LICENSE RENEWAL APPLICATION

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 AND 3

DOCKET Nos. 50-277 AND 50-278

July 2001

SECTION 1.0 ADMINISTRATIVE INFORMATION

1.0 ADMINISTRATIVE INFORMATION

1.1 GENERAL INFORMATION - 10 CFR 54.19

1.1.1 Names of Applicant and Co-Owners

Exelon Generation Company, LLC hereby applies for renewed operating licenses for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. Exelon Generation Company, LLC submits this application individually and as agent for the co-owner licensees named on the operating license. The co-owner licensees are:

- PSEG Nuclear LLC
- Atlantic City Electric Company

1.1.2 Addresses of Applicant and Co-Owners

Exelon Generation Company, LLC
200 Exelon Way
Kennett Square, PA 19348

PSEG Nuclear LLC
80 Park Plaza
Newark, NJ 07102

Atlantic City Electric Company
800 King Street
P.O. Box 231
Wilmington, DE 19899-0231

1.1.3 Descriptions of Business or Occupation of Applicant and Co-Owners

Exelon Generation Company, LLC is a limited liability company formed to own, operate, and acquire nuclear and other electric generating stations; to engage in the sale of electrical energy; and to perform other business activities. Exelon

Generation Company, LLC is a wholly-owned corporate subsidiary of Exelon Ventures Company, which in turn is wholly owned by Exelon Corporation, a corporation formed under the laws of the Commonwealth of Pennsylvania. Exelon Generation Company, LLC is the exclusive licensed operator of PBAPS Units 2 and 3, which is the subject of this application. The current Unit 2 license (Facility Operating License No. DPR-44) expires on August 8, 2013, and the current Unit 3 license (Facility Operating License No. DPR-56) expires on July 2, 2014. Exelon Generation Company, LLC will be named as the exclusive licensed operator on the renewed operating licenses.

PSEG Nuclear LLC is engaged principally in the nuclear generation of electricity as an exempt wholesale generator, authorized to sell electricity at market-based rates. PSEG Nuclear LLC is the licensed operator of the Salem Nuclear Generating Station and the Hope Creek Nuclear Generating Station in the State of New Jersey. PSEG Nuclear is also a co-owner and licensee of the Peach Bottom Atomic Power Station in the Commonwealth of Pennsylvania, and will be named as a co-owner licensee on the renewed operating licenses.

Atlantic City Electric Company (ACE) is engaged in the generation and transmission of electricity and the distribution and sale of such electricity within the State of New Jersey. ACE serves approximately 500,000 customers. ACE has rated capability in excess of 1718 MW and currently provides retail electric service in the southern third of New Jersey. ACE is a co-owner and licensee of Peach Bottom Units 2 and 3 and will be named as a co-owner licensee on the renewal licenses.

1.1.4 Descriptions of Organization and Management of Applicant and Co-Owners

Exelon Generation Company, LLC

Exelon Generation Company, LLC is organized under the laws of the Commonwealth of Pennsylvania. Exelon Generation Company, LLC's principal place of business will be in the Commonwealth of Pennsylvania.

Exelon Ventures Company and Exelon Corporation are corporations organized under the laws of the Commonwealth of Pennsylvania with their headquarters and principal places of business in Chicago. Exelon Corporation is a publicly-traded corporation whose shares are widely traded on the New York Stock Exchange. Exelon Ventures Company is a wholly-owned subsidiary of Exelon Corporation. All of the directors, management committee members, and principal officers of Exelon Generation Company, LLC, Exelon Ventures Company, and Exelon Corporation are U.S. citizens. Neither Exelon Generation Company, LLC nor its parents, Exelon Ventures Company or Exelon

Corporation, are owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

The principal officers of Exelon Generation Company, LLC, and their addresses, are presented below:

Principal Officers (Exelon Generation Company, LLC)		
Name	**Title**	**Address**
Corbin A. McNeill, Jr.	Chief Executive Officer and President	300 Exelon Way Kennett Square, PA 19348
Oliver D. Kingsley, Jr.	President and Chief Nuclear Officer, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
John L. Skolds,	Sr. Vice President and Chief Operating Officer, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
William H. Bohlke	Sr. Vice President, Nuclear Services, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
John B. Cotton	Sr. Vice President, Nuclear Operations Support, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Christopher M. Crane	Sr. Vice President, MidWest Regional Operating Group, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Joseph J. Hagan	Sr. Vice President, MidAtlantic Regional Operating Group, Exelon Nuclear	200 Exelon Way Kennett Square, PA 19348
Christine A. Jacobs	President, Exelon Power	200 Exelon Way Kennett Square, PA 19348
Ian P. McLean	President, Exelon Power Team	300 Exelon Way Kennett Square, PA 19348
David W. Woods	Sr. Vice President, Communications & Public Affairs	300 Exelon Way Kennett Square, PA 19348
Jeffrey A. Benjamin	Vice President, Licensing and Regulatory Affairs, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Bruce C. Williams	Vice President, Nuclear Oversight, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Kenneth W. Cornew	Vice President, Long-Term Transactions, Exelon Power Team	300 Exelon Way Kennett Square, PA 19348
Edward J. Cullen, Jr.	Vice President, General Counsel and Secretary	300 Exelon Way Kennett Square, PA 19348

Principal Officers (Exelon Generation Company, LLC)		
Name	**Title**	**Address**
Michael Erdlen	Vice President, Information Technology, Exelon Power Team	300 Exelon Way Kennett Square, PA 19348
Jan H. Freeman	Vice President, Public Affairs, Exelon Generation	300 Exelon Way Kennett Square, PA 19348
James D. Guerra	Vice President, Business Operations, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Susan O. Ivey	Vice President, Short-Term Transactions, Exelon Power Team	300 Exelon Way Kennett Square, PA 19348
Theodore E. Jennings	Vice President, Supply & Project Management, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Marilyn C. Kray	Vice President, Acquisition Support and Integration, Exelon Nuclear	200 Exelon Way Kennett Square, PA 19348
Richard J. Landy	Vice President, Human Resources & Administration, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Charles P. Lewis	Vice President, Strategy & Development, Exelon Generation	300 Exelon Way Kennett Square, PA 19348
James P. Malone	Vice President, Nuclear Fuel Management, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Cornelius J. McDermott	Vice President, Communications, Exelon Generation	300 Exelon Way Kennett Square, PA 19348
James R. Meister	Vice President, Engineering, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Michael Metzner	Vice President, Finance/Analytics/Risk, Exelon Power Team	300 Exelon Way Kennett Square, PA 19348
James A. Muntz	Vice President, Special Projects, Exelon Generation	200 Exelon Way Kennett Square, PA 19348
John L. Settelen	Vice President and Controller, Exelon Generation	300 Exelon Way Kennett Square, PA 19348
H. Gene Stanley	Vice President, MidWest Operations, Exelon Nuclear	4300 Winfield Road Warrenville, IL 60555
Timothy Tulon	Site Vice President - Quad Cities Nuclear Power Station	Quad Cities Nuclear Power Station 22710 206th Avenue North Cordova, IL 61242

Principal Officers (Exelon Generation Company, LLC)		
Name	**Title**	**Address**
John Doering, Jr.	Site Vice President - Peach Bottom Atomic Power Station	Peach Bottom Atomic Power Station 1848 Lay Road Delta, PA 17314
Richard LoPriore	Site Vice President – Byron Station	Byron Station 4450 North German Church Road Byron, IL 61010
Charles G. Pardee	Site Vice President – LaSalle County Station	LaSalle County Station 2601 North 21st Road Marseilles, IL 61341
Preston D. Swafford	Site Vice President – Dresden Nuclear Power Station	Dresden Nuclear Power Station 6500 North Dresden Road Morris, IL 60450
James D. von Suskil	Site Vice President – Braidwood Station	Braidwood Station 35100 South Rte 53 (Suite 84) Braceville, IL 60407
William Levis	Site Vice President - Limerick Generating Station	Limerick Generating Station Evergreen & Sanatoga Roads Pottstown, PA 19464
Mark E. Warner	Site Vice President – Three Mile Island	Three Mile Island Route 441 South P. O. Box 480 Middletown, PA 17057
Ronald J. DeGregorio	Site Vice President – Oyster Creek	Oyster Creek Route 9 South P. O. Box 388 Forked River, NJ 08731-0388
J. Michael Heffley	Site Vice President – Clinton Power Station	Clinton Power Station P. O. Box 678 Clinton, IL 61726
Robert E. Berdelle	Vice President, Generation	One Financial Place 440 S. LaSalle Street, Suite 3300 Chicago, IL
Robert K. McDonald	Vice President, Generation	Bank One Building 10 S. Dearborn St, 37th Floor Chicago, IL 60647
Steven L. Spencer	Vice President, Business Services, Financial Services	AT&T Building, Room 1055 P. O. Box 805379 Chicago, IL 60680
J. Barry Mitchell	Vice President and Treasurer	10 S. Dearborn St., 37th Floor Chicago, IL 60603
George R. Shicora	Assistant Treasurer	2301 Market Street Philadelphia, PA 19101
Charles S. Walls	Assistant Treasurer	10 S. Dearborn St., 36th Floor Chicago, IL 60603
Todd D. Cutler	Assistant Secretary	2301 Market Street Philadelphia, PA 19101
Scott N. Peters	Assistant Secretary	10 S. Dearborn St., 38th Floor Chicago, IL 60603

PSEG Nuclear LLC

PSEG Nuclear LLC is a limited liability company organized under the laws of the State of Delaware. PSEG Nuclear LLC is a wholly-owned subsidiary of PSEG Power, which is a wholly-owned subsidiary of Public Service Enterprise Group, Inc., with its principal office in Newark, New Jersey.

The names and business addresses of PSEG Nuclear LLC's directors and principal officers, all of whom are citizens of the United States, are as follows:

PSEG Nuclear LLC	
Director	**Address**
Frank Cassidy	80 Park Plaza Newark, New Jersey 07102
Harold W. Keiser	P. O. Box 236 Hancocks Bridge, New Jersey 08308
Thomas R. Smith	80 Park Plaza Newark, New Jersey 07102
Steven R. Teitelman	80 Park Plaza Newark, New Jersey 07102

The principal officers of PSEG Nuclear LLC, and their addresses, are presented below:

Principal Officers (PSEG Nuclear LLC)		
Name	**Title**	**Address**
Harold W. Keiser	President and Chief Nuclear Officer (CNO)	P. O. Box 236 Hancocks Bridge, New Jersey 08308
Elbert C. Simpson	Senior Vice President and Chief Administrative Officer	P. O. Box 236 Hancocks Bridge, New Jersey 08308
Mark B. Bezilla	Vice President - Technical Support	P. O. Box 236 Hancocks Bridge, New Jersey 08308
Harold W. Borden, Jr.	Vice President	80 Park Plaza Newark, New Jersey 07102
David F. Garchow	Vice President - Operations	P. O. Box 236 Hancocks Bridge, New Jersey 08308
Timothy J. O'Connor	Vice President - Nuclear Plant Support and Maintenance	P. O. Box 236 Hancocks Bridge, New Jersey 08308
Martin J. Trum	Vice President - Nuclear Reliability	P. O. Box 236 Hancocks Bridge, New Jersey 08308

Principal Officers (PSEG Nuclear LLC)		
Name	**Title**	**Address**
Morton A. Plawner	Treasurer	80 Park Plaza Newark, New Jersey 07102
Ardeshir Rostami	Assistant Treasurer	80 Park Plaza Newark, New Jersey 07102
Fred F. Saunders	Assistant Treasurer	80 Park Plaza Newark, New Jersey 07102
Edward J. Biggins, Jr.	Secretary	80 Park Plaza Newark, New Jersey 07102
Patrick M. Burke	Assistant Secretary	80 Park Plaza Newark, New Jersey 07102

PSEG Nuclear, PSEG Power and Public Service Enterprise Group, Inc. are neither owned, controlled, nor dominated by an alien, foreign corporation or foreign government.

Atlantic City Electric Company

Atlantic City Electric Company (ACE) is a New Jersey corporation with its principal office in Wilmington, Delaware. It is a wholly-owned subsidiary of Conectiv, a company registered under the Public Utility Holding Company Act of 1935, having its principal place of business in Wilmington, Delaware. Other direct subsidiaries of Conectiv include: Delmarva Power & Light Company, Conectiv Properties and Investments, Inc., Conectiv Solutions LLC, Atlantic Generation, Inc., Conectiv Communications, Inc., Conectiv Resource Partners, Inc., Conectiv Mid-Merit, Inc., Atlantic Southern Properties, Inc., Enerval, L.L.C. and Conectiv Energy Holding Company. Atlantic City Electric Company's direct subsidiaries are Atlantic Capital I and Atlantic Capital II.

Neither ACE nor its parent, Conectiv, is owned, controlled or dominated by an alien, a foreign corporation, or a foreign government.

The names and business addresses of ACE's directors, all of whom are citizens of the United States, are as follows:

Atlantic City Electric	
Director	**Address**
Howard E. Cosgrove	800 King Street Wilmington, DE 19801
Thomas S. Shaw	800 King Street Wilmington, DE 19801
Barbara S. Graham	800 King Street Wilmington, DE 19801
John C. van Roden, Jr.	800 King Street Wilmington, DE 19801

The names and business addresses of ACE's principal officers, all of whom are citizens of the United States, are as follows:

Principal Officers (Atlantic City Electric)		
Name	**Title**	**Address**
Joseph M. Rigby	President	800 King Street Wilmington, DE 19801
John C. van Roden, Jr.	CFO	800 King Street Wilmington, DE 19801
Robert H. Fiedler	Vice President,	800 King Street Wilmington, DE 19801
Skip M. Castaldi	Vice President	800 King Street Wilmington, DE 19801
Lonnie C. Scott	Vice President	800 King Street Wilmington, DE 19801
James C. Weller	Vice President	800 King Street Wilmington, DE 19801
John W. Land	Vice President	800 King Street Wilmington, DE 19801
Philip S. Reese	Vice President and Treasurer	800 King Street Wilmington, DE 19801
Donna Kinzel	Assistant Treasurer	800 King Street Wilmington, DE 19801
Peter F. Clark	Secretary and General Counsel	800 King Street Wilmington, DE 19801
Nina J. Clements	Assistant Secretary	800 King Street Wilmington, DE 19801
Diana C. DeAngelis	Assistant Secretary	800 King Street Wilmington, DE 19801
James P. Lavin	Controller	800 King Street Wilmington, DE 19801

1.1.5 Class of License, Use of the Facility, and Period of Time for Which the License Is Sought

Exelon Generation Company, LLC requests renewal of the Class 104 operating licenses for PBAPS Units 2 and 3 (License Nos. DPR-44 and DPR-56) for a period of 20 years beyond the expiration of the current licenses, midnight on August 8, 2013 for Unit 2 and midnight on July 2, 2014 for Unit 3.

Because the current licensing basis is carried forward with the possible exception of some aging issues, Exelon Generation Company, LLC expects the form and content of the licenses to be generally the same as they now exist. Exelon Generation Company, LLC, thus, also requires similar extensions of specific licenses under 10 CFR Parts 30, 40, and 70 that are contained in the current operating licenses.

1.1.6 Earliest and Latest Dates for Alterations, If Proposed

No physical plant alterations or modifications have been identified as necessary in order to implement the provisions of the application.

1.1.7 Restricted Data

With regard to the requirements of 10 CFR 54.17(f), this application does not contain any “Restricted Data,” as that term is defined in the Atomic Energy Act of 1954, as amended, or other defense information, and it is not expected that any such information will become involved in these licensed activities.

In accordance with the requirements of 10 CFR 54.17(g), the applicants will not permit any individual to have access to, or any facility to possess restricted data or classified national security information until the individual and/or facility has been approved for such access under the provisions of 10 CFR Parts 25 and/or 95.

1.1.8 Regulatory Agencies

Exelon Generation Company, LLC recovers its share of the costs incurred from operating PBAPS Units 2 and 3 in its own wholesale rates, and recovers the remaining costs from PSEG Nuclear LLC and Atlantic City Electric Company in relation to their ownership interests in PBAPS Units 2 and 3. The rates charged and services provided by Exelon Generation Company, LLC are subject to regulation by the Federal Energy Regulatory Commission under the Federal Power Act. Exelon Generation Company, LLC is also subject to regulation as a public utility company by the Securities and Exchange Commission under the Public Utility Holding Company Act of 1935, as amended.

Securities and Exchange Commission
450 Fifth Street, NW
Washington, DC 20549

Federal Energy Regulatory Commission
888 First St. N.E.
Washington, DC 20426

1.1.9 Local News Publications

News publications in circulation near PBAPS that are considered appropriate to give reasonable notice of the application are as follows:

Lancaster Intelligencer
Lancaster Newspapers, Inc.
8 West King Street
P.O. Box 1328
Lancaster, PA 17608-1328
(717) 291-8811
Fax (717) 291-6507

Lancaster New Era
Lancaster Newspapers, Inc.
8 West King Street
P.O. Box 1328
Lancaster, PA 17608-1328
(717) 291-8733
Fax (717) 399-6506

York Daily Record
P.O. Box 15122
York, PA 17405-7122
(717) 771-2000
Fax (717) 771-2009

York Dispatch
205 North George Street
York, PA 17401-2807
(717) 854-1575
Fax (717) 843-2814

The Star
Main Street
Delta, PA 17314
(717) 456-5692

The Aegis
P. O. Box 189
Bel Air, MD 21014
(410) 838-4451
Fax (410) 838-2843

Cecil Whig
P. O. Box 429
Elkton, MD 21922-0429
(410) 398-3311
(410) 398-4044

Rising Sun Herald
P. O. Box 998
Rising Sun, MD 21911
(410) 658-5614
Fax (410) 658-2679

1.1.10 Conforming Changes To Standard Indemnity Agreement

10 CFR 54.19(b) requires that “each application must include conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license.” The current indemnity agreement for PBAPS states in Article VII that the agreement shall terminate at the time of expiration of the licenses specified in Item 3 of the Attachment to the agreement. Item 3 of the Attachment to the indemnity agreement, lists two license numbers, DPR-44 and DPR-56. Applicant requests that any necessary conforming changes be made to Article VII and Item 3 of the Attachment, and any other sections of the indemnity agreement as appropriate to ensure that the indemnity agreement continues to apply during both the terms of the current licenses and the terms of the renewed licenses. Applicant understands that no changes may be necessary for this purpose if the current license numbers for PBAPS Units 2 and 3 are retained.

1.2 GENERAL LICENSE INFORMATION

1.2.1 Application Updates, Renewed Licenses, and Renewal Term Operation

In accordance with 10 CFR 54.21(b), during NRC review of this application, an annual update to the application to reflect any change to the current licensing basis that materially affects the contents of the license renewal application will be provided.

In accordance with 10 CFR 54.37(b), Exelon Generation Company, LLC will maintain a summary list in the PBAPS Units 2 and 3 Updated Final Safety Analysis Report (UFSAR) of activities that are required to manage the effects of aging for the systems, structures or components in the scope of license renewal during the period of extended operation and summaries of the time-limited aging analyses evaluations.

1.2.2 Incorporation By Reference

There are no documents incorporated by reference as part of the application. Any document references, either in text or in Section 1.7 are listed for information only.

1.2.3 Contact Information

Any notices, questions, or correspondence in connection with this filing should be directed to:

Mr. James A. Hutton
Director -Licensing
Exelon Corporation
200 Exelon Way
Kennett Square, PA 19348

with copies to:

Mr. Frederick W. Polaski
Manager License Renewal
Exelon Corporation
200 Exelon Way
Kennett Square, PA 19348

1.3 PURPOSE

This document provides information required by 10 CFR 54 to support the application for renewed licenses for PBAPS Units 2 and 3. The application contains technical information required by 10 CFR 54.21 and environmental information required by 10 CFR 54.23. The information contained herein is intended to provide the NRC with an adequate basis to make the finding required by 10 CFR 54.29.

1.4 DESCRIPTION OF THE PLANT

PBAPS is a two-unit boiling water reactor (BWR) located partly in Peach Bottom Township, York County, partly in Drumore Township, Lancaster County, and partly in Fulton Township, Lancaster County, in southeastern Pennsylvania on the westerly shore of Conowingo Pond at the mouth of Rock Run Creek. Conowingo Pond is formed by the backwater of Conowingo Dam on the Susquehanna River; the dam is located about 9 miles downstream from the Unit 2 reactor. The plant is about 38 miles north-northeast of Baltimore, Maryland, and 63 miles west-southwest of Philadelphia, Pennsylvania. The reactor buildings are separate for each unit. The turbine building, control room, radwaste building, and diesel generator building house equipment used by both units. PBAPS Units 2 and 3 are BWR/4's designed and supplied by General Electric with 251 inch vessels and 764 fuel assemblies. The primary containment of each unit is of the Mark I design that consists of a drywell, a suppression chamber in the shape of a torus, and a connecting vent system between the drywell and the suppression chamber. Each unit is authorized to operate at steady state reactor core power levels not in excess of 3458 megawatts thermal.

1.5 APPLICATION STRUCTURE

The application is structured in accordance with the recommendations of Draft Regulatory Guide DG 1104, “Standard Format and Content for Applications to Renew Nuclear Plant Operating Licenses,” and NEI 95-10, "Industry Guideline on Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule”, Revision 2.

As an aid to the reviewer, electronic versions of the application contain marked hypertext which provide links to the referenced sections.

The application is divided into the following major sections and appendices:

Section 1 – Administrative Information

This section provides the administrative information required by 10 CFR 54.17 and 10 CFR 54.19. It describes the plant and states the purpose for this application. Included in this section are the names, addresses, business descriptions, and organization and management descriptions of the applicant, as well as other administrative information. This section also provides an overview of the structure of the application, general references, and a listing of acronyms used throughout the application.

Section 2 – Structures and Components Subject To Aging Management Review

This section describes and justifies the methods used in the integrated plant assessment to identify those structures and components subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(2). These methods consist of: 1) scoping, which identifies the systems, structures, and components that are within the scope of 10 CFR 54.4(a), and 2) screening under 10 CFR 54.21(a)(1), which identifies those in-scope structures and components that perform their intended function without moving parts or a change in configuration or properties, and that are not subject to replacement based on a qualified life or specified time period.

