CFR 50.55a
	Sleeves,		Steel and	Outside	Initiation	Corrosion	ASME, Sect. XI,
	Penetration		Dissimilar	Contain-	and Growth	Cracking,	Subsection IWE
	Bellows		Metal Welds	ment		Cyclic	10 CFR Part 50,
	Denows		metal welab	mem		Loading	Appendix J
						Loaung	
							NRC IN 92-20
					1		1

II CONTAINMENT STRUCTURES B BWR Containments

B4 Common Components

B4 Common Components		
Aging Management Program		Further
(AMP)	Evaluation and Technical Basis	Evaluation
Components have been designed or evaluated for fatigue for a 40 year design life based on postulated cycles, according to the requirements of the code of record or later approved codes.	Fatigue is a time-limited aging analysis (TLAA) to be performed for the period of license renewal. See the Standard Review Plan, Section 4.6, "Containment Liner Plate and Penetration Fatigue Analysis" for acceptable methods for meeting the requirements of 10CFR54.21(c).	Yes, TLAA
10 CFR 50.55a/ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE and Chapter XI.S4 for an evaluation of 10 CFR Part 50, Appendix J. Evaluation of 10 CFR 50.55a/IWE is augmented as follows:	Yes, Applicant's program to address Attribute (4) needs to be
	(4) Detection of Aging Effects:	evaluated
	 (r) Detection of Aging Linects. Stress corrosion cracking (SCC) is a concern for dissimilar metal welds. In the case of bellows assemblies, SCC may cause aging effects particularly if the material is not shielded from a corrosive environment. Subsection IWE covers inspection of these items under examination categories E-B, E-F, and E-P (10 CFR Part 50, Appendix J pressure tests). 10 CFR 50.55a identifies examination categories E-B and E-F as optional during the current term of operation. For the extended period of operation, Examination Categories E-B & E-F, and augmented VT-1 visual examination of bellows assemblies and dissimilar welds are warranted to address this issue. For cracking due to cyclic loading of penetration sleeves and penetration bellows, VT-3 visual inspection may not detect fine cracks (one option may be to perform VT-1 visual inspections). (10) Operating Experience: IN 92-20 describes an instance of containment bellows cracking, resulting in loss of leak tightness. 	

B **BWR Containments B4 Common Components**

B4		n Compone	nts				
Item	Structure/C omponent	Region of Interest	Material	Environ- ment	Aging Effect	Aging Mechanism	References
Item B4.2			Material Carbon Steel	Environ- ment Inside or Outside Contain- ment	Aging Effect Loss of Material	Aging Mechanism Corrosion	References 10 CFR 50.55a ASME, Sect. XI, Subsection IWE 10 CFR Part 50, Appendix J

B BWR Containments

B4 Common Components

b4 Common Components		
Aging Management Program	Evolution and Taskairal David	Further
(AMP) 10 CFR 50.55a/ASME Section XI,	Evaluation and Technical Basis	Evaluation No
Subsection IWE	See Chapter XI.S1 for evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE.	INO
Subsection IWE	Section AI, Subsection IWE.	
10 CFR Part 50, Appendix J (Containment	See Chapter XI.S4 for evaluation of 10 CFR Part 50,	No
Leak Rate Tests)	Appendix J	
		N.T.
Protective Coating Monitoring and	See Chapter XI.S8 for evaluation of Protective Coating	No
Maintenance Program	Monitoring and Maintenance Program.	
		1

B BWR ContainmentsB4 Common Components

B4		n Compone	nts				
	Structure/C	Region of		Environ-	Aging Effect	Aging	5.0
Item B4.2	omponent Personnel	Interest All	Material Carbon	ment Inside or	Fretting or	Mechanism Mechanical	References 10 CFR 50.55a
B4.2	Airlock; Equipment Hatch; CRD Hatch	All	Steel	Inside or Outside Contain- ment	Lockup	Mechanical Wear of Locks/ Hinges and Closure Mechanisms	ASME, Sect. XI, Subsection IWE
B4.3	Seals, Gaskets, & Moisture Barriers (caulking, flashing, and other sealants)	All	Various	Inside or Outside Contain- ment	Loss of Sealing; Leakage Through Contain- ment	Deteriora- tion of Seals, Gaskets, & Moisture Barriers (caulking, flashing, and other sealants)	10 CFR 50.55a ASME, Sect. XI, Subsection IWE 10 CFR Part 50, Appendix J

B BWR Containments

B4 Common Components

Aging Management Program (AMP)	Evaluation and Technical Basis	Further Evaluation
10 CFR 50.55a/ ASME Section XI, Subsection IWE	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ ASME Section XI, Subsection IWE	No.
10 CFR 50.55a/ ASME Section XI, Subsection IWE	See Chapter XI.S1 for an evaluation of 10 CFR 50.55a/ASME Section XI, Subsection IWE Leak tightness will be monitored by 10 CFR Part 50, Appendix J Leak Rate Tests for pressure boundary, seals and gaskets (including O-rings).	No.

II B4-12

- American Concrete Institute, ACI 349.3R-96, *Evaluation of Existing Nuclear Safety-Related Concrete Structures*, March 1996.
- American Society of Mechanical Engineers, ASME Section III, Rules for Construction of Nuclear Power Plant Components, Division 2, Code for Concrete Reactor Vessels and Containments, 1992 Edition with 1992 Addenda or later edition, as approved in 10 CFR 50.55a, The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.
- American Society of Mechanical Engineers, ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, Subsection IWE, Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Power Plants, 1992 Edition with 1992
 Addenda or later edition, as approved in 10 CFR 50.55a, The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.
- American Society of Mechanical Engineers, ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, Subsection IWL, Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants, 1992 Edition with 1992 Addenda or later edition, as approved in 10 CFR 50.55a, The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.
- Code of Federal Regulations: 10 CFR Part 50, Appendix J, Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors, 2000.
- Code of Federal Regulations: 10 CFR 50.55a, Codes and Standards, 2000.
- NRC Information Notice 92-20, Inadequate Local Leak Rate Testing, March 3, 1992.
- NRC Information Notice 97-10, Liner Plate Corrosion in Concrete Containment, March 13, 1997.
- NRC Information Notice 97-11, Cement Erosion from Containment Subfoundations at Nuclear Power Plants, March 21, 1997.
- NRC Information Notice 98-26, Settlement Monitoring and Inspection of Plant Structures Affected by Degradation of Porous Concrete Subfoundations, July 24, 1998.
- NRC Information Notice 99-10, Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments, April 13, 1999.
- NRC Regulatory Guide 1.35.1, Determining Prestressing Forces for Inspection of Prestressed Concrete Containments, July 1990.

- NUREG-1522, Assessment of Inservice Conditions of Safety-Related Nuclear Power Plant Structures, June 1995.
- NUREG-1611, Aging Management of Nuclear Power Plant Containments for License Renewal, September 1997.