Additionally, the results for systems and structures are described in this section. Scoping results are presented in Table 2.2-1 "Mechanical System Scoping Results", Table 2.2-2 "Structure Scoping Results", and Table 2.2-3 "Electrical and I&C System Scoping Results." Screening results are presented in Sections 2.3, 2.4, and 2.5.

The screening results consist of lists of components or component groups that require aging management review. Brief descriptions of mechanical systems and structures within the scope of license renewal are provided as background information. Mechanical system and structure intended functions are provided for in-scope systems and structures. For each in-scope system and structure, components or component groups requiring an aging management review are identified.

Selected structural and electrical component groups, such as component supports and cables, were evaluated as commodities. Under the commodity approach, selected structural and electrical component groups were evaluated based upon common environments and materials. For each of these commodities, the components or component groups requiring aging management are presented in Sections 2.4 and 2.5.

Section 3 – Aging Management Review Results

10 CFR 54.21 (a)(3) requires a demonstration that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation. Section 3 presents the results of the aging management reviews. Section 3 is the link between the scoping and screening results provided in Section 2 and the aging management activities provided in Appendix B. Aging management review results are presented in tabular form, and arranged by the system or structure associated with one or more intended functions. These tables identify the aging effects and the activities credited with managing the aging effects for component groups within the scope of license renewal.

Selected structural and electrical component groups such as component supports and cables were evaluated as commodities based upon common environments and materials. Aging management review results for these commodities are presented in Sections 3.5 and 3.6.

Section 4 – Time-Limited Aging Analyses

Time-limited aging analyses (TLAAs), as defined by 10 CFR 54.3, are listed in this section. This section includes each of the TLAAs identified in the NRC Standard Review Plan for License Renewal Applications and in plant specific analyses. This section includes a summary of the time-dependent aspects of the analyses. A demonstration is provided to show that the analyses remain valid for the period of extended operation, the analyses have been projected to the end of the period of extended operation, or the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Appendix A –Updated Final Safety Analysis Report Supplement

As required by 10 CFR 54.21(d), the Updated Final Safety Analysis Report (UFSAR) supplement contains a summary of activities credited for managing the effects of aging for the period of extended operation. In addition, summary descriptions of time-limited aging analyses evaluations are provided.

Appendix B – Aging Management Activities

Appendix B describes the program elements for all activities that are credited for managing aging effects for components or structures during the period of extended operation based upon the aging management review results provided in Section 3 and the time-limited aging analyses results provided in Section 4.

Appendix C – Commodity Groups (Optional)

Appendix C is not used.

Appendix D – Technical Specification Changes

This Appendix satisfies the requirement in 10 CFR 54.22 to identify technical specification changes or additions necessary to manage the effects of aging during the period of extended operation.

Appendix E – Environmental Information

This Appendix satisfies the requirements of 10 CFR 54.23 to provide a supplement to the environmental report that complies with the requirements of subpart A of 10 CFR Part 51.

1.6 ACRONYNMS

Acronym	Meaning
ADS	automatic depressurization system
AMR	aging management review
ARI	alternate rod insertion
ASME	American Society of Mechanical Engineers
ATWS	anticipated transients without scram
BWR	boiling water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CAC	containment atmosphere control (system)
CAD	containment atmospheric dilution (system)
CASS	cast austenitic stainless steel
CCW	closed cooling water
CFR	Code of Federal Regulations
CLB	current licensing basis
CRD	control rod drive
CRL	component record list
CST	condensate storage tank
CUF	cumulative usage factor
DBD	design baseline document
DBE	design-basis event
ECCS	emergency core cooling systems
ECT	emergency cooling tower
ECW	emergency cooling water (system)
EDG	emergency diesel generator
EFPY	effective full-power years
EPRI	Electric Power Research Institute
EQ	environmental qualification
ESF	engineered safety feature
ESW	emergency service water (system)
FAC	flow accelerated corrosion
FPP	Fire Protection Program
FSSD	fire safe shutdown
GL	Generic Letter
HELB	high energy line break

Acronym	Meaning
HEPA	high efficiency particulate air
HPCI	high pressure coolant injection (system)
HPSW	high pressure service water (system)
HVAC	heating, ventilation, and air conditioning
I & C	instrumentation and controls
IGSCC	intergranular stress corrosion cracking
IN	Information Notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISI	inservice inspection
IST	inservice testing
LER	licensee event report
LOCA	loss of coolant accident
LPCI	low pressure coolant injection (system)
LPRM	local power range monitor
LRA	license renewal application
MCC	motor control center
MIC	microbiologically influenced corrosion
MOV	motor-operated valve
MSIV	main steam isolation valve
NCR	non conformance report
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
OE	operating experience
P&ID	piping and instrumentation diagram
PBAPS	Peach Bottom Atomic Power Station
PCIS	primary containment isolation system
PM	preventive maintenance
P-T curves	pressure-temperature limit curves
PUA	plant-unique analyses
RAI	request for additional information
RBM	rod block monitor
RCIC	reactor core isolation cooling (system)
RCS	reactor coolant system
RHR	residual heat removal (system)

Acronym	Meaning
RMS	radiation monitoring system
RPS	reactor protection system
RPV	reactor pressure vessel
RT_{NDT}	nil-ductility transition reference temperature
RWM	rod worth minimizer
RWST	refueling water storage tank
SBLC	standby liquid control (system)
SBO	station blackout
SCC	stress corrosion cracking
SGIG	safety grade instrument gas (system)
SGTS	standby gas treatment system
SPOTMOS	suppression pool temperature monitoring system
SRM	source range monitor
SRV	safety relief valve
SSCs	systems, structures, and components
SV	safety valve
TID	total integrated dose
TLAAs	time-limited aging analyses
UFSAR	updated final safety analysis report
USE	upper-shelf energy
WRNM	wide range neutron monitor

1.7 GENERAL REFERENCES

1. 10CFR50.48, “Fire Protection.”
2. 10CFR50.49, “Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants.”
3. 10CFR50.62, “Requirements for Reduction of Risk From Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants.”
4. 10CFR50.63, “Loss of All Alternating Current Power.”
5. 10CFR50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”
6. 10CFR50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.”
7. 10CFR51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.”
8. 10CFR54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.”
9. NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule,” Revision 3, April 16,2001.
10. NUREG-1800, “Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants,” Draft, August 2000.
11. Draft Regulatory Guide DG 1104 “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses.”

SECTION 2.0 STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

List of Tables

List of Figures

2.0 STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 SCOPING AND SCREENING METHODOLOGY

2.1.1 Introduction

For those systems, structures and components (SSCs) within the scope of license renewal, 10 CFR 54.21(a)(1) requires the license renewal applicant in its integrated plant assessment to identify and list the structures and components subject to aging management review. 10 CFR 54.21(a)(2) further requires that the methods used to identify and list the structures and components be described and justified. Section 2 of this application satisfies these requirements.

The process of identifying the systems, structures, and components within the scope of 10 CFR Part 54, the license renewal rule (the rule) is called scoping. Scoping involves a review of plant systems, structures, and components to identify those that meet the scoping criteria of 10 CFR 54.4. As part of the scoping process, the intended functions are also identified. The intended functions are those functions that are the basis for including the system, structure or component within the scope of license renewal. Since plant components can be associated with a system or structure, scoping was initially performed at a system or structure level.

An aging management review (AMR) is required for those in-scope structures and components that perform an intended function without moving parts or without a change in configuration or properties, and that are not subject to replacement based on a qualified life or specified time frame. Structures and components that perform an intended function without moving parts or without a change in configuration or properties are called “passive.” Structures and components that are not subject to replacement based on a qualified life or specified time frame are called “long-lived.” The process of identifying the “passive,” “long-lived” structures and components that are subject to an aging management review is called screening.

The Peach Bottom Atomic Power Station (PBAPS) scoping and screening methodology is based on the guidance provided in NEI 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule." Scoping, screening, and documentation of results were performed in accordance with an approved procedure. This methodology provides reasonable assurance that structures and components requiring aging management review have been identified.

The PBAPS scoping methodology is described in greater detail in Section 2.1.2. Scoping results are provided in Section 2.2. The screening methodology is described in Section 2.1.3. Screening results are provided in Sections 2.3, 2.4, and 2.5. An overview of the PBAPS scoping and screening process is presented in Figure 2.1-1.

2.1.2 Scoping Methodology

2.1.2.1 Systems, Structures and Components Within the Scope of License Renewal

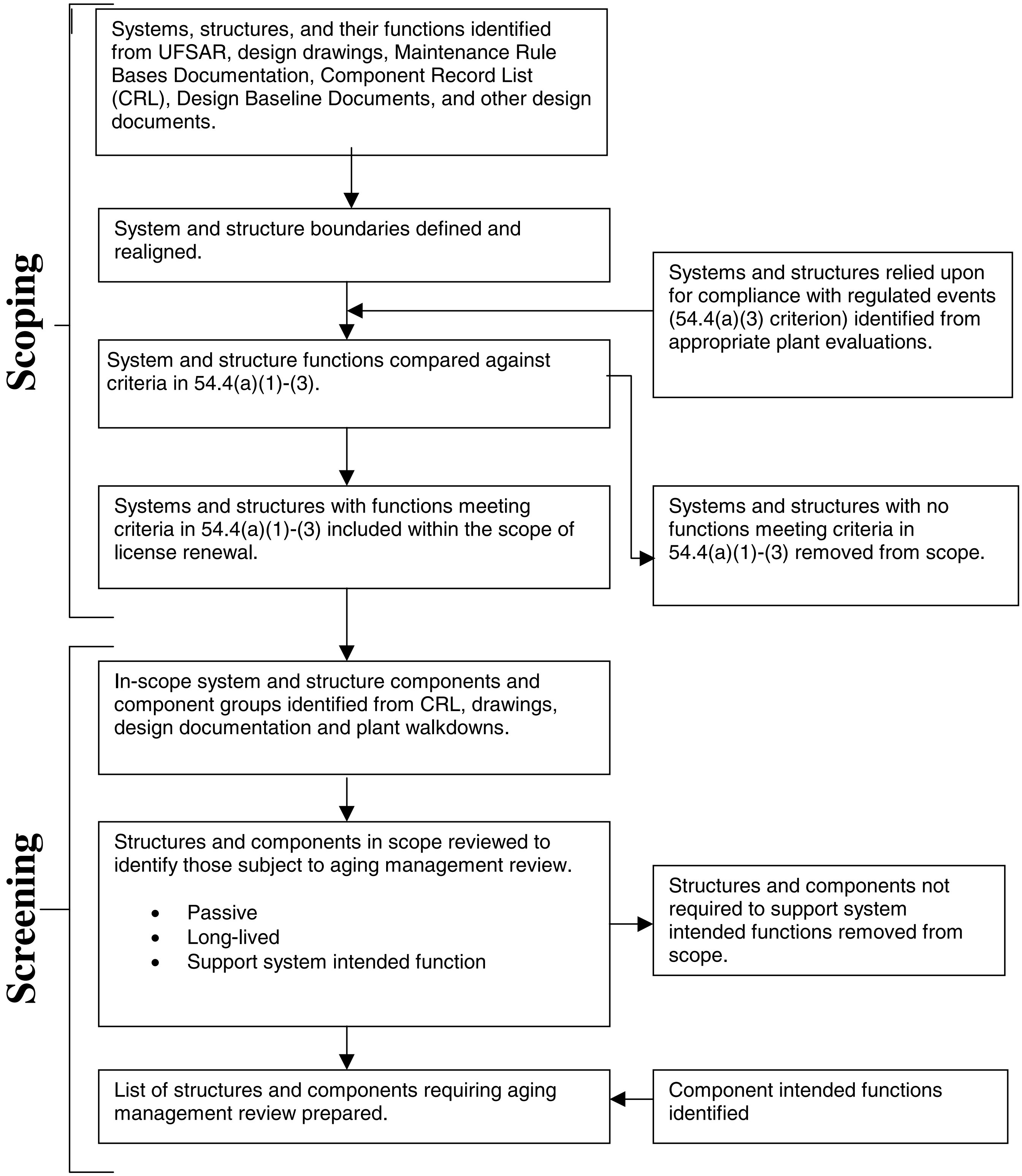
Scoping at the System and Structure Level

Identification of systems, structures and components that fall within the scope of the rule began by evaluating each system and structure in the plant. Plant systems and structures were identified through review of the PBAPS UFSAR, plant design drawings, Maintenance Rule Bases documents, plant equipment lists and other plant design documentation. System and structure functions were identified through review of the system Design Baseline Documents and the PBAPS UFSAR. System and structure boundaries were defined, and each system and structure was then evaluated against the criteria of 10 CFR 54.4(a)(1)-(3) for inclusion into the scope of the rule. This approach allowed for the components within a system or structure to be evaluated as a group against the license renewal scoping criteria.

System level scoping is an efficient method for identifying components in the scope of the rule at PBAPS. The plant is organized into systems, and each system is assigned a unique system number. These system numbers are used throughout the documents that govern the design and operation of the plant. Component identification procedures link individual components with the system to which they are physically connected or functionally support. Components associated with in-scope systems were identified and evaluated during the screening process as described in Section 2.1.3.

Plant structures were identified from the PBAPS UFSAR and plant design drawings, and were evaluated individually against the criteria of 10 CFR 54.4(a)(1)-(3) for inclusion into the scope of the rule. Components associated with in-scope structures were identified and evaluated during the screening process as described in Section 2.1.3.

Figure 2.1-1 - Scoping and Screening Process Overview



Scoping at the system and structure level is a conservative approach to scoping of plant components, since there may be components within a system or structure that are not required to support the system or structure intended functions. Components identified during the component level screening process (described in Section 2.1.3) that did not support the associated system or structure intended function were removed from the scope of license renewal at that point.

Use of the Component Record List

Plant components such as pumps, valves, tanks, heat exchangers, and instruments at PBAPS are assigned unique component numbers that are maintained in a controlled electronic database called the Component Record List (CRL). The system numbering convention at PBAPS assigns each system a unique system number, and each component in that system is assigned a unique CRL component identification number that contains the associated system number. This system numbering convention allows for easy identification of components in a given system.

The CRL system numbering convention encompasses more than just the traditional systems required to support plant operation. Certain groups of components that are not associated with a traditional plant system have been assigned component and system numbers for work control purposes. Examples of these nontraditional systems include snubbers, cranes and fuel handling equipment. These nontraditional systems were reviewed during system scoping to identify components potentially requiring aging management review.

Plant equipment items that are not assigned unique component numbers and may not be included in the CRL are typically commodities such as piping, flexible hoses, electrical cable, and ventilation ductwork. As described in Section 2.1.3, evaluation of design drawings and walkdowns of the physical plant were used to identify those additional commodities or groups of items potentially requiring aging management review that were not assigned unique CRL component numbers.

System and Structure Boundary Drawings

A combination of the CRL system component listing and the plant design drawings were used to establish the boundaries of systems and structures within the scope of license renewal. License renewal boundary drawings were prepared, documenting the boundaries of systems and structures in the scope of license renewal. Although not a requirement of the rule, the development of boundary drawings provided additional confirmation of correct system and structure scoping.

For mechanical systems, Piping and Instrumentation Diagrams (P&IDs) were used to establish evaluation boundaries of systems and components in scope. For structures, physical plant arrangement drawings were used to establish evaluation boundaries of structures in scope. For electrical systems, a simplified single line drawing was prepared to show the interfaces with the outside electrical distribution system.

System Boundary Realignment

Interfaces between systems were examined and realigned, as necessary, to ensure that interfacing components were associated with the appropriate system for license renewal. For example, a valve in an out-of-scope system that provides an isolation boundary interface with an in-scope system would be considered in the scope of license renewal. This is an example of system boundary realignment. The valve is “realigned” to the in-scope system, and the remainder of the out-of-scope system remains out-of-scope. Similar realignments are used to address out-of-scope systems that interface with the primary containment boundary.

Electrical distribution systems interface with many systems, including many mechanical systems, and the interface point is often an electrical isolation device such as a fuse or circuit breaker. These electrical isolation devices are typically considered as part of the mechanical system because they functionally provide electrical isolation of these systems. These interfaces were examined to confirm interfacing components had been identified in the correct system for license renewal. For example, a fuse in an out-of-scope mechanical system that provides an isolation boundary interface with an in-scope electrical system would be considered in the scope of license renewal. The fuse would be “realigned” to the in-scope electrical system, and the out-of-scope mechanical system would remain out-of-scope.

In some cases, components were realigned to support specific intended functions. For example, at PBAPS the main steam isolation valves (MSIVs) are air-operated valves and require compressed gas to perform their intended function. These valves do not rely on the instrument air distribution system, but instead utilize a dedicated instrument air accumulator. Accordingly, the MSIVs instrument air accumulators are required to support the intended function of the MSIVs. For purposes of system scoping, these instrument air accumulators were realigned from the instrument air system to the main steam system.

License renewal component realignments can modify system boundaries from those defined by the CRL and P&IDs. Component realignments are evaluated for impact on system functions and corresponding impact on system level scoping criteria. Significant boundary realignments are identified in Section 2.2, "Plant Level Scoping Results."

System and Structure Scoping Criteria

Each plant system and structure was reviewed to determine whether it is within the scope of license renewal. The scoping criteria from 10 CFR 54.4 define the license renewal scope as:

> (1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49(b)(1)) to ensure the following functions:
>
> (i) The integrity of the reactor coolant pressure boundary;
>
> (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
>
> (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34 (a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11.
>
> (2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in (1)(i), (ii), or (iii) above.
>
> (3) All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

The term “design basis events” in scoping criterion (1) refers to the abnormal operational transients and postulated design basis accidents that have been analyzed in the PBAPS UFSAR. The PBAPS systems relied upon to perform a required safety action following an abnormal operational transient or design basis accident have been included within the scope of the PBAPS license renewal application.

Scoping criterion (1) is the definition of nuclear safety related as applied to systems, structures and components at PBAPS. The CRL includes a “component classification” field for each component, and the components that meet this criterion are classified as safety-related. Individual structures are not identified in the CRL. The UFSAR is relied upon to identify seismic classification of structures and structural components. Seismic Class I structures and structural components are considered safety-related.

Scoping criterion (1) also appears in other sections of 10 CFR Part 50, including 10 CFR 50.65(b)(1). This section defines, in part, the scope of the monitoring programs specified in 10 CFR 50.65, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants (maintenance rule).

Scoping criterion (2) is similar to the maintenance rule scoping criterion 10 CFR 50.65(b)(2)(ii):

> Nonsafety related structures, systems or components whose failure could prevent safety-related structures, systems and components from fulfilling their safety-related function.

The maintenance rule wording is slightly different than that used in license renewal. The wording of the license renewal criterion describes SSC failures that could prevent safety-related functions, while the maintenance rule wording describes SSC failures that could prevent structures, systems and components from fulfilling safety-related functions. The difference is not considered significant for PBAPS license renewal scoping. At PBAPS, any system, structure, or component that is needed for satisfactory accomplishment of any of the functions in 10 CFR 54.4(a)(1)(i), (ii), or (iii) is considered safety related.

Recognizing the similarities in the license renewal and maintenance rule scoping criteria, the PBAPS license renewal methodology used the results of maintenance rule system scoping as one input into the evaluation of systems and structures against license renewal scoping criteria 10 CFR 54.4(a)(1) and (2).

An evaluation was performed to identify any supporting systems whose failure could prevent satisfactory accomplishment of any intended function of systems and structures in the scope of the rule under 10 CFR 54.4(a)(1). This evaluation was performed to confirm that the scoping for 10 CFR 54.4(a)(2) did not miss any support systems needed to maintain intended functions of systems in scope based on 10 CFR 54.4(a)(1). For systems determined to be in scope, the supporting systems required to support an intended function were identified. The result of this supporting system evaluation is that supporting systems, or portions thereof, whose failure could impact a system intended function, had been previously included in the scope of license renewal based on evaluations performed against the criteria of 10 CFR 54.4(a)(1) and (2).

In evaluating supporting systems, hypothetical failures that could result from system interdependencies that are not part of the current licensing bases and that have not been previously experienced at PBAPS were not considered.

In accordance with the PBAPS UFSAR, SSCs are classified as seismic Class I or seismic Class II. Seismic Class I SSCs are those required to remain functional and/or protect vital equipment and systems during and following postulated design basis events. Seismic Class II SSCs are those whose failure would not result in the release of significant radioactivity and would not prevent reactor shutdown. Seismic Class I structures were included within the scope of license renewal under scoping criterion (1).

In responding to scoping criterion (2), consideration is also given to the following:

- Structural integrity of non-safety related piping systems whose failure could adversely impact a safety related SSC function.

- Structural integrity of non-safety related SSCs whose failure during a seismic event could cause an interaction with safety related SSCs and potentially result in the failure of the safety related SSCs to perform their intended function(s). This is generally referred to as “Seismic II/I”.

With respect to the structural integrity of non-safety related piping, the PBAPS scoping process identified non-safety related piping, which is an extension of the safety related piping beyond the functional boundary (pressure boundary valves). In cases where the non-safety related system is required to structurally support the safety related piping, the non-safety related piping segments and supports, up to the seismic anchor (or equivalent), are categorized as in scope for license renewal.

With respect to seismic II/I, the scoping process involved a systematic review of potential non-safety related/safety related interactions. The UFSAR, licensing correspondence, and design basis documents were relied upon in addressing these interactions. It is important to note that PBAPS, Units 2 & 3 were not originally licensed for “seismic II/I”. However seismic II/I concerns were addressed as a result of Unresolved Safety Issue USI A-46, “Seismic Qualification of Equipment in Operating Plants” and considered for license renewal scoping.

For seismic II/I, PBAPS has chosen an area-based approach to scoping. Seismic Class II structural components, mechanical and electrical system supports, foundation, and anchorage located in structures containing safety related systems and components, including the Safe Shutdown Equipment List (SSEL) credited for USI A-46 resolution, are included in the scope of license renewal pursuant to 10CFR54.4 (a)(2).

Scoping criteria (3) requires an evaluation to identify systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the listed NRC regulations. The methodology used to address scoping for each of the five regulated events is as follows:

SSCs Required to Demonstrate Compliance With 10 CFR 50.48 (Fire Protection)

Included are systems and structures associated with plant fire detection and suppression, and also systems and structures required to assure safe shutdown capability during postulated fire events. Compliance with 10 CFR 50.48 is documented in the Fire Protection Program (FPP) that is part of the PBAPS UFSAR.

Fire detection and suppression equipment is included in the plant fire protection systems. Plant fire protection systems relied upon to demonstrate compliance with 10 CFR 50.48 are included in the scope of license renewal.

Plant systems and structures required to assure safe shutdown capability during postulated fire events were identified from a review of the safe shutdown analysis. The safe shutdown analysis for PBAPS includes the identification of plant fire areas, with a demonstration of safe shutdown capability for postulated fire scenarios in each fire area. Safe shutdown capability is demonstrated by assuring fires will be contained to the analyzed fire area, and by assuring availability of one or more of the defined safe shutdown methods. Systems and structures required to maintain credited fire barriers or support credited safe shutdown methods are included in the scope of license renewal.

SSCs Required to Demonstrate Compliance With 10 CFR50.49 (Environmental Qualification)

The qualified life of equipment in PBAPS environmental qualification (EQ) program is based on the normal ambient temperature, radiation exposure and cyclical aging with appropriate margins added. The qualified life calculations consider the effects of aging over time and therefore meet the definition of time limited aging analyses (TLAA) as defined in paragraph 54.3 of the rule. A controlled data field in the CRL identifies components required to demonstrate compliance with EQ (10 CFR 50.49). Components included in the EQ program are in the scope of license renewal. The detailed discussion of the EQ program and the components covered by the EQ program is contained in Section 4.4 of the application.

SSCs Required to Demonstrate Compliance With 10 CFR 50.61 (Pressurized Thermal Shock)

Pressurized thermal shock is an issue for pressurized water reactors. PBAPS, Units 2 and 3 are boiling water reactors. Therefore, evaluation to this criterion is not applicable.

SSCs Required to Demonstrate Compliance With 10 CFR 50.62 (Anticipated Transient Without Scram)

Components required to demonstrate compliance with Anticipated Transient Without Scram (ATWS) are identified in the CRL. ATWS component level data was extracted from the CRL, and summarized at the system level. The system level list was reviewed to determine which systems and structures are relied upon to demonstrate compliance with the ATWS requirements. Systems and structures relied upon to demonstrate compliance with 10 CFR 50.62 were included in the scope of license renewal.

SSCs Relied on to Demonstrate Compliance With 10 CFR 50.63 (Station Blackout)

For PBAPS, compliance with the station blackout (SBO) rule involves the use of an Alternate AC power source in accordance with NUMARC 87-00 "Guidelines and Technical Basis for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors." Therefore, the Alternate AC power source is considered to be within the scope of license renewal. The design of the SBO Alternate AC power source is such that it is not available immediately after SBO occurs, but will be available prior to one hour after SBO occurs. Therefore, the scope of systems and structures required to demonstrate compliance with the station blackout rule also includes the systems and structures necessary to cope with the station blackout for up to the one-hour duration before the Alternate AC power source is available. Systems and structures relied upon to demonstrate compliance with 10 CFR 50.63 are included in the scope of license renewal.

2.1.2.2 Intended Functions of SSCs Within the Scope of License Renewal

As described in Section 2.1.2.1, scoping was performed at the system or structure level. As part of the scoping process, intended functions were also identified. The system and structure intended functions are those functions that are the basis for including them within the scope of license renewal as specified in 10CFR54.4(a)(1) through (3).

In many cases, the intended functions are a subset of all the functions of a system or structure. Most systems and structures perform other functions that do not meet the criteria of 10 CFR 54.4(a). Only those portions of the systems or structures needed to support the intended functions are required to be included within the scope of license renewal. As described in Section 2.1.3, components that were identified as not required to support a system or structure intended function were removed from the scope of license renewal.

The term “component intended function” refers to the specific component, component group or commodity intended function needed to support a system or structure intended function. Component intended functions are identified during the screening process. See Section 2.1.3 for additional information on component intended functions.

The PBAPS UFSAR and the design baseline documents (DBD) were reviewed to identify the intended functions for each system and structure determined to fall within the scope of the rule. The system, structure and component intended functions are provided in Sections 2.3, 2.4, and 2.5 for each of the systems and structures within the scope of the rule.

Stored Equipment

Equipment that is stored on site for installation in response to a design basis event is considered to be within the scope of license renewal. At PBAPS, the only stored equipment that falls within the scope of license renewal is equipment that may be required to facilitate repairs following an Appendix R fire scenario. The stored equipment credited for Appendix R repairs are fuses, test switches and bypass air jumper assemblies. Each bypass air jumper assembly consists of stainless steel flexible hose and two stainless steel check valves. These components are confirmed available and in good operating condition by periodic surveillance inspections. Tools and supplies used to place the stored equipment in service are not in the scope of license renewal.

Excluded Systems and Structures

Certain structures and equipment were excluded at the outset based on engineering judgment. These include: driveways and parking lots, temporary equipment, health physics equipment, portable radios, portable measuring and testing equipment, tools, spare parts, and motor vehicles. In addition, structures and equipment for emergency preparedness and security were excluded from the scope of license renewal.

Conclusion

Systems, structures and components within the scope of license renewal were identified using the methodology described in Section 2.1.2. The scoping methodology meets the requirements of 10 CFR 54.4 and is based on the guidance provided in NEI 95-10. Current Licensing Basis (CLB) information used in the scoping evaluations was obtained from controlled sources, including the PBAPS UFSAR, the Component Record List, Design Baseline Documents (DBD), Maintenance Rule Program documentation, and plant design drawings.

2.1.3 Screening Methodology

Identification of Structures and Components Subject to an Aging Management Review

For each mechanical and electrical and I&C system determined to be within the scope of the rule, a listing of components within the system was extracted from the CRL. Plant equipment items that are not assigned component numbers and are not included in the CRL, typically commodity items, were identified and added to this component listing as commodity items. These additional items were identified by evaluation of design drawings and documents, and by plant walkdowns.

For each structure determined to be within the scope of the rule, a listing of included structural components was developed based upon information contained in the CRL, information contained in design documents, information contained in the FPP, and information obtained during plant walkdowns.

Each listed structural component, mechanical component and electrical/I&C component was then evaluated to assess whether it should be considered passive for license renewal. Passive structures and components are those that perform an intended function without moving parts or without a change in configuration or properties. Appendix B of NEI 95-10 was used as a basis for identifying the passive components.

The passive structures and components were then reviewed to determine whether they are subject to replacement based on a qualified life or specified time period. Structures and components not subject to such replacement, or with qualified lives or replacement intervals 40 years or greater, are considered to be “long-lived.” Structures and components subject to replacement based on a qualified life or specified time period less than 40 years are identified as "short-lived" and are not subject to an aging management review in accordance with 10 CFR 54.21(a)(1)(ii).

All components of systems and structures within the scope of the rule were reviewed to identify the passive, long-lived components subject to an aging management review. During this screening review process, individual components or portions of systems were identified that were not required to support the associated system or structure intended functions. If the decision was made to delete such components from the scope of license renewal, the component listings and boundary drawings were revised as appropriate.

The majority of electrical components in the CRL were determined to be active for license renewal, and therefore do not require an aging management review. The passive, long-lived electrical components subject to aging management review are commodities such as cable or electrical connectors and are not uniquely identified in the CRL. The PBAPS screening process identified the passive, long-lived electrical commodities used in the plant without regard for system intended functions. The guidance provided in NEI 95-10, Appendix B was used to define electrical commodities subject to aging management review.

Some of the ventilation systems in the scope of license renewal include system filters such as fiberglass prefilter elements, HEPA filters and charcoal filters. These system filters are also in the scope of license renewal, but are replaced on condition and are not subject to aging management review. Periodic testing and inspection programs are in place to monitor filter performance such that system intended functions are maintained. System filters are replaced as conditions warrant, therefore an aging management review is not required.

Fire extinguishers, self-contained breathing air packs and fire hoses are within the scope of license renewal, but are not subject to aging management because they are replaced on condition. These components are periodically inspected in accordance with National Fire Protection Association (NFPA) standards. These standards require replacement of equipment based on their condition or performance during testing and inspection. These components are not long-lived and are subject to replacement based on NFPA standards, therefore an aging management review is not required.

Component Groups

To facilitate the aging management reviews, the passive, long-lived structures and components were organized into component groups. In addition to electrical commodities discussed above, the component groups also include commodities such as piping or ventilation duct. The component groups subject to aging management review are listed in Sections 2.3, 2.4, and 2.5.

Component Intended Functions

Component intended functions were identified for each of the passive, long-lived structural, mechanical and electrical components within the scope of the rule. Table 2.1-1 "Component Intended Functions" is a listing of mechanical, structural and electrical component intended functions. One or more of these intended functions were identified for each passive, long-lived mechanical, structural and electrical component. The intended function associated with a component is based on the type of component, and how it is relied upon to support the associated system or structure intended function. For example, a restricting orifice would have intended functions of “throttling” and “pressure boundary” if the throttling function is required to support the system intended function. If the throttling function is not required to support the system intended function, the restricting orifice intended function would be “pressure boundary” only.

Conclusion

The structure and component screening results are provided in Sections 2.3, 2.4, and 2.5 for the mechanical systems, structures and electrical and instrument and controls systems, respectively. These sections list the structures and components requiring an aging management review as part of the Integrated Plant Assessment (IPA).

The screening methodology is consistent with the guidance provided in NEI 95-10. This screening process provides reasonable assurance that the passive, long-lived structures and components that are subject to aging management review have been identified in accordance with the rule.

Table 2.1-1 Component Intended Functions

List of Mechanical Component Intended Functions

Label [1]	Description of Component Intended Function
Pressure Boundary	Provide pressure-retaining boundary so that sufficient flow at adequate pressure is delivered, provide fission product barrier for reactor coolant pressure boundary piping and components, or provide containment isolation for fission product retention.
Throttle	Provide flow restriction
Spray	Convert fluid flow into a spray
Filter	Provide filtration
Heat Transfer	Provide heat transfer
Structural Support	Provide structural support to safety-related components
Containment, Holdup and Plateout	Provide post-accident containment, holdup and plateout of MSIV bypass leakage.
Structural Support to Non-S/R Components	Provide structural support to non-safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions

List of Structural Component Intended Functions

Label[1]	Description of Intended Function
Structural Support	Provide structural support to safety-related components
Fire Barrier	Provide fire rated barrier to confine or retard a fire from spreading to or from adjacent areas of the plant
Shelter, Protection, and/or Shielding	Provide shelter, protection, or radiation shielding
Flood Barrier	Provide flood protection barrier
Fission Product Barrier	Provide fission product barrier
Missile Barrier	Provide missile barrier
HELB Shielding	Provide HELB shielding
Structural Support to Non-S/R Components	Provide structural support to non-safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions
Pipe Whip Restraint	Provide pipe whip restraint
Over-pressure Protection	Provide over-pressure protection
Pressure Boundary	Provide pressure-retaining boundary
Contain Fluid	Contain fluid leaks or spills within an area
Absorb Neutrons	Absorb neutrons
Insulating Characteristics	Control heat loss
Insulation Jacket Integrity	Prevent moisture absorption of insulation

List of Electrical Component Intended Functions

Label[1]	Description of Component Function
Electrical Continuity	Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals.
Insulate	Insulate and support an electrical conductor.

(1) These “labels” provide a concise description of the component intended functions, for use in the tables in application Sections 2.3, 2.4, 2.5 and Section 3.

2.2 PLANT LEVEL SCOPING RESULTS

Table 2.2-1 "Mechanical System Scoping Results" provides the results of the plant level scoping for each of the mechanical systems at PBAPS. Table 2.2-2 "Structure Scoping Results" provides the results of the plant level scoping for each of the structures at PBAPS. Table 2.2-3 "Electrical System Scoping Results" provides the results of the plant level scoping for each of the electrical systems.

Included in each of the tables with the mechanical system and structure names are references to the appropriate sections in the application that provide system and structure descriptions, system and structure intended functions, and identification of the component groups requiring aging management review. For electrical systems, these references are not provided, except for the station blackout system, because aging management review of electrical components and commodities was performed using a 'spaces' approach.

Table 2.2-1
Mechanical System Scoping Results

Description	Within Scope of License Renewal?	Comments
Reactor Coolant System		
Reactor Pressure Vessel and Internals (Section 2.3.1.1)	Yes	
Fuel Assemblies (Section 2.3.1.2)	Yes	
Reactor Pressure Vessel Instrumentation System (Section 2.3.1.3)	Yes	
Reactor Recirculation System (Section 2.3.1.4)	Yes	

Table 2.2-1
Mechanical System Scoping Results
(Continued)

Description	Within Scope of License Renewal?	Comments
Engineered Safety Features Systems		
High Pressure Coolant Injection System (Section 2.3.2.1)	Yes	
Core Spray System (Section 2.3.2.2)	Yes	
Primary Containment Isolation System (Section 2.3.2.3)	Yes	Includes containment boundary piping and components from out-of-scope systems which interface with the primary containment.
Reactor Core Isolation Cooling System (Section 2.3.2.4)	Yes	
Residual Heat Removal System (Section 2.3.2.5)	Yes	
Containment Atmosphere Control and Dilution System (Section 2.3.2.6)	Yes	
Standby Gas Treatment System (Section 2.3.2.7)	Yes	
Secondary Containment (Section 2.3.2.8)	Yes	
Drywell Ventilation System	No	Instrumentation credited for Fire Safe Shutdown is included in the Fire Safe Shutdown System. Piping and components associated with the primary containment boundary are included with primary containment isolation system (PCIS).
Primary Containment Leak Test System	No	Piping and components associated with the primary containment boundary are included with PCIS.
Reactor Building Ventilation System	No	Piping and components associated with RHR, Core Spray, HPCI, and RCIC pump room cooling are included with the associated systems. Components credited for secondary containment boundary are included in secondary containment system.

**Table 2.2-1
Mechanical System Scoping Results
(Continued)**

Description	Within Scope of License Renewal?	Comments
Auxiliary Systems		
Fuel Handling System (Section 2.3.3.1)	Yes	
Fuel Pool Cooling and Cleanup System (Section 2.3.3.2)	Yes	Piping and components required to support fuel pool makeup from the RHR system are the only part of the system in scope.
Control Rod Drive System (Section 2.3.3.3)	Yes	
Standby Liquid Control System (Section 2.3.3.4)	Yes	
High Pressure Service Water System (Section 2.3.3.5)	Yes	
Emergency Service Water System (Section 2.3.3.6)	Yes	
Fire Protection Systems (Section 2.3.3.7)	Yes	
Control Room Ventilation System (Section 2.3.3.8)	Yes	
Battery And Emergency Switchgear Ventilation System (Section 2.3.3.9)	Yes	
Diesel Generator Building Ventilation System (Section 2.3.3.10)	Yes	
Pump Structure Ventilation System (Section 2.3.3.11)	Yes	
Safety Grade Instrument Gas System (Section 2.3.3.12)	Yes	
Backup Instrument Nitrogen to ADS (Section 2.3.3.13)	Yes	
Emergency Cooling Water System (Section 2.3.3.14)	Yes	
Condensate Storage System (Section 2.3.3.15)	Yes	
Emergency Diesel Generator (Section 2.3.3.16)	Yes	

Table 2.2-1
Mechanical System Scoping Results
(Continued)

Description	Within Scope of License Renewal?	Comments
Auxiliary Systems (Continued)		
Suppression Pool Temperature Monitoring System (Section 2.3.3.17)	Yes	
Cranes and Hoists (Section 2.3.3.18)	Yes	Includes reactor building cranes.
Service Water System	No	
Service Water Bay Chemical Injection System	No	
Reactor Building Closed Cooling Water System	No	Piping and components associated with the primary containment boundary are included with PCIS.
Reactor Water Cleanup System	No	RWCU system piping and components inside containment are included with Reactor Recirculation System. RWCU containment penetration piping and components are included with PCIS.
Turbine Building Closed Cooling Water System	No	
Chilled Water System	No	Piping and components associated with the primary containment boundary are included with PCIS.
Turbine Building Ventilation System	No	
Radwaste Building Ventilation System	No	
Miscellaneous Ventilation Systems	No	
Water Treatment System	No	

Table 2.2-1
Mechanical System Scoping Results
(Continued)

Description	Within Scope of License Renewal?	Comments
Auxiliary Systems (Continued)		
Instrument Nitrogen System	No	Piping and components associated with the inboard main steam isolation valve nitrogen accumulator pressure boundary are included with the main steam system. Piping and components associated with the primary containment boundary are included with PCIS.
Instrument Air System	No	Piping and components associated with the outboard main steam isolation valve air accumulator pressure boundary are included with the main steam system. Piping and components associated with safety grade instrument gas system pressure boundary are included with the safety grade instrument gas system. Piping and components associated with nitrogen backup to the battery and emergency switchgear ventilation system are included with the battery and emergency switchgear ventilation system.
Service Air Systems	No	Piping and components associated with the primary containment boundary are included with PCIS.
Domestic Water System	No	
Sewage Treatment System	No	
Plant Equipment and Floor Drain System	No	Piping and components associated with the primary containment boundary are included with PCIS.
Process Sampling System	No	Piping and components associated with the primary containment boundary are included with PCIS.
Auxiliary Steam System	No	
Offgas and Recombiner System	No	
Circulating Water System and Cooling Towers	No	
Traveling Water Screen System	No	

Table 2.2-1
Mechanical System Scoping Results
(Continued)

Description	Within Scope of License Renewal?	Comments
Auxiliary Systems (Continued)		
Hypochlorite System	No	
Condensate System	No	
Condensate Transfer	No	
Refueling Water Storage and Transfer	No	
Torus Water Storage and Transfer	No	
Hydrogen Water Chemistry System	No	
Radwaste System	No	
Torus Water Cleanup System	No	Piping and components associated with the primary containment boundary are included with PCIS.
Post Accident Sampling System	No	Piping and components interfacing with in-scope systems are included with the in-scope system.
Traversing In Core Probe	No	Piping and components associated with the primary containment boundary are included with PCIS.
Security Systems	No	
Emergency Eyewash and Showers	No	

Table 2.2-1
Mechanical System Scoping Results
(Continued)

Description	Within Scope of License Renewal?	Comments
Steam and Power Conversion Systems		
Main Steam System (Section 2.3.4.1)	Yes	
Main Condenser (Section 2.3.4.2)	Yes	
Feedwater System (Section 2.3.4.3)	Yes	Portions of the system required to support HPCI and RCIC injection flowpaths, reactor coolant pressure boundary and primary containment boundary are the only parts of feedwater included in scope.
Turbine-Generator	No	

Table 2.2-2
Structure Scoping Results

Description	Within the Scope of License Renewal?
Containment Structure (Section 2.4.1)	Yes
Reactor Building Structure (Section 2.4.2)	Yes
Radwaste Building and Reactor Auxiliary Bay (Section 2.4.3)	Yes
Turbine Building and Main Control Room Complex (Section 2.4.4)	Yes
Emergency Cooling Tower and Reservoir (Section 2.4.5)	Yes
Station Blackout Structure and Foundations (Section 2.4.6)	Yes
Yard Structures (Manholes, Duct Banks, Valve Pits, etc.) (Section 2.4.7)	Yes
Stack (Section 2.4.8)	Yes
Nitrogen Storage Building (Section 2.4.9)	Yes
Diesel Generator Building (Section 2.4.10)	Yes
Circulating Water Pump Structure (Section 2.4.11)	Yes
Recombiner Building (Section 2.4.12)	Yes
Water Treatment Building	No
Outdoor Electric Switchgear, North Substation	No
Boiler House	No
Off-Gas Filter Station	No
Watertight Dikes	No
Cooling Towers	No
Intake Screen Structure	No
Cooling Tower Pump Structures	No
Discharge Control Structure	No
Bridge Structure	No
Administration Building and Shop	No
Plant Services Building	No
Site Management Building	No
Warehouse Complex	No
Secondary Alarm Station Building	No
Plant Entrance and Radiochemistry Laboratory	No
Radwaste Onsite Storage Facility	No
Guardhouse	No
Independent Spent Fuel Storage Installation	No
Dewatering Building	No

Table 2.2-3
Electrical and I&C System Scoping Results

Description	Within Scope of License Renewal?	Comments
Electrical and I&C Systems		
Radiation Monitoring System	Yes	
4 Kv	Yes	
480 Volt Emergency Load Centers	Yes	
480 Volt Emergency Motor Control Centers	Yes	
DC System	Yes	
Instrument AC System Panels	Yes	
Communications	Yes	
Station Lighting System	Yes	
Remote Shutdown Panel	Yes	
Neutron Monitoring System	Yes	
Reactor Protection System	Yes	
Station Blackout (Section 2.5.3)	Yes	
Fire Safe Shutdown	Yes	
Annunciators	No	
Substations & Transformers	No	Equipment credited for Fire Safe Shutdown and Station Blackout is included in those systems.
13 Kv	No	Equipment credited for Fire Safe Shutdown and Station Blackout is included in those systems.
480 Volt Load Centers	No	
480 Volt Motor Control Centers	No	
Computer	No	
RPS-MG Set And Alternate Feed	No	
Reactor Manual Control	No	
Cathodic Protection	No	
Electrical Heat Tracing System	No	
Seismic Monitoring System	No	
Meteorology	No	

2.3 SCOPING AND SCREENING RESULTS: MECHANICAL

The scoping and screening results for mechanical systems consist of lists of components and component groups that require aging management review, arranged by system. Brief descriptions of mechanical systems within the scope of license renewal are provided as background information. Mechanical system intended functions are provided for in-scope systems. For each in-scope system, components or component groups requiring an aging management review are provided.

Specifically, this section provides the results of the scoping and screening process for mechanical systems including:

- A general description of the system and its purpose,
- A reference to the applicable UFSAR section,
- A reference to the applicable license renewal boundary diagrams,
- The system intended functions,
- A listing of mechanical components or component groups that are subject to an aging management review, associated component intended functions, and environments.

A discussion of component groups, component intended functions, and environments is provided in Section 3.0.

For each system, the tables are sorted by component group and then by environment.

The mechanical scoping and screening results are provided in four subsections:

- Reactor Coolant Systems
- Engineered Safety Features Systems
- Auxiliary Systems
- Steam and Power Conversion Systems

2.3.1 Reactor Coolant System

2.3.1.1 Reactor Pressure Vessel and Internals

System Description

The reactor pressure vessel is a vertical, cylindrical pressure vessel with hemispherical heads and is of welded construction. The cylindrical shell and bottom hemispherical head of the reactor vessel are fabricated of low alloy steel plate. The shell is clad on the interior with a stainless steel overlay, and the bottom head with an inconel overlay. The major safety consideration for the reactor vessel is the ability of the vessel to function as a radioactive material barrier. The vessel also provides a floodable core volume, contains the moderator, and provides support for the reactor vessel internals.

The reactor vessel internals are installed to properly distribute the flow of coolant delivered to the vessel, to locate and support the fuel assemblies, and to provide an inner volume containing the core that can be flooded following a break in the nuclear system process barrier external to the reactor vessel.

The reactor pressure vessel and internals are discussed in UFSAR Sections 3.3 and 4.2. License renewal boundary diagram reference for the reactor pressure vessel is LR-M-351.

Intended Functions within the Scope of License Renewal

Containment - The reactor vessel and internals provide a fission product and pressure barrier.

Physical Support - The reactor vessel and internals provide vertical and horizontal support for the core and other reactor pressure vessel internal components.

Core Cooling - The reactor vessel and internals provide a means to distribute coolant to the fuel assemblies located in the central region and in the periphery of the core.

Floodable Volume - The reactor vessel and internals provide a means to flood the core to at least two-thirds core height following design basis accidents.

Component Groups Requiring Aging Management Review

Table 2.3.1-1 Component Groups Requiring Aging Management Review - Reactor Pressure Vessel and Internals

Component Group	Component Intended Function	Environment
Reactor Vessel		
Top Head	• Pressure Boundary	Steam
Bottom Head	• Structural Support • Pressure Boundary	Reactor Coolant
Shell courses	• Pressure Boundary	Reactor Coolant
Flanges	• Pressure Boundary	Reactor Coolant
Closure studs	• Pressure Boundary	Sheltered Reactor Coolant
Closure nuts	• Pressure Boundary	Sheltered, Reactor Coolant
Stabilizer bracket	• Structural Support	Sheltered
Support skirt	• Structural Support	Sheltered
Feedwater nozzle, other nozzles	• Pressure Boundary	Reactor Coolant
Nozzle safe ends (including Core ∆P/SLC nozzle safe end)	• Pressure Boundary	Reactor Coolant
Core spray attachments, jet pump riser brace attachments, shroud support attachment	• Structural Support	Reactor Coolant
Other attachments	• Structural Support	Steam, Reactor Coolant
CRD Stub tube penetrations, ICM housing penetrations, and instrument penetrations	• Pressure Boundary	Reactor Coolant
RPV Internals		
Shroud	• Structural Support • Pressure Boundary	Reactor Coolant
Shroud support	• Structural Support • Pressure Boundary	Reactor Coolant
Access Hole Cover	• Pressure Boundary	Reactor Coolant
Core Support Plate, Top Guide	• Structural Support	Reactor Coolant
Core ∆P/SLC Line, Core Spray Lines and Core Spray Spargers	• Pressure Boundary • Spray	Reactor Coolant
Jet Pump Assemblies	• Structural Support • Pressure Boundary	Reactor Coolant
Orificed Fuel Support, CRD Guide Tube Base	• Structural Support	Reactor Coolant
CRD Housing stub tubes	• Structural Support	Reactor Coolant
CRD Housing guide tubes	• Structural Support	Reactor Coolant
In-core housing guide tubes, LPRM and WRNMS dry tubes	• Pressure Boundary	Reactor Coolant

Aging management review results for the reactor pressure vessel and internals are provided in Section 3.1.1.

2.3.1.2 Fuel Assemblies

System Description

The fuel assemblies are high integrity assemblies of fissionable material that can be arranged in a critical array. Each assembly must be capable of transferring the generated fission heat to the circulating coolant water while maintaining structural integrity and containing the fission products.

The nuclear fuel is designed to assure that fuel damage limits will not be exceeded during either normal operation or anticipated operational occurrences. The nuclear fuel is utilized as the initial barrier for containment of fission products.

There are 764 fuel assemblies in each reactor, with each assembly consisting of a matrix of zircaloy fuel rods.

Fuel assemblies are discussed in UFSAR Sections 3.2 and 3.6.

Intended Functions within the Scope of License Renewal

Containment - The fuel cladding is the primary fission product barrier.

Component Groups Requiring Aging Management Review

Table 2.3.1-2 Component Groups Requiring Aging Management Review - Fuel Assemblies

Component Group	Component Intended Function	Environment
• None (Note 1)	• Not Applicable	Not Applicable

Note 1: Fuel assemblies do not require aging management review because they are short-lived. See Section 3.1.2.

2.3.1.3 Reactor Pressure Vessel Instrumentation System

System Description

The reactor pressure vessel instrumentation monitors and transmits information concerning key reactor vessel operating parameters during planned operations to ensure that sufficient control of these parameters is possible in order to avoid (1) release of radioactive material such that the limits of 10 CFR 20 are exceeded, (2) nuclear system stress in excess of that allowed by applicable industry codes, and (3) the existence of any operating conditions not considered by plant safety analyses.

The reactor pressure vessel instrumentation system consists of components utilized for flow, water level, pressure, and temperature measurements required for the operation of the reactor under various normal, transient, shutdown, and accident conditions.

Reactor vessel instrumentation is designed to provide the operator with sufficient indication of the following:

- Reactor core flow rate during planned operations to avoid operating conditions not considered by plant safety analyses.

- Reactor vessel water level during planned operations to determine that the core is adequately covered by the coolant inventory inside the reactor vessel to avoid the release of radioactive materials such that the limits of 10 CFR 20 are exceeded, and to avoid operating conditions not considered by plant safety analyses.

- Reactor vessel pressure and temperature during planned operations to avoid operating conditions not considered by plant safety analyses.

- Reactor vessel flange leakage during planned operations to avoid nuclear system stress in excess of that allowed by applicable industry codes and the release of radioactive material such that the limits of 10 CFR 20 are exceeded.

The reactor pressure vessel instrumentation is described in UFSAR Section 7.8. License renewal boundary diagram reference for the reactor pressure instrumentation system is LR-M-352.

Intended Functions within the Scope of License Renewal

Provide Signal Input - The reactor pressure vessel instrumentation provides trip signals to plant safety systems, signals to plant non-safety systems, and to provide plant process information.

Monitor Key Parameters - The reactor pressure vessel instrumentation monitors key water level, pressure, and temperature indications.

Component Groups Requiring Aging Management Review

Table 2.3.1-3 Component Groups Requiring Aging Management Review - Reactor Pressure Vessel Instrumentation

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant, Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant, Sheltered
Piping • Pipe	• Pressure Boundary	Steam
Piping Specialties • Condensing Chamber	• Pressure Boundary	Reactor Coolant
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant
Piping Specialties • Condensing Chamber • Restricting Orifice	• Pressure Boundary	Sheltered
Piping Specialties • Condensing Chamber	• Pressure Boundary	Steam

Aging management review results for the reactor pressure vessel instrumentation are provided in Section 3.1.3.

2.3.1.4 Reactor Recirculation System

System Description

The reactor recirculation system is a reactivity control system that serves to control reactor power levels by varying the coolant rate through the core over a limited range so that greater versatility is available in making power adjustments without the use of control rods.

The recirculation system consists of two independent loops, external to the reactor pressure vessel, each with a motor driven centrifugal pump, suction and discharge valves, piping, piping supports, and restraints. The recirculation system is part of the reactor coolant pressure boundary, and functions to maintain the pressure boundary during normal operation, transients, and accident scenarios to prevent the release of radioactive liquid and gas. The system piping and pump design pressures are based on peak steam pressure in the reactor dome plus the static head above the lowest point in the recirculation loop.

The reactor recirculation system provides flow paths out of the reactor pressure vessel for residual heat removal (RHR) and reactor water cleanup systems and into the reactor vessel for RHR shutdown cooling and low pressure coolant injection.

The coolant rate through the reactor core is varied by using variable frequency motor-generator sets and flow control instrumentation to change the speed of the centrifugal pumps to control the recirculation system drive flow rate.

A recirculation pump trip on reactor high pressure or reactor low water level has been provided to limit the consequences of a failure to scram during a transient.

The reactor recirculation system is discussed in detail in UFSAR Sections 4.3 and 7.9. License renewal boundary diagram references for the reactor recirculation system are LR-M-351, LR-M-352, and LR-M-353.

Intended Functions within the Scope of License Renewal

Pressure Boundary - The reactor recirculation system maintains the integrity of the reactor coolant pressure boundary.

RHR Flow Path - The reactor recirculation system provides flow paths for RHR shutdown cooling and low pressure coolant injection.

Flow-Biased Neutron Monitoring - The reactor recirculation system supports average power range neutron monitor signal input.

Recirculation Pump Trip - The reactor recirculation pump motor-generator set supports anticipated transient without scram mitigation by recirculation pump trip.

Component Groups Requiring Aging Management Review

Table 2.3.1-4 Component Groups Requiring Aging Management Review - Reactor Recirculation System

Component Group	Component Intended Function	Environment
Casing and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Reactor Coolant, Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant, Sheltered
Piping Specialties • Flow Elements • Thermowells	• Pressure Boundary	Reactor Coolant
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant
Piping Specialties • Flow Elements • Thermowells • Restricting Orifice	• Pressure Boundary	Sheltered

Aging management review results for the reactor recirculation system are provided in Section 3.1.4.

2.3.2 Engineered Safety Features Systems

2.3.2.1 High Pressure Coolant Injection System

System Description

The high pressure coolant injection (HPCI) system is provided to assure that the reactor is adequately cooled to limit fuel clad temperature in the event of a small break in the nuclear system and loss of coolant which does not result in rapid depressurization of the reactor vessel. The system is designed to allow the plant to be shut down while maintaining sufficient reactor vessel water inventory until the reactor vessel is depressurized. The HPCI system continues to operate until reactor vessel pressure is below the pressure at which low pressure coolant injection (LPCI) operation or core spray system operation maintains core cooling.

The HPCI system consists of a turbine driven pump, piping, valves and controls which provide for a complete and independent emergency core cooling system. The primary water source is water from the condensate storage tank, with a backup supply of water available from the suppression pool. Delivery of water to the vessel occurs via the "A" feedwater line. Steam supply to the HPCI turbine is from the reactor via the "B" main steam line. The system is equipped with a test line shared with the reactor core isolation cooling system to permit functional testing and a minimum flow bypass line which directs flow to the suppression pool for pump protection purposes during periods of low system flow. The exhaust steam from the turbine is discharged to the suppression pool.

The HPCI system is described in detail in UFSAR section 6.4.1. License renewal boundary diagram references for the HPCI system are LR-M-303, LR-M-306, LR-M-309, LR-M-365, and LR-M-366.

Intended Functions within the Scope of License Renewal

Coolant Injection - The HPCI system provides sufficient coolant to the reactor vessel to limit fuel clad temperature in the event of a small break in the reactor coolant system and a subsequent loss of coolant which does not result in a rapid depressurization of the reactor vessel.

Component Groups Requiring Aging Management Review

Table 2.3.2-1 Component Groups Requiring Aging Management Review - High Pressure Coolant Injection System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Condensate Storage Water
Casting and Forging • Valve Bodies • Filter Bodies • Pump Casings	• Pressure Boundary	Lubricating Oil
Casting and Forging • Valves Bodies	• Pressure Boundary	Reactor Coolant
Casting and Forging • Valve Bodies • Pump Casings • Filter Bodies • Turbine Casing	• Pressure Boundary	Sheltered
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Ventilation Atmosphere
Casting and Forging • Valve Bodies • Turbine Casing	• Pressure Boundary	Wetted Gas
Elastomer • Flexible Hoses	• Pressure Boundary	Lubricating Oil, Sheltered
Heat Exchanger • HPCI Gland Seal Condenser	• Pressure Boundary • Heat Transfer	Condensate Storage Water, Steam
Heat Exchanger • HPCI Turbine Lube Oil Cooler	• Pressure Boundary • Heat Transfer	Condensate Storage Water, Lubricating Oil
Heat Exchanger • HPCI Pump Rooms Cooling Coils	• Pressure Boundary	Raw Water, Sheltered
Heat Exchanger • HPCI Gland Seal Condenser • HPCI Turbine Lube Oil Cooler	• Pressure Boundary	Sheltered

Table 2.3.2-1 Component Groups Requiring Aging Management Review - High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Lubricating Oil
Piping • Pipe	• Pressure Boundary	Reactor Coolant
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Steam
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)
Piping • Pipe • Tubing	• Pressure Boundary	Torus Grade Water
Piping • Pipe	• Pressure Boundary	Ventilation Atmosphere
Piping • Pipe	• Pressure Boundary	Wetted Gas
Piping Specialties • Thermowell • Flow Elements • Restricting Orifice	• Pressure Boundary	Condensate Storage Water
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Condensate Storage Water
Piping Specialties • Steam Trap	• Pressure Boundary	Reactor Coolant
Piping Specialties • Thermowell • Flow Elements • Restricting Orifice • Steam Trap • Rupture Disc	• Pressure Boundary	Sheltered
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam
Piping Specialties • Sparger	• Spray	Torus Grade Water
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water

Table 2.3.2-1 Component Groups Requiring Aging Management Review - High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Ventilation Atmosphere
Piping Specialties • Steam Trap	• Pressure Boundary	Wetted Gas
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Wetted Gas
Piping Specialties • Rupture Disc	• Pressure Boundary	Wetted Gas
Vessel • Lubricating Oil Tanks	• Pressure Boundary	Lubricating Oil, Sheltered

Aging management review results for the high pressure coolant injection system are provided in Section 3.2.1.

2.3.2.2 Core Spray System

System Description

The core spray system provides a redundant means for removal of decay heat from the core following a postulated LOCA. The system also provides a means for flooding the reactor vessel to remove decay heat from the core to support alternate shutdown cooling.

The system consists of two independent loops per unit, each with two 50% capacity motor driven pumps and associate piping, valves and instrumentation necessary to perform the system intended functions. The core spray system automatically sprays water onto the top of the fuel assemblies upon receipt of signals indicative of a LOCA. The system delivers cooling water at a sufficient flow rate to cool the core and prevent excessive fuel clad temperature. The low pressure coolant injection system initiates on the same signal as the core spray system and operates independently to fulfill the same objective as the core spray system. The system is maintained in a standby condition, powered by independent safeguard buses in the electrical distribution system.

The core spray system provides protection to the core for large break scenarios with resultant low reactor pressure. In addition; protection can be afforded for small break scenarios in which the automatic depressurization system has initiated to lower reactor vessel pressure.

The core spray system is discussed in additional detail in UFSAR sections 6.1, 6.2, 6.3, 6.4, 6.5, and 6.6. License renewal boundary diagram reference for the core spray system is LR-M-362.

Intended functions within the Scope of License Renewal

Core Cooling - The core spray system provides water to spray onto the top of the fuel assemblies to cool the core and prevent excessive fuel clad temperature following a design basis accident.

Minimum Flow Bypass -The core spray system has a minimum flow bypass mode which is initiated for pump protection whenever a core spray pump is operating and flow through the pump is low.

Component Groups Requiring Aging Management Review

Table 2.3.2-2 Component Groups Requiring Aging Management Review - Core Spray System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Sheltered
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Torus Grade Water
Heat Exchanger • Core Spray Pump Motor Oil Cooler	• Pressure Boundary • Heat Transfer	Lubricating Oil, Raw Water
Heat Exchanger • Core Spray Pump Rooms Cooling Coils	• Pressure Boundary • Heat Transfer	Raw Water, Sheltered
Heat Exchanger • Core Spray Pump Motor Oil Cooler	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Condensate Storage Water
Piping • Pipe	• Pressure Boundary	Dry Gas
Piping • Pipe	• Pressure Boundary	Reactor Coolant
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)
Piping • Pipe • Tubing	• Pressure Boundary	Torus Grade Water
Piping Specialties • Restricting Orifices	• Pressure Boundary • Throttle	Dry Gas
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant

Table 2.3.2-2 Component Groups Requiring Aging Management Review - Core Spray System (Continued)

Component Group	Component Intended Function	Environment
Piping Specialties • Flow Elements • Thermowells • Restricting Orifice • Cyclone Separators	• Pressure Boundary	Sheltered
Piping Specialties • Flow Elements • Thermowells • Restricting Orifices • Cyclone Separators	• Pressure Boundary	Torus Grade Water
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water

Aging management review results for the core spray system are provided in Section 3.2.2.

2.3.2.3 Primary Containment Isolation System

System Description

The primary containment isolation system is a plant protection system and includes the steam leak detection system. The system provides timely protection against the onset and consequences of accidents involving the gross release of radioactive materials from the fuel and nuclear system process barrier. The primary containment and reactor vessel isolation control system initiates automatic isolation of appropriate lines that penetrate the primary containment whenever monitored variables exceed pre-selected operational limits.

The system initiates isolation of the reactor pressure vessel, isolation of piping which penetrate primary containment, and isolation of piping in selected balance of plant systems that provide potential paths for the release of radioactive materials coming from breaks in the reactor coolant pressure boundary.

The primary containment isolation system is discussed in additional detail in UFSAR Sections 5.1, 5.2, 7.3, 14.6, and Appendix M. License renewal boundary diagram references for the primary containment isolation system are LR-M-316, LR-M-320, LR-M-327, LR-M-332, LR-M-333, LR-M-351, LR-M-353, LR-M-354, LR-M-359, LR-M-361, LR-M-362, LR-M-365, LR-M-368, LR-M-369, LR-M-372, LR-M-373, LR-M-376, LR-M-390, and LR-M-391.

Intended functions within the Scope of License Renewal

Reactor Pressure Vessel Isolation - The primary containment isolation system initiates isolation of the reactor pressure vessel to contain released fission products in the event of gross fuel failure.

Primary Containment Isolation - The primary containment isolation system initiates automatic closure of isolation valves in piping that penetrates the primary containment whenever monitored parameters indicate a fluid loss from the reactor coolant pressure boundary or high leakage from the piping for selected nuclear steam supply or auxiliary systems.

Leak Detection - The steam leak detection system provides piping and equipment area high temperature signals when steam leaks from high energy piping cause unacceptably high temperatures.

Component Groups Requiring Aging Management Review

Table 2.3.2-3 Component Groups Requiring Aging Management Review - Primary Containment Isolation System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Closed Cooling Water
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant
Casting and Forgings • Valve Bodies	• Pressure Boundary	Wetted Gas
Castings and Forgings • Valve Bodies	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Closed Cooling Water
Piping • Pipe	• Pressure Boundary	Dry Gas
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Wetted Gas
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant
Piping Specialties • Flow Elements	• Pressure Boundary	Reactor Coolant
Piping Specialties • Restricting Orifice • Flow Elements	• Pressure Boundary	Sheltered

Aging management review results for the primary containment isolation system are provided in Section 3.2.3.

2.3.2.4 Reactor Core Isolation Cooling System

System Description

The reactor core isolation cooling (RCIC) system is a high pressure coolant makeup system which supports safe shutdown of the reactor whenever the reactor is isolated from its heat sink at elevated temperatures and pressures. The system functions to prevent a release to the environs because of inadequate core cooling. The RCIC system has sufficient makeup capacity to accommodate decay heat boil-off during a normal shutdown when the reactor is isolated from its normal heat sink at elevated pressure. The system will facilitate depressurization of the reactor vessel to the point where the shutdown cooling mode of the residual heat removal (RHR) system can be placed in operation. The primary water source is demineralized water from the condensate storage tank, with a backup supply of treated water available from the suppression pool.

The RCIC system consists of a turbine driven pump, piping, valves and controls, which provide for delivery of makeup water to the reactor vessel. The system is equipped with a test line shared with the high pressure coolant injection system to permit functional testing and a minimum flow bypass line which directs flow to the suppression pool for pump protection purposes during periods of low system flow. The exhaust steam from the turbine is directed to the suppression pool.

The RCIC system is described in detail in UFSAR Section 4.7. License renewal boundary diagram references for the reactor core isolation cooling system are LR-M-303, LR-M-306, LR-M-309, LR-M-359 and LR-M-360.

Intended Functions within the Scope of License Renewal

Coolant Injection - The RCIC system provides makeup water to the reactor vessel during shutdown and reactor isolation in order to prevent excessive fuel cladding temperatures.

Reactor Vessel Level Control - The RCIC system provides reactor vessel level control to maintain water level in the reactor vessel above the top of the active fuel should the reactor vessel be isolated from normal feedwater flow.

Reactor Vessel Pressure Control - The RCIC system provides reactor pressure control by drawing off steam for turbine operation and directing the discharge to the suppression pool. The pressure will decay to the level suitable for operation of the shutdown cooling mode of the RHR system.

Component Groups Requiring Aging Management Review

Table 2.3.2-4 Component Groups Requiring Aging Management Review - Reactor Core Isolation Cooling System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Condensate Storage Water
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies	• Pressure Boundary	Lubricating Oil
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Turbine Casing	• Pressure Boundary	Sheltered
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water
Casting and Forging • Valve Bodies • Turbine Casing	• Pressure Boundary	Wetted Gas
Heat Exchanger • RCIC Turbine Lube Oil Cooler	• Pressure Boundary • Heat Transfer	Condensate Storage Water, Lubricating Oil
Heat Exchanger • RCIC Pump Rooms Cooling Coils	• Pressure Boundary	Raw Water, Sheltered
Heat Exchanger • RCIC Turbine Lube Oil Cooler	• Pressure Boundary	Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Lubricating Oil

Table 2.3.2-4 Component Groups Requiring Aging Management Review - Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment
Piping • Pipe	• Pressure Boundary	Reactor Coolant
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Steam
Piping • Pipe	• Pressure Boundary	Torus Grade Water
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)
Piping • Pipe	• Pressure Boundary	Wetted Gas
Piping Specialties • Thermowell • Y-Strainer Body • Flow Element	• Pressure Boundary	Condensate Storage Water
Piping Specialties • Y-Strainer Screens	• Filter	Condensate Storage Water
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Condensate Storage Water
Piping Specialties • Restricting Orifice	• Pressure Boundary	Condensate Storage Water
Piping Specialties • Steam Trap	• Pressure Boundary	Reactor Coolant
Piping Specialties • Restricting Orifice • Thermowells • Y Strainer Bodies • Steam Trap • Rupture Disc	• Pressure Boundary	Sheltered
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water
Piping Specialties • Steam Trap • Restricting Orifices	• Pressure Boundary • Throttle	Wetted Gas
Piping Specialties • Rupture Disc	• Pressure Boundary	Wetted Gas
Vessel • Tank (Barometric Condenser)	• Pressure Boundary	Condensate Storage Water, Sheltered

Aging management review results for the reactor core isolation cooling system are provided in Section 3.2.4.

2.3.2.5 Residual Heat Removal System

System Description

The Residual Heat Removal (RHR) system is an emergency core cooling system and heat removal system. The RHR system restores and maintains the coolant inventory in the reactor vessel such that the core is adequately cooled after a LOCA. The system also provides containment cooling by condensing steam resulting from the blowdown due to a design basis accident.

The RHR system consists of two independent loops. Each loop consists of two heat exchangers, two parallel RHR pumps, plus the associated piping, valves, and instrumentation. The loops are located in different areas of the reactor building to minimize the possibility of a single physical event causing the loss of the entire system.

The RHR system is designed for three modes of operation: shutdown cooling, containment cooling, and low-pressure injection. Each mode of operation is defined as a subsystem of the RHR system, with each subsystem contributing toward satisfaction of all objectives and design bases of the system.

The shutdown cooling subsystem is placed in operation during a normal shutdown and cooldown. The subsystem uses one or more RHR heat exchangers to remove reactor core decay heat and sensible heat from the reactor core to achieve and maintain the reactor in a cold shutdown condition.

The containment cooling subsystem provides a means for cooling the containment when operating in either the suppression pool cooling or containment spray modes. The suppression pool cooling mode provides a means to remove the reactor core decay heat and sensible heat discharged to the suppression pool in the event of a design basis accident or event. The containment cooling subsystem also provides the ability to reduce containment pressure by using the spray headers in the drywell and above the suppression pool.

The low pressure coolant injection (LPCI) subsystem operates to restore and, if necessary, maintain the coolant inventory in the reactor vessel after a LOCA so that the core is sufficiently cooled to preclude excessive fuel clad temperature. The LPCI subsystem operates in conjunction with the high pressure coolant injection system, the automatic depressurization system, and the core spray system to achieve this goal. The LPCI subsystem is designed to reflood the reactor vessel to at least two-thirds core height and maintain this level. After the core has been flooded to this height, the capacity of one RHR pump is more than sufficient to maintain the level.

The RHR system is described in detail in UFSAR Section 4.8. License renewal boundary diagrams for the residual heat removal system are LR-M-353 and LR-M-361.

Intended functions within the Scope of License Renewal

Shutdown Cooling - the RHR system provides the shutdown cooling function to remove decay heat and sensible heat from the primary system following depressurization of the reactor.

Containment Cooling - The RHR system provides a means to cool the Containment when operating in the suppression pool cooling or containment spray modes.

Alternate Shutdown Cooling - The RHR system provides alternate heat removal capability to cool the core in the event that the shutdown cooling mode of the system cannot be established.

Low Pressure Coolant Injection (LPCI) - The LPCI subsystem operates to restore and maintain the coolant inventory in the vessel post-LOCA so that the core is sufficiently cooled to preclude excessive fuel clad temperatures.

Minimum Flow Bypass - The RHR system has a minimum flow bypass mode which is initiated for pump protection whenever an RHR pump is operating and flow through the pump is low.

Sample Isolation - The RHR sample valves isolate on a primary containment isolation system Group I signal.

Component Groups Requiring Aging Management Review

Table 2.3.2-5 Component Groups Requiring Aging Management Review - Residual Heat Removal System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Sheltered
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Torus Grade Water
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas
Heat Exchanger • RHR Heat Exchangers	• Pressure Boundary • Heat Transfer	Raw Water, Torus Water
Heat Exchanger • RHR Pump Room Cooling Coils	• Pressure Boundary • Heat Transfer	Raw Water, Sheltered
Heat Exchanger • RHR Heat Exchangers	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Dry Gas
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Torus Grade Water
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)
Piping • Pipe	• Pressure Boundary	Wetted Gas

Table 2.3.2-5 Component Groups Requiring Aging Management Review - Residual Heat Removal System (Continued)

Component Group	Component Intended Function	Environment
Piping Specialties • Thermowells • Flow Elements • Cyclone Separators • Restricting Orifices	• Pressure Boundary	Sheltered
Piping Specialties • Thermowells • Flow Elements • Cyclone Separators	• Pressure Boundary	Torus Grade Water
Piping Specialties • Restricting Orifices	• Pressure Boundary • Throttle	Torus Grade Water
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water

Aging management review results for the residual heat removal system are provided in Section 3.2.5.

2.3.2.6 Containment Atmosphere Control and Dilution System

System Description

The containment atmosphere control (CAC) system assures that the initial concentration of oxygen prior to a LOCA is maintained below the flammability limits of five (5) percent within primary containment. This is done by maintaining the primary containment atmosphere inert with nitrogen and ensuring that no external sources of oxygen are introduced into containment as part of normal and post accident operation.

During each startup, the primary containment is purged of air with nitrogen until the atmosphere contains less than four (4) percent oxygen. The containment inerting system is used during the initial purging of the primary containment and provides a supply of makeup nitrogen. The system consists of a liquid nitrogen storage tank; a water-bath vaporizer; ambient vaporizers; an electric heater; pressure-reducing valves and controller; instrumentation; valves; and piping.

The containment atmospheric dilution (CAD) system is a standby system during the normal operation of the plant. Following a beyond design basis LOCA, the CAD system is used instead of the normal nitrogen inerting system to maintain the oxygen concentration within the containment at less than five (5) percent by volume.

The CAD system is composed of a common liquid nitrogen storage tank, redundant nitrogen electrical vaporizers, a pressure reducing valve, isolation valves, flow indication instrumentation, and flow control devices. Two piping systems are routed to each unit to provide redundant nitrogen supplies.

The containment atmosphere is monitored by a combined CAD and CAC analyzer system. The CAD and CAC analyzer system consists of two redundant combustible gas analyzers subsystems. Each monitors torus and drywell oxygen and hydrogen for both the CAD and CAC systems.

A description of the CAC and CAD systems is provided in UFSAR Section 5.2. License renewal boundary diagram references for the CAC and CAD systems are LR-M-367, LR-M-372.

Intended Functions within the Scope of License Renewal

Containment Pressure Control - The CAD system provides a means of controlling containment pressure following a design basis event.

Nitrogen Source - The CAD liquid nitrogen storage tank is the source of nitrogen for the safety grade instrument gas system.

Combustible Gas Monitoring - The CAD and CAC analyzer system provides a means to monitor the oxygen and hydrogen concentration of the primary containment atmosphere.

Component Groups Requiring Aging Management Review

Table 2.3.2-6 Component Groups Requiring Aging Management Review - Containment Atmosphere Control and Dilution System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Dry Gas
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Sheltered
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas
Piping • Pipe	• Pressure Boundary	Dry Gas
Piping • Pipe	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Wetted Gas
Piping Specialties • Nitrogen Electric Vaporizer	• Pressure Boundary	Dry Gas, Sheltered
Vessel • Nitrogen Storage Tanks • H_2 and O_2 Detection Chambers	• Pressure Boundary	Dry Gas, Sheltered

Aging management review results for the CAC and CAD systems are provided in Section 3.2.6.

2.3.2.7 Standby Gas Treatment System

System Description

The standby gas treatment system (SGTS) is an engineered safety feature system for limiting the ground level release from the reactor building. The system also provides for an elevated release of primary and secondary containment air at an elevated release point via the main stack.

The system is common to both Units 2 and 3 and is located in a shielded room in the radwaste building between the reactor buildings.

The SGTS consists of two parallel filter trains connected to three full capacity exhaust fans. Each filter train is made up of the following components: moisture separator, electric resistance heater, pre-filter, high-efficiency filter, charcoal filter, and another high efficiency filter downstream of the charcoal filter. A fire protection system is provided at the charcoal filter trays. Each fan is capable of exhausting the rated flow through either filter train and up through the main stack.

The system uses the normal reactor building ventilation system exhaust piping and ductwork. Two exhaust lines from each reactor building connect to the common filter train inlet plenum. One line is connected to the reactor building refueling floor ventilation exhaust duct. The second line is connected to the reactor building air spaces below the refuel floor, and also to the torus and drywell.

A detailed description of the standby gas treatment system is provided in detail in UFSAR Section 5.3.3. License renewal boundary diagram references for the SGTS are LR-M-391 and LR-M-397.

Intended functions within the Scope of License Renewal

Filtration - Following a design basis accident, the SGTS filters the exhaust air to remove radioactive gases and particulates that may be present in the secondary containment prior to discharge to the environment.

Containment - The SGTS maintains a negative pressure in the reactor building under normal atmospheric conditions.

Elevated Release - The SGTS provides for an elevated release of radioactive materials post-LOCA.

Component Groups Requiring Aging Management Review

Table 2.3.2-7 Component Groups Requiring Aging Management Review - Standby Gas Treatment System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Ventilation Atmosphere, Sheltered
Elastomer • Fan Flex Connections • Filter Plenum Access Door Seals	• Pressure Boundary	Ventilation Atmosphere, Sheltered
Piping • Pipe	• Pressure Boundary	Buried
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Ventilation Atmosphere
Piping Specialties • Flow Elements • Pressure Elements • Temperature Element Couplings	• Pressure Boundary	Ventilation Atmosphere, Sheltered
Sheet Metal • Ducting • Plenums • Fan Enclosures • Damper Enclosures	• Pressure Boundary	Ventilation Atmosphere, Sheltered
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere

Aging management review results for the SGTS are provided in Section 3.2.7.

2.3.2.8 Secondary Containment System

System Description

The reactor building, in conjunction with the reactor building heating and ventilating system and the standby gas treatment system (up to and including the second outboard isolation valve) constitutes the secondary containment. This includes penetrations of the reactor building. The penetrations for piping, ventilation ducts, electrical cables, and instrument leads are sealed. The ventilation ducts are provided with valves for automatic closure when reactor building isolation is required. Refer to Section 2.4.2 for a description of the reactor building structure.

The reactor building completely encloses the primary containment, and auxiliary systems of the nuclear steam supply system, and houses the associated spent fuel storage pool, dryer and separator storage pool, and reactor well. The secondary containment serves as the containment during reactor refueling when the primary containment is open, and as an additional barrier when the primary containment is functional.

The secondary containment is further discussed in UFSAR sections 5.1 and 5.3. License renewal boundary diagram reference for secondary containment is LR-M-391. There are no other system boundary drawings since penetrations are considered as part of the structure.

Intended Functions within the Scope of License Renewal

Containment - The secondary containment system provides a secondary containment boundary to contain any release of radioactive material outside the primary containment.

Component Groups Requiring Aging Management Review

Table 2.3.2-8 Component Groups Requiring Aging Management Review – Secondary Containment System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Ventilation Atmosphere, Sheltered
Piping • Tubing	• Pressure Boundary	Ventilation Atmosphere, Sheltered
Sheet Metal • Ducting	• Pressure Boundary	Ventilation Atmosphere, Sheltered

Aging management review results for the secondary containment system are provided in Section 3.2.8.

2.3.3 Auxiliary Systems

2.3.3.1 Fuel Handling System

System Description

The fuel handling system consists of the refueling platform equipment assembly and the fuel preparation machines. The Units 2 and 3 refueling floors are physically separated. Each unit has its own fuel handling system and fuel pool.

The refueling platform includes a bridge structure that spans the spent fuel pool and the reactor well. The platform travels on rails that extend the length of the fuel storage pool and the reactor well. A working platform extends the width of the bridge structure, providing working access to the entire width of the pools and the reactor well area.

Two fuel preparation machines located in each fuel storage pool are used to strip the channels from spent fuel assemblies, and to install the used channels on new fuel assemblies.

Additional information pertaining to the fuel handling system is found in UFSAR Sections 10.3 and 10.4.

Intended Functions within the Scope of License Renewal

Maintain Structural Integrity - Maintain structural integrity of the refueling platform and the fuel preparation machines.

Component Groups Requiring Aging Management Review

Table 2.3.3-1 Component Groups Requiring Aging Management Review - Fuel Handling System

Component Group	Component Intended Function	Environment
Fuel Preparation Machines	• Structural Support	Fuel Pool Water
Refueling Platform (assembly)	• Structural Support	Sheltered
Refueling Platform (rails)	• Structural Support	Sheltered
Refueling Platform (mast)	• Structural Support	Fuel Pool Water

Aging management review results for the fuel handling system are provided in Section 3.3.1.

2.3.3.2 Fuel Pool Cooling and Cleanup System

System Description

The fuel pool cooling and cleanup system provides fuel pool water temperature control and is used to maintain fuel pool water clarity, purity, and level.

The fuel pool cooling and cleanup system cools the fuel storage pool by transferring decay heat through the heat exchangers to the service water system. Water purity and clarity in the fuel storage pool, reactor well, and steam dryer-separator storage pit are maintained by filtering and demineralizing the pool water.

The system consists of three fuel pool cooling pumps, three heat exchangers, filter demineralizer(s), two skimmer surge tanks, and associated piping and valves. The three fuel pool cooling pumps are connected in parallel, as are the three heat exchangers. The pumps and heat exchangers are located in the reactor building. An interconnection with the RHR system provides backup cooling and makeup water to the fuel storage pool.

The fuel pool cooling and cleanup system is further discussed in UFSAR Section 10.5. License renewal boundary diagram reference for the fuel pool cooling and cleanup system is LR-M-363.

Intended Functions within the Scope of License Renewal

Emergency Make-up - The fuel pool cooling and cleanup system provides a safety related path for providing make-up water for the fuel pool in the event of a loss of fuel pool inventory when normal makeup is not available.

Component Groups Requiring Aging Management Review

Table 2.3.3-2 Component Groups Requiring Aging Management Review - Fuel Pool Cooling and Cleanup System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Fuel Pool Water, Sheltered
Piping • Pipe	• Pressure Boundary	Fuel Pool Water, Sheltered
Piping Specialties • Vacuum Breakers • Restricting Orifice	• Pressure Boundary	Fuel Pool Water, Sheltered

Aging management review results for the fuel pool cooling and cleanup system are provided in Section 3.3.2.

2.3.3.3 Control Rod Drive System

System Description

The control rod drive (CRD) system is a reactivity control system that utilizes pressurized demineralized water to rapidly insert control rods in the core upon receipt of a scram signal. The system also provides control rod manipulation and positioning for power adjustments, and serves as a source of cooling water for the graphitar seals of the CRD mechanisms.

The CRD system serves as a source of purge water for the reactor water cleanup pumps and reactor recirculation pump seals. The system also serves as a source of injection water to reactor vessel level instrumentation reference legs to mitigate the accumulation of gases.

The alternate rod insertion (ARI) system is a subsystem of the CRD system and serves as a backup means to provide a reactor scram, independent of the reactor protection system, by venting off the scram air header. The ARI function serves to reduce the probability of an ATWS event and may be initiated automatically or manually.

The CRD system is described in detail in UFSAR Section 3.4. License renewal boundary diagram references for the control rod drive system are LR-M-356 and LR-M-357.

Intended Functions within the Scope of License Renewal

CRD Scram - The control rod drive system provides rapid control rod insertion in the core upon receipt of an automatic or manual scram signal.

Alternate Rod Insertion - The alternate rod insertion feature of the CRD system reduces the probability of an ATWS event by providing an alternate means to scram the reactor.

Component Groups Requiring Aging Management Review

Table 2.3.3-3 Component Groups Requiring Aging Management Review - Control Rod Drive System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas
Castings and Forgings • Valve Bodies	• Pressure Boundary	Sheltered
Castings and Forgings • Valve Bodies	• Pressure Boundary	Wetted Gas
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water
Piping • Pipe	• Pressure Boundary	Dry Gas
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Wetted Gas
Piping Specialties • Filter Bodies	• Pressure Boundary	Condensate Storage Water
Piping Specialties • Rupture Disc	• Pressure Boundary	Dry Gas
Piping Specialties • Filter Bodies • Rupture Disc	• Pressure Boundary	Sheltered
Vessel • Accumulators	• Pressure Boundary	Condensate Storage Water
Vessel • Accumulators	• Pressure Boundary	Dry Gas
Vessel • Accumulators	• Pressure Boundary	Sheltered

Aging management review results for the control rod drive system are provided in Section 3.3.3.

2.3.3.4 Standby Liquid Control System

System Description

The purpose of the standby liquid control system is to provide a backup method, which is redundant with, and independent of, the control rod drive system to shutdown the reactor and maintain it in a cold, subcritical condition. Maintaining subcriticality as the nuclear system cools assures that the fuel barrier is not threatened by overheating in the event that not enough of the control rods can be inserted to counteract the positive reactivity effects of a decrease in the moderator temperature. A neutron absorber consisting of enriched sodium pentaborate in solution is injected into the vessel and distributed throughout the core in sufficient quantity to achieve and maintain shutdown while allowing for margin due to leakage and imperfect mixing.

The system consists of a solution storage tank, a test tank, two 100% capacity positive displacement pumps with their associated relief valves and accumulators, two explosive valves installed in parallel, and associated controls and instrumentation. The system is manually initiated from the control room via a three-position key-locked selector switch.

The standby liquid control system is described in detail in UFSAR Section 3.8. License renewal boundary diagram references for the standby liquid control system are LR-M-351 and LR-M-358.

Intended Functions within the Scope of License Renewal

Reactivity Control - The standby liquid control system injects sodium pentaborate solution into the reactor vessel in sufficient quantity and concentration to bring the reactor from rated power to a cold shutdown at any time in core life.

Component Groups Requiring Aging Management Review

Table 2.3.3-4 Component Groups Requiring Aging Management Review - Standby Liquid Control System

Component Group	Component Intended Function	Environment
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Borated Water
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Borated Water
Piping • Pipe	• Pressure Boundary	Reactor Coolant
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping Specialties • Thermowells	• Pressure Boundary	Borated Water, Sheltered
Vessel • Accumulators • Solution Tank	• Pressure Boundary	Borated Water
Vessel • Accumulators	• Pressure Boundary	Dry Gas
Vessel • Accumulators • Solution Tank	• Pressure Boundary	Sheltered

Aging management review results for the standby liquid control system are provided in Section 3.3.4.

2.3.3.5 High Pressure Service Water System

System Description

The high pressure service water (HPSW) system provides cooling water for the residual heat removal system (RHR) heat exchangers under normal, hot standby, refueling and post-accident conditions. The system provides core decay heat removal capability during shutdown periods, and containment cooling during normal operations and during post accident conditions. The HPSW pumps are located in the circulating water pump structure, central portion.

The system consists of four pumps and the necessary piping, valves and controls to provide cooling water from either the Conowingo Pond or the emergency cooling tower via the HPSW pump bay. The pumps deliver cooling water at a pressure greater than RHR system pressure. This ensures radioactive leakage from the RHR system to the environs is inhibited. Radioactivity in the HPSW system is monitored upstream and downstream of the RHR heat exchangers to detect activity in potential release paths. The HPSW system discharges through one pipe for each unit to the discharge pond.

The HPSW system is described in detail in UFSAR section 10.7. License renewal boundary diagram references for the high pressure service water system are LR-M-315, LR-M-330, and LR-M-361.

Intended Functions within the Scope of License Renewal

RHR Heat Sink - The HPSW system provides cooling water flow to transfer heat from the RHR heat exchangers for the normal operation, post accident shutdown, hot standby, or refueling modes of operation.

Component Groups Requiring Aging Management Review

Table 2.3.3-5 Component Groups Requiring Aging Management Review - High Pressure Service Water System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor
Casting and Forging • Pump Casings • Strainer Bodies • Valve Bodies	• Pressure Boundary	Raw Water
Casting and Forging • Strainer Screens	• Filter	Raw Water
Casting and Forging • Pump Casings (External)	• Pressure Boundary	Raw Water
Casting and Forging • Strainer Bodies • Valve Bodies	• Pressure Boundary	Sheltered
Heat Exchanger • HPSW Pump Motor Oil Cooler	• Pressure Boundary • Heat Transfer	Lubricating Oil, Raw Water
Heat Exchanger • HPSW Pump Motor Oil Cooler	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Buried
Piping • Pipe • Tubing	• Pressure Boundary	Raw Water
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water
Piping Specialties • Flow Elements • Restricting Orifice	• Pressure Boundary	Sheltered

Aging management review results for the high pressure service water system are provided in Section 3.3.5.

2.3.3.6 Emergency Service Water System

System Description

The emergency service water (ESW) system provides a reliable supply of cooling to diesel generator coolers, emergency core cooling system and reactor core isolation cooling compartment air coolers, core spray pump motor oil coolers and other selected equipment during a loss of offsite power or during a loss of normal station service water.

The system consists of two 100% capacity ESW pumps, associated discharge and distribution piping, piping components, valves and instrumentation and controls. The two ESW pumps take suction from individual pump bays within the circulating water pump structure. A return header in each unit returns the water to the discharge pond or the emergency cooling water system. During normal operations, all system loads with the exception of the emergency diesel generator heat exchangers are supplied with cooling water from the service water system. The ESW system provides the cooling water whenever the pumps are operating and the ESW system pressure is greater than service water system pressure or the service water system is manually isolated from the ESW system. In the event of extreme high or low Conowingo Pond level, the ESW system can be shifted to closed cycle operation through the use of the emergency cooling water system.

The ESW system is described in UFSAR section 10.9. License renewal boundary diagram references for the emergency service water system are LR-M-315 and LR-M-330.

Intended Functions within the Scope of License Renewal

Component Cooling - The ESW system provides cooling water flow to transfer heat from certain safety related equipment during a loss of offsite power or maximum credible accident via either an open loop or a closed loop configuration.

Component Groups Requiring Aging Management Review

Table 2.3.3-6 Component Groups Requiring Aging Management Review - Emergency Service Water System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Raw Water
Casting and Forging • Pump Casings (External)	• Pressure Boundary	Raw Water
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Buried
Piping • Pipe • Tubing	• Pressure Boundary	Raw Water
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping Specialties • Thermowells • Flow Elements • Expansion Joints	• Pressure Boundary	Raw Water
Piping Specialties • Thermowells • Flow Elements • Expansion Joints	• Pressure Boundary	Sheltered

Aging management review results for the emergency service water system are provided in Section 3.3.6

2.3.3.7 Fire Protection System

System Description

The term "fire protection system" refers to the integrated complex of components and equipment provided for detection and suppression of fires. In addition to this system, the "fire protection program" includes the concepts of design and layout implemented to prevent or mitigate fires, administrative controls and procedures, and personnel training. The fire protection program uses a defense-in-depth approach aimed at preventing fires, minimizing the effect of any fires that occur, providing appropriate fire detection and suppression equipment, and training personnel in fire prevention and fire fighting.

The fire protection system detects the presence of smoke or excessive heat in designated plant areas, provides local alarms, control room annunciation horn and printed record, and suppression system activation. The fire protection system includes various types of water, foam, and carbon dioxide suppression systems. Additionally, the fire protection system includes active and passive features such as fire doors, fire dampers, penetration seals, fire wraps, combustible free zones, and water curtains which retard fires from spreading from one area of the plant to another.

Heat and smoke detection is accomplished by the appropriate detectors installed in areas where fire potential exists and in all areas containing safety related equipment except where a specific exemption was granted by the NRC. The circuits of these installations go directly to local system panels. The local panels contain detector circuits for supervisory and alarm functions and trouble circuits for remote indication.

Circuits for annunciation are physically separated from those circuits that actuate the fire suppression systems. Detection of fire by any smoke or heat detector will activate an audible control room alarm with visual annunciation and printed record of event.

The source of water for the PBAPS fire protection system is Conowingo Pond. This source allows continuous operation of either pump as long as required. The fire pumps take suction from independent, isolatable intake wells. Check valves are installed at the pump discharges to prevent water from one source from being pumped into the other source.

There are two vertical turbine fire pumps, each rated for 2,500 gpm at 125 psig total head. The lead pump is electric-motor-driven, and the 100 percent capacity backup pump is diesel-engine-driven. The pumps and their controllers are UL-listed.

The system is capable of supplying water at the required pressure for the largest sprinkler flow plus 500 gpm.

The fire protection system is described in detail in PBAPS Fire Protection Program (FPP). License renewal boundary diagram references for the fire protection are LR-M-318 and LR-M-323.

Intended Functions within the Scope of License Renewal

Fire Protection (detection, suppression, containment, standby) - The fire protection system provides methods to detect, suppress, contain, and monitor fire events.

Component Groups Requiring Aging Management Review

Table 2.3.3-7 Component Groups Requiring Aging Management Review - Fire Protection System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Buried
Casting and Forging • Sprinkler Heads	• Pressure Boundary • Spray	Dry Gas
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Strainer Screens	• Pressure Boundary • Filter (Strainer Screens Only)	Fuel Oil
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor
Casting and Forging • Hydrants	• Pressure Boundary	Outdoor
Casting and Forging • Sprinkler Heads	• Pressure Boundary • Spray	Raw Water
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Hydrants	• Pressure Boundary	Raw Water
Casting and Forging • Pump Casings (External)	• Pressure Boundary	Raw Water
Casting and Forging • Strainer Screens	• Filter	Raw Water
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies	• Pressure Boundary	Sheltered

Table 2.3.3-7 Component Groups Requiring Aging Management Review - Fire Protection System (Continued)

Component Group	Component Intended Function	Environment
• Sprinkler Heads		
Elastomer • Flexible Hoses	• Pressure Boundary	Fuel Oil
Piping • Pipe	• Pressure Boundary	Buried
Piping • Pipe	• Pressure Boundary	Dry Gas
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Fuel Oil
Piping • Pipe	• Pressure Boundary	Outdoor
Piping • Pipe • Tubing	• Pressure Boundary	Raw Water
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Wetted Gas
Piping Specialties • Discharge Nozzles	• Pressure Boundary • Spray	Dry Gas
Piping Specialties • Strainer Bodies • Y Strainer Body	• Pressure Boundary	Dry Gas
Piping Specialties • Strainer Screens	• Filter	Dry Gas
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water
Piping Specialties • Strainer Bodies • Y Strainer Body • Discharge Nozzles • Restricting Orifice • Flow Elements • Metal Flex Connection	• Pressure Boundary	Sheltered
Piping Specialties • Metal Flex Connection	• Pressure Boundary	Wetted Gas
Vessel • Cardox Tank	• Pressure Boundary	Dry Gas

Table 2.3.3-7 Component Groups Requiring Aging Management Review - Fire Protection System (Continued)

Component Group	Component Intended Function	Environment
Vessel • Fuel Tank	• Pressure Boundary	Fuel Oil
Vessel • Cardox Tank • Fuel Tank • Muffler	• Pressure Boundary	Sheltered
Vessels • Muffler	• Pressure Boundary	Wetted Gas

Aging management review results for the fire protection system are provided in Section 3.3.7.

2.3.3.8 Control Room Ventilation System

System Description

The control room ventilation system is a safety-related system that is common to PBAPS, Units 2 and 3. The system consists of several subsystems: control room fresh air supply, control room emergency ventilation filter, control room air conditioning ventilation supply, and the control room return air system.

The system ensures the habitability of the control room even under the design basis events. The fresh air portion of the system is operable during the loss of offsite power. The fresh air intake is filtered when control room emergency ventilation is initiated to prevent iodine and particulate contamination of the control room air.

The system consists of normal and emergency ventilation supply fans, air conditioning supply and return fans, filters, heating coils and cooling coils, refrigerant water chillers, chilled water pumps, dampers, ductwork, instrumentation, and controls.

The control room fresh air supply system consists of two 100% capacity, redundant supply fans, roll filter, and preheat coil. The system is supplied with outside air from the outside air intake plenum.

The control room emergency ventilation filter system is a safety related system which consists of two 100% capacity filter units and redundant supply fans. Each filter unit consists of a charcoal filter and two banks of HEPA filters upstream and downstream of the charcoal filter.

The control room ventilation system is described in additional detail in UFSAR Section 10.13. License renewal boundary diagram reference for the control room ventilation system is LR-M-384.

Intended Functions within the Scope of License Renewal

Control Room Isolation and Filtration - The control room ventilation system provides isolation and filtration for the control room during accident conditions.

Ventilation - The system provides ventilation for the control room during normal, abnormal, accident, and post-accident conditions.

Component Groups Requiring Aging Management Review

Table 2.3.3-8 Component Groups Requiring Aging Management Review - Control Room Ventilation System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Elastomer • Filter Plenum Access Door Seals • Fan Flex Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Piping Specialties • Flow Elements	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Ducting • Damper Enclosures • Plenums • Fan Enclosures	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere

Aging management review results for the control room ventilation system are provided in Section 3.3.8.

2.3.3.9 Battery and Emergency Switchgear Ventilation System

System Description

The battery and emergency switchgear ventilation system consists of a common air supply system and separate exhaust systems. Outdoor air is filtered, conditioned by heating coils when required, and discharged by one of the two supply fans to the emergency switchgear and battery rooms of Units 2 and 3. One of the two emergency switchgear room return air fans exhaust air to atmosphere at the radwaste building roof or back to the suction of the supply fan as controlled by an air-operated damper. One of the two battery room exhaust fans discharges exhaust air from the battery rooms to atmosphere at the radwaste building roof. Loss of duct pressure automatically starts standby fans and sounds an alarm in the main control room.

The ventilation system is normally in operation and continues to operate during accident conditions including the loss of offsite power. All system controls are from a local panel. Redundant fans are provided for reliable system operation.

The battery and emergency switchgear ventilation system is described in additional detail in UFSAR Section 10.14. License renewal boundary diagram references for the battery and emergency switchgear ventilation system are LR-M-389 and LR-M-399.

Intended Functions within the Scope of License Renewal

Ventilation - The system provides ventilation to the emergency switchgear and battery rooms during normal, abnormal, and accident conditions.

Heating - The system provides room heating during all normal plant operating conditions and following a design basis event or accident. Heating is the recirculation of heated air with reduced air exchange with the outdoor environment.

Component Groups Requiring Aging Management Review

Table 2.3.3-9 Component Groups Requiring Aging Management Review - Battery and Emergency Switchgear Ventilation System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Elastomer • Fan Flex Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Piping • Tubing	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Bird Screens	• Filter	Outdoor, Ventilation Atmosphere
Sheet Metal • Exhaust Hoods	• Pressure Boundary	Outdoor, Ventilation Atmosphere
Sheet Metal • Ducting • Plenums • Damper Enclosures • Fan Enclosures	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere

Aging management review results for the battery and emergency switchgear ventilation system are provided in Section 3.3.9.

2.3.3.10 Diesel Generator Building Ventilation System

System Description

The diesel generator building ventilation system provides heating, cooling and ventilation for personnel comfort, for the diesel generators and associated equipment, and for the ESW booster pumps. The system provides ventilation and cooling to the emergency diesel generator rooms during normal plant operation and following design basis events. It supplies heating as required during normal operating conditions. The system also provides ventilation, cooling, and heating as required to the Cardox and ESW booster pump room during normal plant operating conditions.

Each emergency diesel generator room is provided with ventilation air supply fans and an exhaust relief damper. Combustion air for the diesel engine is taken from the room. The ventilation systems are supplied with power from the diesels during the loss of offsite power.

The diesel generator building ventilation system is discussed in further detail in UFSAR Section 10.14. License renewal boundary diagram reference for the diesel generator building ventilation system is LR-M-392.

Intended Functions within the Scope of License Renewal

Ventilation - The system provides ventilation to maintain an acceptable environment to support proper diesel generator operation during normal plant operating conditions and following design basis events.

Cooling - The system provides cooling to maintain an acceptable environment to support proper operation of the diesel generators and their associated equipment during normal plant operating conditions and following design basis events.

Component Groups Requiring Aging Management Review

Table 2.3.3-10 Component Groups Requiring Aging Management Review - Diesel Generator Building Ventilation System

Component Group	Component Intended Function	Environment
Elastomer • Fan Flex Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Ducting • Damper Enclosures • Fan Enclosures	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere

Aging management review results for the diesel generator building ventilation system are provided in Section 3.3.10.

2.3.3.11 Pump Structure Ventilation System

System Description

The emergency service water and high pressure service water compartment housing the high pressure service water pumps, emergency service water pumps, fire pumps, and service water screen wash pumps is provided with a ventilation supply and exhaust system in each of the two seismic Class I compartments. The pump structure ventilation system is supplied with standby power during the loss of offsite power. Redundant ventilation equipment is furnished in each compartment for uninterrupted service. Each pump room contains two safety related 100% capacity supply fans, two safety related 100% capacity exhaust fans, and one non-safety related steam unit heater.

Each pump room has a missile protected concrete air mixing box which contains an outdoor air damper and a return air damper. Air is exhausted to a missile protected concrete exhaust air plenum.

The pump structure ventilation system is described in detail in UFSAR Section 10.14. License renewal boundary diagram reference for the pump structure ventilation system is LR-M-392.

Intended Functions within the Scope of License Renewal

Ventilation - The system provides ventilation to maintain an acceptable environment to support proper ESW and HPSW pump operation during normal plant operating conditions and following design basis events.

Cooling - The system provides cooling to maintain an acceptable environment to support proper operation of the ESW and HPSW pumps and their associated equipment during normal plant operating conditions and following design basis events.

Component Groups Requiring Aging Management Review

Table 2.3.3-11 Component Groups Requiring Aging Management Review - Pump Structure Ventilation System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Elastomer • Flex Hose Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Piping • Tubing	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Ducting • Damper Enclosures • Fan Enclosures	• Pressure Boundary	Sheltered, Ventilation Atmosphere
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere
Sheet Metal • Bird Screens	• Filter	Ventilation Atmosphere, Outdoor

Aging management review results for the pump structure ventilation system are provided in Section 3.3.11.

2.3.3.12 Safety Grade Instrument Gas System

System Description

The safety grade instrument gas (SGIG) system supplies pressurized nitrogen gas from the containment atmospheric dilution tank as a backup to normal instrument air. The safety grade pneumatic supply is isolated from the non-safety grade portion of the air supply by spring-loaded, soft-seat, check valves designed for zero leakage.

Following a LOCA coincident with a loss of instrument air, the SGIG system supplies pressurized nitrogen gas as a backup pneumatic source to the containment atmospheric control purge and vent isolation valves, torus to secondary containment vacuum breakers and the containment atmospheric dilution vent control valves.

A detailed description of the safety grade instrument gas system is provided in UFSAR Sections 5.2 and 10.17. License renewal boundary diagram references for the safety grade instrument gas system are LR-M-367 and LR-M-372.

Intended Functions within the Scope of License Renewal

Backup Nitrogen Supply - The safety grade instrument gas system provides a backup nitrogen supply to safety related pneumatically operated components.

Component Groups Requiring Aging Management Review

Table 2.3.3-12 Component Groups Requiring Aging Management Review - Safety Grade Instrument Gas System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Dry Gas
Piping • Pipe	• Pressure Boundary	Sheltered, Dry Gas
Piping Specialties • Flexible Hoses	• Pressure Boundary	Sheltered, Dry Gas

Aging management review results for the safety grade instrument gas system are provided in Section 3.3.12.

2.3.3.13 Backup Instrument Nitrogen to ADS System

System Description

The backup instrument nitrogen to ADS system consists of a split ring header with a seismic Category I bottle rack, three nitrogen bottles located in the reactor building, seismic Category I piping and valves, and an external nitrogen connection located outside the reactor building at ground level. The split ring header supplies five ADS valves, three from one section of the header, and two from the other section.

The backup instrument nitrogen to the automatic depressurization system (ADS) supplies a safety related pneumatic supply of nitrogen to the ADS valves in the event that the instrument nitrogen system is unavailable or inoperable. Short-term ADS operation is provided by locally mounted accumulators on each ADS valve which supply sufficient pneumatic pressure for two valve actuations at 70% of drywell design pressure.

The backup instrument nitrogen to ADS system also supports ADS in its emergency core cooling and residual heat removal capacity by providing a safety related pneumatic supply capable of sustaining ADS operation for 100 days post-LOCA.

A long-term, backup, safety grade pneumatic nitrogen supply has been provided to selected safety relief valves. This pneumatic supply is provided to enable remote operation of the above valves for a period of 72 hours following a design basis fire in fire areas that have been postulated to render the ADS valves available for only short-term operation. The source of the pneumatic nitrogen supply is the safety grade instrument gas that is tied into the liquid nitrogen tank that supplies the containment atmospheric dilution system.

A description of the backup instrument nitrogen system is provided in UFSAR Sections 4.4 and 10.17. License renewal boundary diagram references for the backup instrument nitrogen to the ADS are LR-M-333 and LR-M-351.

Intended Functions within the Scope of License Renewal

Backup Nitrogen Supply - Backup instrument nitrogen to the ADS supplies a long-term, back-up, safety grade supply of nitrogen to the five ADS valves during all normal plant operating and accident conditions.

Component Groups Requiring Aging Management Review

Table 2.3.3-13 Component Groups Requiring Aging Management Review - Backup Instrument Nitrogen to ADS

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Dry Gas
Piping • Pipe	• Pressure Boundary	Sheltered, Dry Gas
Piping Specialties • Flexible Hoses • Flow Element	• Pressure Boundary	Sheltered, Dry Gas
Vessel • Accumulators	• Pressure Boundary	Sheltered, Dry Gas

Aging management review results for the backup instrument nitrogen to the ADS are provided in Section 3.3.13.

2.3.3.14 Emergency Cooling Water System

System Description

The emergency cooling water (ECW) system provides a reliable back-up source of cooling water to the emergency service water and high pressure service water systems when the circulating water pump structure is isolated from the normal heat sink, the Conowingo Pond. The source of water for the ECW system is the Emergency Cooling Tower, which includes the reservoir, which is described in Section 2.4.5.

The ECW system is designed to remove, via the ESW and HPSW systems, the sensible and decay heat from the reactor primary and auxiliary systems so that the reactor can be shutdown in the event of the unavailability of the normal heat sink.

The ECW system consists of one ECW pump, two ESW booster pumps, three emergency cooling tower fans in an induced draft three-cell cooling tower with integral storage reservoir and associated discharge and distribution piping.

When the normal heat sink is lost, or when flooding occurs, sluice gates in the circulating water pump structure are closed. Water is provided through two gravity fed lines from the emergency cooling tower basin into the circulating water pump structure. The ECW pump in conjunction with the ESW booster pump and HPSW pumps, supply cooling water to heat exchangers required to bring Units 2 and 3 to safe shutdown. Return water from the HPSW flows to the emergency cooling tower. Return water from the ESW system flows through one of the two ESW booster pumps and is pumped into the emergency cooling tower.

The emergency cooling water system is discussed in additional detail in UFSAR Section 10.24. License renewal boundary diagram reference for the emergency cooling water system is LR-M-330.

Intended Functions within the Scope of License Renewal

Component Cooling - The ECW (including the emergency cooling tower) system provides cooling water flow to transfer heat from the ESW and HPSW systems during the mitigation of a flood or loss of the normal heat sink, the Conowingo Pond.

Back-up Cooling - The ECW system is available to provide a reliable back-up source of cooling water to the ESW system during normal plant operation in the unlikely event of failure of the ESW pumps.

Component Groups Requiring Aging Management Review

Table 2.3.3-14 Component Groups Requiring Aging Management Review - Emergency Cooling Water System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Raw Water, Sheltered
Casting and Forging • Pump Casings (External)	• Pressure Boundary	Raw Water
Piping • Pipe	• Pressure Boundary	Buried, Outdoor
Piping • Pipe • Tubing	• Pressure Boundary	Raw Water, Sheltered
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water, Sheltered

Aging management review results for the emergency cooling water system are provided in Section 3.3.14.

2.3.3.15 Condensate Storage System

System Description

The condensate storage system is the preferred water supply for the high pressure coolant injection system (HPCI) and the reactor core isolation cooling system (RCIC). The system also provides plant system makeup needs, receives reject flow, and provides condensate for any continuous service needs.

The system consists of two 200,000 gallon capacity (one for each unit), carbon steel condensate storage tanks, two condensate transfer pumps, a condensate transfer system keep full pump, and associated piping and valves necessary to complete required system functions. The condensate storage system is common to both units at PBAPS. Although the condensate storage system is non-safety related, it supplies the HPCI and RCIC systems during fire safe shutdown and station blackout scenarios.

Additional information pertaining to the condensate storage system is found in UFSAR Sections 4.7 and 6.4. License renewal boundary diagram reference for the condensate storage system is LR-M-309.

Intended Functions within the Scope of License Renewal

Water Storage and Supply - The condensate storage system supports HPCI and RCIC Systems during fire safe shutdown and station blackout events by providing a water supply and a means for its storage.

Component Groups Requiring Aging Management Review

Table 2.3.3-15 Component Groups Requiring Aging Management Review - Condensate Storage System

Component Groupings	Component Intended Function	Environment
Casing and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor, Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water
Piping • Pipe	• Pressure Boundary	Outdoor
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Vessel • Condensate Storage Tanks	• Pressure Boundary	Condensate Storage Water
Vessel • Condensate Storage Tanks	• Pressure Boundary	Outdoor
Vessel • Condensate Storage Tanks (Tank Nozzles)	• Pressure Boundary	Outdoor

Aging management review results for the condensate storage system are provided in Section 3.3.15.

2.3.3.16 Emergency Diesel Generator

System Description

Four emergency diesel generators (EDGs) supply independent standby AC power to Units 2 and 3. Each EDG set consists of a diesel engine, a generator, and auxiliary systems (starting air, fuel oil, jacket cooling, air coolant, and lubricating oil). Each EDG is connected to one 4kV Class 1E emergency bus per unit. The 4kV emergency switchgear bus distributes AC power to engineered safeguard and selected non-safeguard systems. Power provided to engineered safeguard loads is divided into four safeguard channels, "A" through "D", for each unit so that the failure of one diesel generator or one 4kV emergency bus will not prevent a safe shutdown of either unit.

Each EDG is automatically started on loss of offsite power, low reactor water level, or high drywell pressure signals. The EDGs are connected to the 4kV emergency buses upon a loss of offsite power after generator voltage and frequency are established.

The EDGs are housed in a seismic Class I, watertight diesel generator enclosure. Each unit is enclosed in its own concrete cell and is isolated from the other units. The building location is separate from the power block.

The emergency diesel generator and standby AC distribution system is discussed in detail in UFSAR Section 8.5. License renewal boundary diagram reference for the EDG system is LR-M-377.

Intended Functions within the Scope of License Renewal

Provide Emergency AC Power - The EDG sets provide Class 1E electrical power to the emergency buses in a Loss of Off-site power (LOOP) condition or a LOCA coincident with LOOP condition.

Support Offsite Power Transfer - The EDG sets are used to support the transfer of power from one offsite safeguard source to another by providing a parallel source of AC power to the emergency buses during the transfer operation.

Component Groups Requiring Aging Management Review

Table 2.3.3-16 Component Groups Requiring Aging Management Review - Emergency Diesel Generator

Component Group	Component Intended Function	Environment
Casting and Forging • Pump Casings • Valve Bodies	• Pressure Boundary	Closed Cooling Water

Table 2.3.3-16 Component Groups Requiring Aging Management Review - Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies	• Pressure Boundary	Lubricating and Fuel Oil
Casting and Forging • Strainer Screens	• Filter	Lubricating and Fuel Oil
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor
Casting and Forging • Pump Casings • Valve Bodies • Strainer Bodies	• Pressure Boundary	Sheltered
Casting and Forging • Strainer Screens	• Filter	Wetted Gas
Casting and Forging • Valve Bodies • Strainer Bodies	• Pressure Boundary	Wetted Gas
Elastomer • Flexible Hoses	• Pressure Boundary	Closed Cooling Water
Elastomer • Flexible Hoses	• Pressure Boundary	Lubricating and Fuel Oil
Elastomer • Flexible Hoses	• Pressure Boundary	Sheltered
Elastomer • Flexible Hoses	• Pressure Boundary	Wetted Gas
Heat Exchanger • EDG Jacket Coolant Coolers	• Pressure Boundary • Heat Transfer	Closed Cooling Water, Raw Water
Heat Exchanger • EDG Air Coolant Coolers	• Pressure Boundary • Heat Transfer	Closed Cooling Water, Raw Water
Heat Exchanger • EDG Lube Oil Coolers	• Pressure Boundary • Heat Transfer	Lubricating Oil, Raw Water
Heat Exchanger • EDG Jacket Coolant Coolers • EDG Air Coolant Coolers • EDG Lube Oil Coolers	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Buried
Piping • Pipe • Tubing	• Pressure Boundary	Closed Cooling Water
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Lubricating and Fuel Oil

Table 2.3.3-16 Component Groups Requiring Aging Management Review - Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment
Piping • Pipe	• Pressure Boundary	Outdoor
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered
Piping • Pipe	• Pressure Boundary	Wetted Gas
Piping Specialties • Thermowells	• Pressure Boundary	Closed Cooling Water
Piping Specialties • Thermocouple Cap	• Pressure Boundary	Closed Cooling Water
Piping Specialties • Restricting Orifices • Expansion Joints	• Pressure Boundary	Closed Cooling Water
Piping Specialties • Expansion Joints • Thermowells • Thermowell Caps • Restricting Orifices • Drain Traps	• Pressure Boundary	Sheltered
Piping Specialties • Drain Traps • Expansion Joints	• Pressure Boundary	Wetted Gas
Vessel • Fuel Oil Storage Tank	• Pressure Boundary	Buried, Fuel Oil
Vessel • Expansion Tank	• Pressure Boundary	Closed Cooling Water
Vessel • Fuel Oil Day Tank	• Pressure Boundary	Fuel Oil
Vessel • Lubricating Oil Tank	• Pressure Boundary	Lubricating Oil
Vessel • Lubricating Oil Tank • Expansion Tank • Fuel Oil Day Tank • Air receivers • Silencers	• Pressure Boundary	Sheltered
Vessel • Air Receivers • Silencers	• Pressure Boundary	Wetted Gas

Aging management review results for the emergency diesel generator are provided in Section 3.3.16.

2.3.3.17 Suppression Pool Temperature Monitoring System

System Description

The suppression pool temperature monitoring system (SPOTMOS) provides indication of the individual and average bulk torus water temperature in the control room to ensure torus water is maintained within specified temperature limits. The system also provides indication of torus water temperature to the remote shutdown panel and the high pressure coolant injection alternative control station for remote indication when the control room is not accessible.

The SPOTMOS consists of two independent divisionalized monitoring systems. Each system consists of temperature sensors and a processing unit to display temperature in the control room.

Within each divisionalized system, SPOTMOS is capable of providing individual as well as the average of the temperature sensor indications. For each division, only one of the dual elements for each sensor is permanently connected. The remaining elements are not permanently connected and are provided as installed spares.

The SPOTMOS is normally energized and is supplied from independent divisionalized Class 1E power sources.

The suppression pool temperature monitoring system is discussed in UFSAR Section 7.20.4.7. License renewal boundary diagram reference for the SPOTMOS is LR-M-361.

Intended Functions within the Scope of License Renewal

Torus Water Temperature Monitoring - The suppression pool temperature monitoring system provides indication of the individual and average bulk torus water temperature in the control room to ensure torus water is maintained within specified temperature limits.

Component Groups Requiring Aging Management Review

Table 2.3.3-17 Component Groups Requiring Aging Management Review - Suppression Pool Temperature Monitoring System

Component Group	Component Intended Function	Environment
• Penetration Sleeves (Thermowells)	• Pressure Boundary • Fission Product Barrier	Torus Water, Sheltered

Aging management review results for the suppression pool temperature monitoring system are provided in Section 3.3.17.

2.3.3.18 Cranes and Hoists

System Description

The reactor building cranes, as well as cranes such as the four emergency diesel generator building cranes and hoists in proximity of safety systems, structures, and components are within the scope of this system.

Safety related cranes and hoists in proximity of safety systems, structures, and components (SSCs), are designed and analyzed to perform tasks so as not to prevent the SSCs from performing their safety related function.

The reactor building crane for each unit is designed such that no credible postulated failure of any crane component will result in the dropping of the fuel cask; therefore, the consequences of this accident are precluded.

Additional information pertaining to cranes and hoists is found in UFSAR Sections 10.3, 10.4, 12.2, 14.4, and UFSAR Appendix C.

Intended Functions within the Scope of License Renewal

Prevent Fuel Cask Drop Accident - The reactor building crane is designed to lift and transport spent fuel cask such that no credible postulated failure of any crane component will result in the dropping of the cask.

Heavy Loads - The reactor building cranes support single failure proof criteria for lifting heavy loads over fuel in the reactor pressure vessel or over the spent fuel pool.

Structural Integrity - Cranes and hoists are required to maintain their structural integrity while they travel above or in proximity of safety related SSCs.

Component Groups Requiring Aging Management Review

Table 2.3.3-18 Component Groups Requiring Aging Management Review - Cranes and Hoists

Component Group	Component Intended Function	Environment
Cranes and Hoists • Circulating Water Pump Structure Crane 35 Ton Gantry (Structural Members, Rails, Rail Clips, and Rail Bolts)	• Structural Support to Non-S/R Components	Outdoor
Cranes and Hoists • Reactor Building Overhead Bridge Cranes (Rails, Rail Clips and Rail Bolts)	• Structural Support • Structural Support to Non-S/R Components	Sheltered
Cranes and Hoists • Other Cranes and Hoists (Rails, Monorail Flanges, Rail Clips, and Rail Bolts)	• Structural Support to Non-S/R Components	Sheltered

Aging management review results for cranes and hoists are provided in Section 3.3.18.

2.3.4 Steam and Power Conversion Systems

2.3.4.1 Main Steam System

System Description

The main steam system conducts steam from the reactor vessel through the primary containment to the steam turbine over the full range of reactor power operation. Four steam lines are utilized between the reactor and the main turbine. The use of multiple lines permits turbine stop valve and main steam line isolation valve tests during plant operation with a minimum amount of load reduction. Each main steam line up to and including the main steam line isolation valve external to the primary containment is seismic Class I.

The main steam system provides steam on demand to the high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) system turbines via the "B" and "C" main steam lines, respectively.

Overpressure protection of the reactor pressure vessel is provided via the main steam safety relief valves (SRVs) and safety valves (SVs). This function ensures the integrity of the reactor coolant pressure boundary and associated piping. The capability to depressurize the reactor vessel via the automatic depressurization system (ADS) designated SRVs during all normal plant operating conditions and following a design basis event allows the operation of the low pressure ECCS systems should they be required.

The five safety relief valves designated to fulfill the ECCS function, in conjunction with the ADS logic, ensure that the low pressure ECCS systems provide adequate core cooling during accident and post accident conditions in the event that the high pressure coolant injection systems are unavailable or unable to maintain level in the vessel.

The main steam system operates in conjunction with the primary containment isolation system to mitigate the consequences of accidents which could result in potential offsite exposure due to a breach of the main steam system. The main steam isolation valves (MSIVs) will close on signals indicative of a LOCA or leak in the main steam system to containment. The main steam line flow restrictors limit maximum steam flow under assumed accident conditions of a steam line rupture to a value which ensures that the steam dryer in the reactor vessel remains in place. This feature ensures that fragments from the dryer will not be blown into the steam lines preventing tight closure of the MSIVs. This function also serves to limit steam line flow during a steam line rupture outside of primary containment until the MSIVs can close, thereby limiting potential radioactive release.

The main steam system also allows for a path for alternate shutdown cooling in the event that the shutdown cooling mode of the RHR system cannot be established. This is accomplished by closure of the main steam isolation valves, raising the reactor vessel level to the main steam lines, and using no more than two ADS SRVs for low pressure liquid discharge to the suppression pool, and one or more RHR loops operating in the suppression pool cooling mode of the system.

Post accident containment, holdup and plateout of MSIV bypass leakage is credited in accident analyses when calculating airborne activities. Plateout of elemental and particulate iodine is credited in steam line piping and the main condenser.

The main steam system is described in detail in UFSAR Sections 4.4, 4.11, 6.4.2, and 14.9. License renewal boundary diagram references for the main steam system are LR-M-303, LR-M-304, LR-M-306, LR-M-308, LR-M-331, and LR-M-351.

Intended Functions within the Scope of License Renewal

Deliver steam to HPCI and RCIC systems - The main steam system provides steam to the HPCI and RCIC systems via the "B" and "C" main steam lines, respectively.

Overpressure Protection of the RPV - This function ensures the integrity of the reactor coolant pressure boundary and associated piping via SRVs and SVs.

RPV Depressurization - This function utilizes the ADS designated SRVs to accommodate operation of the low-pressure ECCS systems should they be required.

Containment Isolation - This function uses the primary containment isolation system to mitigate the consequences of accidents that could result in potential offsite exposure due to a breach of the main steam system.

Limit steam line flow - This function limits potential radioactive release by restricting steam flow during a steam line rupture outside of primary containment. Flow is also limited to ensure integrity of dryers in order to prevent restriction of MSIV closure.

Steam flow measurement – The main steam system provides main steam flow input to PCIS.

Alternate shutdown cooling - This function provides for core cooling in the event that the normal shutdown cooling flow path cannot be established.

Post accident containment, holdup and plateout of MSIV bypass leakage - The main steam system provides for post accident containment, holdup and plateout of MSIV bypass leakage.

Component Groups Requiring Aging Management Review

Table 2.3.4-1 Component Groups Requiring Aging Management Review - Main Steam System

Component Group	Component Intended Function	Environment
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas
Piping • Pipe	• Pressure Boundary	Dry Gas
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Steam
Piping • SRV Tailpipe	• Pressure Boundary	Torus Grade Water
Piping • SRV Tailpipe	• Pressure Boundary	Torus Grade Water (Gas Interface)
Piping • Pipe • Pipe (RPV Head Flange Leakoff)	• Pressure Boundary	Wetted Gas
Piping Specialties • Dashpot	• Pressure Boundary	Dry Gas
Piping Specialties • Flexible Hoses	• Pressure Boundary	Dry Gas
Piping Specialties • Flow Elements • Dashpot • Y Strainer • Condensing Chamber • Restricting Orifice • Flexible Hoses	• Pressure Boundary	Sheltered

Table 2.3.4-1 Component Groups Requiring Aging Management Review - Main Steam System (Continued)

Component Group	Component Intended Function	Environment
Piping Specialties • Flow Elements (body) • Y Strainer • Condensing Chambers	• Pressure Boundary	Steam
Piping Specialties • Flow Elements (throat)	• Throttle	Steam
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam
Piping Specialties • Spargers	• Spray	Torus Grade Water
Piping Specialties • Restricting Orifice (RPV Head Flange Leakoff**)**	• Pressure Boundary • Throttle	Wetted Gas
Vessel • Accumulators	• Pressure Boundary	Dry Gas, Sheltered

Aging management review results for the main steam system are provided in Section 3.4.1.

2.3.4.2 Main Condenser

System Description

The main condenser provides a heat sink for the turbine exhaust steam, turbine bypass steam, and other flows. It also deaerates and stores the condensate for reuse after a period of radioactive decay. Additionally, the main condenser provides for post accident containment, holdup and plateout of main steam isolation valve (MSIV) bypass leakage.

The main condenser is a single pass, single pressure, deaerating type with a reheating deaerating hotwell and divided waterboxes. The condenser consists of three sections, each section located below the low-pressure elements of the turbine, with the tubes oriented transverse to the turbine-generator axis. The steam exhausts directly down into the condenser shells through exhaust openings in the bottom of each low-pressure turbine casing. The condensers also receive steam from the reactor feed pump turbines.

PBAPS accident analyses evaluated MSIV bypass leakage as part of primary containment leakage. This is treated as a ground level release, with credit for holdup and plateout (elemental and particulate iodine only) in steam line piping and the condenser. This leakage is to the condenser, which is assumed to leak at one percent of volume per day.

Additional information pertaining to the main condenser is found in UFSAR Sections 11.3 and 14.9. License renewal boundary diagram reference for the main condenser is LR-M-303.

Intended Functions within the Scope of License Renewal

Post accident containment, holdup and plateout of MSIV bypass leakage - The main condenser provides for post accident containment, holdup and plateout of MSIV bypass leakage.

Component Groups Requiring Aging Management Review

Table 2.3.4-2 Component Groups Requiring Aging Management Review - Main Condenser

Component Group	Component Intended Function	Environment
Main Condenser (Waterbox)	• Containment, Holdup and Plateout	Raw Water
Main Condenser (Shell, Feedwater Heater Shell, Nozzles, Expansion Joint)	• Containment, Holdup and Plateout	Sheltered
Main Condenser (Feedwater Heater Shell) (Drain Cooler Shell)	• Containment, Holdup and Plateout	Steam
Main Condenser (Nozzles)	• Containment, Holdup and Plateout	Steam
Main Condenser (Expansion Joint)	• Containment, Holdup and Plateout	Steam
Main Condenser (Shell)	• Containment, Holdup and Plateout	Steam, Reactor Coolant
Main Condenser (Tubes) (Tubesheet)	• Containment, Holdup and Plateout	Steam, Raw Water

Aging management review results for the main condenser are provided in Section 3.4.2.

2.3.4.3 Feedwater System

System Description

The feedwater system is safety related from the outermost primary containment isolation valve to the reactor pressure vessel (RPV). The portion of the feedwater system from the inlet of the drain cooler up to, but not including, the outermost primary containment isolation valve is non-safety related.

During normal plant operation, the feedwater system receives its supply of water from the outlet of the condensate demineralizers. The system consists of three feedwater heater strings (with cascading drains) connected in parallel, each consisting of five low pressure feedwater heaters and one drain cooler in series. The feedwater heaters receive steam from the main turbine system and preheat feedwater prior to entering the reactor feed pumps, thus increasing the heat cycle efficiency. The outlets of the three heater strings are cross-connected and provide a common suction header for the three reactor feed pumps. The reactor feed pumps are mounted in parallel with each having an individual suction valve, discharge check valve, and discharge valve. The reactor feed pumps discharge to a common discharge header that connects to two feedwater headers. These two feedwater headers contain inboard and outboard containment isolation valves. Inside containment, these two feedwater headers each split into three piping runs for a total of six, which then go to the RPV. The feedwater system provides the injection path for HPCI and RCIC during transient and accident conditions. HPCI and RCIC join the feedwater system outside the primary containment. Flow is then channeled through the feedwater piping to the RPV.

The feedwater system is discussed in further detail in UFSAR Sections 4.11, 7.10, and 11.8. License renewal boundary diagram references for the feedwater system are LR-M-308 and LR-M-351.

Intended functions within the Scope of License Renewal

HPCI and RCIC Injection - The feedwater system provides an injection path into the RPV for both HPCI and RCIC during transient or accident conditions.

Primary Containment Isolation - The feedwater system provides primary containment isolation to prevent primary containment leakage under transient and accident conditions.

Component Groups Requiring Aging Management Review

Table 2.3.4-3 Component Groups Requiring Aging Management Review - Feedwater System

Component Group	Component Intended Function	Environment
Casting and Forging • Valves	• Pressure Boundary	Reactor Coolant, Sheltered
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant, Sheltered
Piping Specialties • Flow Elements • Thermowell	• Pressure Boundary	Reactor Coolant, Sheltered

Aging management review results for the feedwater system are provided in Section 3.4.3.

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES AND COMPONENT SUPPORTS

The structure scoping and screening results consist of lists of components and component groups that require aging management review, arranged by structure. Brief descriptions of structures within the scope of license renewal are provided as background information. Structure intended functions are provided for in-scope structures. For each in-scope structure, components or component groups requiring an aging management review are provided.

In addition to the structures within the scope of license renewal presented in this section, several structural component groups, such as component supports, were evaluated as commodities. Commodity groups were determined based upon similar design or similar materials and similar environments.

For each of the structures within the scope of license renewal, this section provides the following information:

- A general description of the structure,
- The intended functions of the structure within the scope of license renewal,
- A reference to the applicable UFSAR section,
- A reference to the applicable license renewal boundary diagrams,
- A listing of the components or component groups that require aging management review, associated component intended functions and environments.

A discussion of component groups, component intended functions and environments is provided in Section 3.0.

For each structure, the tables are sorted by component group and then by environment.

For each of the structural commodities, this section provides the following information:

- A general description of the commodity,
- A listing of the components or component groups that require aging management review, associated component intended functions and environments.

Section 3.5 provides the results of the aging management reviews for the component groups in each of these structures and commodities.

2.4.1 Containment Structure

Structure Description

The containment structure consists of the primary containment of each unit and internal structural steel. The primary containment of each unit is of the Mark I design that consists of a drywell, a suppression chamber in the shape of a torus, and a connecting vent system between the drywell and the suppression chamber. The containment structure is part of a "multibarrier" system with a primary barrier consisting of the primary containment with its pressure suppression system, and a secondary barrier consisting of the reactor building with a system to limit the ground level release of airborne radioactive material from the secondary containment.

The containment structure contains the released steam in the event of the design basis LOCA to limit the release to the reactor building of fission products associated with this accident.

The containment structure is an enclosure for the reactor vessel, the reactor coolant recirculation system, and other branch connections of the reactor coolant system. It includes a drywell and connected pressure suppression chamber, isolation valves, vacuum breakers, containment cooling systems, and other service equipment. The drywell is a steel pressure vessel in the shape of a light bulb, and the pressure suppression chamber is a torus-shaped steel pressure vessel located below and encircling the drywell. The primary containment is a seismic Class I structure. The drywell is enclosed in reinforced concrete for shielding purposes.

The stiffened pressure suppression chamber is a steel pressure vessel in the shape of a torus. It contains approximately 125,000 cu ft of water and has a gas space volume above the pool. The suppression chamber is supported on braced vertical columns to carry its loading to the reinforced concrete foundation slab of the reactor building.

Internal structural steel is provided at various elevations of the primary containment drywell and the pressure suppression chamber. The internal structural steel provides structural support to safety related and non-safety related systems and equipment inside the primary containment drywell. It also provides personnel access to the equipment for maintenance and testing.

The containment structure is further discussed in UFSAR Sections 5.2, 14.6, and Appendix M.3. License renewal boundary diagram reference for the containment structure is LR-S-001.

Intended Functions within the Scope of License Renewal

Primary Containment - The primary containment provides an essentially leak tight fission product barrier.

Primary Containment Pressure Suppression - The containment structure supports pressure suppression by providing the following:

1. LOCA vent system steam discharge pressure suppression
2. Steam discharge pressure suppression
3. Suppression pool water inventory and supply

Physical Support - The containment structure provides physical support for safety related and non-safety related systems and equipment during normal, and abnormal loading conditions.

Component Groups Requiring Aging Management Review

Table 2.4-1 Component Groups Requiring Aging Management Review - Containment Structure

Component Group	Component Intended Function	Environment
Reinforced Concrete • Reactor Pedestal • Foundation • Floor Slab	• Structural Support • Shelter, Protection and/or Radiation Shielding	Sheltered
Unreinforced Concrete • Sacrificial Shield Wall	• Shelter, Protection and/or Radiation Shielding	Sheltered
Drywell • Shell • Head	• Pressure Boundary • Structural Support • Shelter, Protection and/or Radiation Shielding • Fission Product Barrier	Sheltered
Drywell • CRD Removal Hatch • Equipment Hatch • Personnel Airlock • Access Manhole and Inspection Ports • Penetrations	• Pressure Boundary • Fission Product Barrier	Sheltered
Drywell • Penetration Bellows	• Pressure Boundary • Fission Product Barrier	Sheltered
Drywell • Gaskets, O-Rings and Packing Materials	• Pressure Boundary	Sheltered

Table 2.4-1 Component Groups Requiring Aging Management Review - Containment Structure (Continued)

Component Group	Component Intended Function	Environment
Pressure Suppression Chamber • Shell	• Pressure Boundary • Structural Support • Fission Product Barrier	Sheltered, Torus Water
Pressure Suppression Chamber • Ring Girders	• Structural Support	Sheltered, Torus Water
Pressure Suppression Chamber • Column and Saddle Supports • Seismic Restraints	• Structural Support	Sheltered
Pressure Suppression Chamber • Lubrite Plates	• Structural Support	Sheltered
Pressure Suppression Chamber • Access Hatches	• Pressure Boundary • Fission Product Barrier	Sheltered
Pressure Suppression Chamber • Penetrations	• Pressure Boundary • Fission Product Barrier	Sheltered, Torus Water
Pressure Suppression Chamber • Elastomers (Gaskets)	• Pressure Boundary	Sheltered
Vent System • Vent Lines • Vent Line Bellows	• Pressure Boundary • Fission Product Barrier	Sheltered
Vent System • Header and Downcomers	• Pressure Boundary	Sheltered, Torus Water
Vent System • Downcomer Bracing • Vent System Supports	• Structural Support	Sheltered, Torus Water
Structural Steel • Reactor Vessel Pedestal Steel • Sacrificial Shield Wall Steel • Sacrificial Shield Wall Stabilizer • Radial Beam Seats • Lubrite Plates	• Structural Support	Sheltered
Structural Steel • Jet Impingement Shields	• HELB Shielding	Sheltered
Structural Steel • Pipe Whip Restraints	• Pipe Whip Restraint	Sheltered
Structural Steel • Missile Barriers	• Missile Barrier	Sheltered
Structural Steel • Radiation Shields	• Shelter, Protection and/or Radiation Shielding	Sheltered

Aging management review results for the containment structure are provided in Section 3.5.1.

2.4.2 Reactor Building Structure

Structure Description

The reactor building, for each unit, is a seismic Class I structure completely enclosing the primary containment and auxiliary systems of the nuclear steam supply system, and housing the associated spent fuel storage pool, dryer and separator storage pool, and reactor well. The building is a reinforced concrete structure from its foundation floor to its refueling floor. Above this floor, the building superstructure consists of metal siding and roof decking supported on structural steel framework. The foundation of the building consists of a reinforced concrete mat supported on rock. This mat also supports the primary containment and its internals, including the reactor vessel pedestal. The exterior and some interior walls of the building above the foundation are cast-in-place concrete. Other interior walls are normal weight concrete block walls. Floor slabs of the buildings are of composite construction with cast-in-place concrete over structural steel beams and metal floor deck. The thickness of walls and slabs were governed by structural requirements or shielding requirements.

The steel-framed superstructure is cross-braced to withstand wind and earthquake forces, supports metal siding, metal roof deck, and roofing. The frame also supports a runway for the 125-ton traveling reactor building crane.

The reactor building is further discussed in UFSAR Section 12.2 and Appendix C. License renewal boundary diagram reference for the reactor building is LR-S-001.

Intended functions within the Scope of License Renewal

Physical Support - The reactor building provides physical support for safety related and non-safety related systems and equipment during normal, severe environmental, extreme environmental and abnormal loading conditions.

Protection - The reactor building provides protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Containment - The reactor building provides a secondary containment boundary to contain any release of radioactive material outside the primary containment.

Fire Protection - The reactor building provides rated fire barriers or retards a fire from spreading to adjacent areas of the plant.

Storage - The spent fuel pool portion of the reactor building provides storage for spent fuel, new fuel, and spent fuel storage cask.

Water Volume - The spent fuel pool holds the volume of water necessary for shielding, cooling, and reactivity control during normal plant operation.

Reactivity Management - The spent fuel storage racks maintain spent fuel in subcritical configuration having a k(eff) less than or equal to 0.95.

Component Groups Requiring Aging Management Review

Table 2.4-2 Component Groups Requiring Aging Management Review - Reactor Building Structure

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission Product Barrier • Missile Barrier • HELB Shielding • Structural Support to Non-S/R Components • Contain Fluids	Buried, Outdoor, Sheltered
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • HELB Shielding • Structural Support to Non-S/R Components	Sheltered
Fuel Pool Liner	• Pressure Boundary	Sheltered, Fuel Pool Water
Fuel Pool Gates	• Pressure Boundary	Sheltered, Fuel Pool Water
Fuel Storage Racks	• Structural Support	Fuel Pool Water
Boraflex Absorbers	• Absorb Neutrons	Fuel Pool Water
Component Supports	• Structural Support	Fuel Pool Water
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered

Table 2.4-2 Component Groups Requiring Aging Management Review - Reactor Building Structure (Continued)

Component Group	Component Intended Function	Environment
Structural Steel • Pipe Whip Restraints	• Pipe Whip Restraint	Sheltered
Structural Steel • Missile Barrier	• Missile Barrier	Sheltered
Structural Steel • Metal Siding	• Fission Product Barrier	Outdoor
Structural Steel • Roof Deck	• Fission Product Barrier	Sheltered
Structural Steel • Blowout Panels	• Fission Product Barrier • Over-Pressure Protection	Sheltered, Outdoor

Aging management review results for the reactor building structure are provided in Section 3.5.2.

2.4.3 Radwaste Building and Reactor Auxiliary Bay

Structure Description

The radwaste building and reactor auxiliary bay are connected to the control room and are located between the two reactor buildings. This complex is designed as a seismic Class I structure. Though located between the reactor buildings, the radwaste building is structurally separated from them. The radwaste building houses various components of the radwaste system, the standby gas treatment system, and associated equipment. It also houses the recirculation system motor generator sets for the two units of the power plant, along with the heating and ventilating equipment for the radwaste building and the main control room. The adjoining reactor auxiliary bay houses HPCI and RCIC turbine pumps, and RHR equipment.

The building is founded on rock with a reinforced concrete mat. All walls except the west wall are concrete up to the roof. The west wall consists of concrete and metal siding for its full height.

The HPCI and RCIC equipment is protected by concrete walls and floor slabs for protection from floods, missiles, and tornados.

The heating and ventilating equipment located at elevation 165 ft. is considered essential for a safe shutdown of the plant, and thus is protected from tornado missiles.

The radwaste building and reactor auxiliary bay are discussed in additional detail in UFSAR Section 12.2 and Appendix C. License renewal boundary diagram reference for the radwaste building and reactor auxiliary bay is LR-S-001.

Intended functions within the Scope of License Renewal

Physical Support - The radwaste building and reactor auxiliary bay provide physical support for safety related and non-safety related systems and equipment during normal, severe environmental, extreme environmental, and abnormal loading conditions.

Protection - The radwaste building and reactor auxiliary bay provide protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Fire Protection - The radwaste building and reactor auxiliary bay provide rated fire barriers or retard a fire from spreading to adjacent areas of the plant.

Component Groups Requiring Aging Management Review

Table 2.4-3 Component Groups Requiring Aging Management Review - Radwaste Building and Reactor Auxiliary Bay

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • HELB Shielding • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered
Structural Steel • Jet Impingement Shields	• HELB Shielding	Sheltered
Structural Steel • Missile Barrier	• Missile Barrier	Sheltered

Aging management review results for the radwaste building and reactor auxiliary bay are provided in Section 3.5.3.

2.4.4 Turbine Building and Main Control Room Complex

Structure Description

The turbine building is nominally 600 ft. by 150 ft. in plan and houses both turbine-generators, one for each unit, and other auxiliary plant equipment.

This building is founded on rock at various elevations below elevation 116 ft. The external and some internal walls are concrete up to the operating floor. The structure above this level is metal siding and deck above a 20-ft. band of precast concrete wall panels all supported by structural steel frames. Frames also support two 110-ton overhead bridge cranes in tandem.

Each turbine-generator is mounted on a concrete pedestal nominally 225 ft. by 42 ft. and 50 ft. high. The pedestals are supported on a concrete mat and founded on rock. The turbine building is designed with the seismic design criteria for Zone 1 established by the Uniform Building Code. The turbine building is located east of the two reactor buildings and is separated from them by a gap to accommodate movements of the structures during an earthquake.

The main control room, the cable spreading room, computer room, battery rooms, and emergency switchgear rooms, are located in the center portion of the turbine building.

The failure of the turbine building will not impair the safety function of any seismic Class I structure or equipment inside it or adjacent to it.

The turbine building and main control room complex is discussed in UFSAR Section 12.2 and Appendix C. License renewal boundary diagram reference for the turbine building is LR-S-001.

Intended functions within the Scope of License Renewal

Physical Support - The turbine building provides physical support for safety related and non-safety related systems and equipment during normal, severe environmental, extreme environmental and abnormal loading conditions.

Protection - The turbine building provides protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Leak-tightness - The control room provides airtight containment for the habitability areas housed within.

Fire Protection - The turbine building provides rated fire barriers or retards a fire from spreading to adjacent areas of the plant.

Support and Protection - The turbine building provides support and protection for the condensers that are credited for accident analysis in UFSAR Chapter 14.

Component Groups Requiring Aging Management Review

Table 2.4-4 Component Groups Requiring Aging Management Review - Turbine Building and Main Control Room Complex

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • HELB Shielding • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered
Structural Steel • Missile Barrier	• Missile Barrier	Sheltered

Aging management review results for the turbine building and main control room complex are provided in Section 3.5.4.

2.4.5 Emergency Cooling Tower and Reservoir

Structure Description

The emergency cooling tower and reservoir and associated mechanical and electrical equipment are classified as seismic Class I. The Class I elements of the emergency cooling tower and reservoir structure are founded on rock.

The reservoir of the emergency cooling tower and reservoir has a one-week water storage capacity, and is a reinforced concrete tank structure approximately 25 ft. deep with a pre-cast, prestressed concrete roof. The tank structure is founded on rock.

The cooling tower is a mechanical induced draft type, consisting of three cells. The reservoir and tower facility is a reinforced concrete structure. The cooling tower fill consists of vitreous clay tiles of the multi-cell block design.

UFSAR Sections 10.24 and 12.2 describe the emergency cooling tower and reservoir in detail. License renewal boundary diagram reference for the emergency cooling tower structure is LR-S-001.

Intended Functions within the Scope of License Renewal

Physical Support - The emergency cooling tower and reservoir provides physical support for safety related and non-safety related systems and equipment during normal, severe environmental, extreme environmental, and abnormal loading conditions.

Protection - The emergency cooling tower and reservoir provides protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Fire Protection - The emergency cooling tower and reservoir provides rated fire barriers or retards a fire from spreading to adjacent areas of the plant.

Emergency Heat Sink - The emergency cooling tower and reservoir provides sufficient capacity for removing the sensible and decay heat from the reactor's primary systems so that both reactors can be shut down in the event of unavailability of the normal heat sink.

Sustained Operation - The emergency cooling tower and reservoir provides sufficient storage water capacity to permit emergency cooling tower operation until a makeup water supply can be established.

Component Groups Requiring Aging Management Review

Table 2.4-5 Component Groups Requiring Aging Management Review - Emergency Cooling Tower and Reservoir

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls	• Structural Support	Raw Water, Outdoor
Reinforced Concrete • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered
Prestressed Concrete • Roof Slab	• Structural Support • Shelter, Protection and/or Radiation Shielding	Outdoor
Reinforced Concrete Block Walls	• Structural Support • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered

Aging management review results for the emergency cooling tower and reservoir are provided in Section 3.5.5.

2.4.6 Station Blackout Structure and Foundations

Structure Description

The station blackout structure houses the switchgear necessary to connect the alternate AC source to PBAPS. The structure is a pre-fabricated steel enclosure with double doors at either end of the structure to facilitate equipment transfer in and out of the structure as required. The structure is designed to protect the equipment from damage due to external weather exposure and is mounted on three reinforced concrete piers. License renewal boundary diagram reference for the station blackout structure is LR-S-001.

Intended functions within the Scope of License Renewal

Protection - The station blackout structure protects equipment required for SBO.

Physical Support - The station blackout structure provides support for equipment required for SBO.

Component Groups Requiring Aging Management Review

Table 2.4-6 Component Groups Requiring Aging Management Review - Station Blackout Structure and Foundations

Component Group	Component Intended Function	Environment
Reinforced Concrete • Foundation	• Structural Support to Non-S/R Components	Buried, Outdoor
Structural Steel • Metal Siding	• Shelter, Protection and/or Radiation Shielding	Outdoor
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support to Non-S/R Components	Sheltered

Aging management review results for the station blackout structure and foundation are provided in Section 3.5.6.

2.4.7 Yard Structures

Structure Description

Yard structures consist of various conduit duct banks, manholes, high pressure service water system valve pit, service water pipe tunnel and condensate storage tank foundations.

Conduit duct banks are located throughout the plant to provide passageways and protection for electrical cables and conduits. Manholes provide access to electrical components to meet accessibility requirements. These concrete structures provide a method for routing cables and protection from various environmental conditions. Manholes are protected from intrusion of combustible liquid by raised curbing.

The high pressure service water valve pit is a concrete structure located in the yard area south of the discharge outlet structure. Two high pressure service water valves as well as one emergency service water valve are located within the valve pit.

The Unit 2 condensate storage tank is located south of the Unit 2 reactor building. Its base is supported on a 14 inches thick perimeter ring reinforced concrete wall and sub-base consisting of crushed stone and sand. The Unit 3 condensate storage tank is located north of the Unit 3 reactor building. Its base is supported on the crushed stone and sand sub-base.

The high pressure service water, service water, and emergency service water pipes run from the circulating water pump structure to the turbine building in the service water pipe tunnel.

The yard structures are described in the Fire Protection Program, Section 6.3. License renewal boundary diagram reference for the yard structures is LR-S-001.

Intended functions within the Scope of License Renewal

Physical support - The yard structures provide physical support for safety and non-safety related systems and equipment during normal, severe environmental, extreme environmental, and abnormal loading conditions.

Protection - The yard structures provide protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Fire Barrier - The yard structures provide rated fire barriers or retard a fire from spreading to adjacent areas of the plant.

Component Groups Requiring Aging Management Review

Table 2.4-7 Component Groups Requiring Aging Management Review - Yard Structures

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slabs • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor
Condensate Storage Tanks Foundation	• Structural Support	Buried
Structural Steel • Reinforced Concrete Embedments (Service Water Pipe Tunnel)	• Structural Support • Structural Support to Non-S/R Components	Sheltered

Aging management review results for the yard structures are provided in Section 3.5.7.

2.4.8 Stack

Structure Description

A single stack is used to discharge gaseous waste from both units. The stack is located approximately 670 ft. west of the reactor buildings, where the grade elevation is approximately 265 ft.

The stack is a tapered, reinforced concrete structure 500 ft. high. The foundation is an octagonal concrete mat approximately 7 ft. thick. The dilution fans and eductor are housed in the lower 30 feet of the structure.

The stack is designed to seismic Class I criteria and for normal wind load; it is not designed to withstand tornado wind forces. The stack is located a sufficient distance from the reactor buildings that they would not incur any damage in the event of a complete stack failure.

The stack is further discussed in UFSAR Sections 12.2 and Appendix C. License renewal boundary diagram reference for the stack is LR-S-001.

Intended functions within the Scope of License Renewal

Elevated Release - The stack provides for the discharge of gaseous waste to meet the requirements of 10 CFR 100.

Component Groups Requiring Aging Management Review

Table 2.4-8 Component Groups Requiring Aging Management Review - Stack

Component Group	Component Intended Function	Environment
Reinforced Concrete	• Structural Support	Buried, Outdoor, Sheltered

Aging management review results for the stack are provided in Section 3.5.8.

2.4.9 Nitrogen Storage Building

Structure Description

The nitrogen storage building is a seismic Class I reinforced concrete structure nominally 26.6 ft. by 43.2 ft. founded on rock and structural lean concrete backfill supported on rock. The western portion of the building is supported and connected to the residual heat removal pump room cover slab. The east wall is butted directly up to the Unit 2 condensate storage water dike wall. The north wall is structurally separated from the reactor building to eliminate interaction between both structures.

License renewal boundary diagram reference for the nitrogen storage building is LR-S-001.

Intended functions within the Scope of License Renewal

Physical Support - The nitrogen storage building provides physical support for safety related and non-safety related systems and equipment during normal, severe environmental, extreme environmental and abnormal loading conditions.

Protection - The nitrogen storage building provides protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Component Groups Requiring Aging Management Review

Table 2.4-9 Component Groups Requiring Aging Management Review - Nitrogen Storage Building

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slab • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered
Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered

Aging management review results for the nitrogen storage building are provided in Section 3.5.9.

2.4.10 Diesel Generator Building

Structure Description

The diesel generator building is a seismic Class I structure. The diesel generator building is a separate structure located south of the Unit 2 turbine building. The building is founded on steel H piles and concrete shear walls which are supported on rock. The superstructure of the building consists of reinforced concrete walls and roof. Large openings in the diesel generator building are either protected by missile-proof doors, or have baffle walls located in front of them. The emergency diesel fuel supply is stored in underground steel tanks east of the building.

The diesel generator building is further discussed in UFSAR Sections 12.2 and Appendix C. License renewal boundary diagram reference for the diesel generator building is LR-S-001.

Intended functions within the Scope of License Renewal

Physical Support - The diesel generator building provides physical support for safety related and non-safety related systems and equipment during normal, severe environmental, extreme environmental, and abnormal loading conditions.

Protection - The diesel generator building provides protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Fire Protection - The diesel generator building provides rated fire barriers or retards a fire from spreading to adjacent areas of the plant.

Component Groups Requiring Aging Management Review

Table 2.4-10 Component Groups Requiring Aging Management Review - Diesel Generator Building

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered
Steel Foundation Piles	• Structural Support	Buried

Aging management review results for the diesel generator building are provided in Section 3.5.10.

2.4.11 Circulating Water Pump Structure

Structure Description

The Circulating Water Pump Structure complex, nominally 280 ft. by 80 ft. of reinforced concrete founded on rock, consists of several sections. The central portion is a reinforced concrete, seismic Class I, tornado-resistant structure. The central portion has three pump bays; one for Unit 2, one for Unit 3, and a third, smaller bay containing the two emergency service water pumps in individual cells. These pump bays are interconnected by openings equipped with sluice gates.

The superstructure over these pumps is constructed with reinforced concrete walls and floor and has a concrete roof supported on structural steel beams. Removable panels in the roof provide access to the pumps. A structural steel and plate wall divides the pump area into two rooms for additional protection. The rooms are flood protected to Elevation 135 ft. by means of watertight doors and sealed floor penetrations.

To the east of this superstructure is a similar reinforced concrete, seismic Class I, tornado-resistant structure housing the service water traveling screens. Four screens, two per unit, screen the water before it goes into the pump bays. Each screen has a sluice-gated opening on each side.

The seismic Class I portion of the circulating water pump structure is designed such that no credible event, including internal flooding due to failure of a seismic Class II structure or component would prevent the equipment housed therein from functioning as necessary to assure safe shutdown of both Units 2 and 3.

The circulating water pump structure is described in further detail in UFSAR Section 12.2. License renewal boundary diagram reference for the circulating water pump structure is LR-S-001.

Intended Functions within the Scope of License Renewal

Physical Support - The circulating water pump structure provides physical support for safety related and non-safety related systems and equipment during normal, severe environmental, extreme environmental, and abnormal loading conditions.

Protection - The circulating water pump structure provides protection for safety related and non-safety related systems and equipment from external, internal, and environmental hazards.

Fire Protection - The circulating water pump structure provides rated fire barriers or retards a fire from spreading to adjacent areas of the plant.

Component Groups Requiring Aging Management Review

Table 2.4-11 Component Groups Requiring Aging Management Review - Circulating Water Pump Structure

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • Structural Support to Non-S/R Components	Raw Water, Buried, Outdoor, Sheltered
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered
Structural Steel • Sluice Gates and Embedments	• Pressure Boundary	Raw Water, Sheltered
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components • Flood Barrier	Sheltered

Aging management review results for the circulating water pump structure are provided in Section 3.5.11.

2.4.12 Recombiner Building

Structure Description

The recombiner building is a rectangular shaped structure nominally 66.5 ft. by 80.4 ft. consisting of several cubicle areas constructed of reinforced concrete founded on rock. The recombiner building is a seismic Class I structure and houses the hydrogen recombiner system catalytic recombiner, condensers, preheaters, analyzers, and other system equipment. This structure is located north of the Unit 3 reactor building and west of the Unit 3 turbine building.

The structure has two exterior doors at elevation 135 ft. on the north wall. The recombiner building is a shared structure and houses equipment for both Unit 2 and Unit 3.

The recombiner building is discussed in UFSAR Section 12.1 and Appendix C. License renewal boundary diagram reference for the recombiner building is LR-S-001.

Intended functions within the Scope of License Renewal

Physical Support - The recombiner building supports structures and components whose failure could adversely impact safety related structures.

Component Groups Requiring Aging Management Review

Table 2.4-12 Component Groups Requiring Aging Management Review - Recombiner Building

Component Group	Component Intended Function	Environment
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered
Structural Steel • Structural Steel	• Structural Support to Non-S/R Components	Sheltered

Aging management review results for the recombiner building are provided in Section 3.5.12.

2.4.13 Component Supports

Description

The component support commodity group includes the following component groupings:

- Support members;
- Anchors; and
- Grout

The support members component group includes supports for piping and components, HVAC ducts, conduits, cable trays, instrumentation tubing trays, electrical junction and terminal boxes, electrical and I&C devices, instrument tubing, and supports for major equipment, including pumps, transformers, HVAC fans and filters. This component group also includes components such as spring hangers, including the springs, rod hangers, braces, guides, clamps, base plates, metal to metal sliding joints, lubrite plates, snubber supports, stops, mounting brackets, support bolting, instrument racks and bottle racks.

The anchors component group is the part of the component support assembly used to attach electrical panels, electrical cabinets, racks, switchgears, enclosures for electrical and instrumentation equipment, pipe hangers, pumps, transformers, HVAC fans, and HVAC filters to other components or structures. Welds are used for steel attachments while undercut anchors, expansion anchors, cast-in-place anchors, and grouted-in anchors are used for concrete attachments.

The grout component group includes grouted support pads and grouted base plates. Grout is used in the construction of equipment pads, and for filling, leveling, and setting equipment bases to their respective foundations.

Component Groups Requiring Aging Management Review

Table 2.4-13 Component Groups Requiring Aging Management Review - Component Supports

Component Group	Component Intended Function	Environment
Anchors (Emergency Cooling Water)	Structural Support	Outdoor
Anchors	Structural Support	Sheltered
Grout	Structural Support	Sheltered
Lubrite Plates	Structural Support	Sheltered
Support Members	Structural Support	Sheltered
Support Members	Structural Support	Raw Water, Torus Water
Support Members (Emergency Cooling Water)	Structural Support	Outdoor

Aging management review results for component supports are provided in Section 3.5.13.

2.4.14 Hazard Barriers and Elastomers

Description

Hazard barrier components include fire and other hazard barrier penetration seals, fire wraps, and fire and other hazard barrier doors. Elastomer components include expansion joint seals (seismic joint seal material, control joint seal material, and seismic separation joint seal material), moisture barrier inside drywell at the juncture of the drywell shell wall with the concrete floor, reactor building blowout panel seals, and reactor building metal siding gap seals. Hazard barriers and elastomers are treated as a commodity because of similarities in design, material, aging effect, and or environment.

Component Groups Requiring Aging Management Review

Table 2.4-14 Component Groups Requiring Aging Management Review - Hazard Barriers and Elastomers

Component Group	Component Intended Function	Environment
Hazard Barrier: • Fire Barrier Penetration Seals	• Fire Barrier	Sheltered, Outdoor
Hazard Barrier: • Other Penetration Seals	• Flood Barrier • HELB Shielding • Fission Product Barrier	Sheltered, Outdoor
Hazard Barrier: • Fire Barrier Doors	• Fire Barrier	Sheltered, Outdoor
Hazard Barrier: • Other Hazard Barrier Doors	• Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission Product Barrier • Missile Barrier • HELB Shielding • Over-Pressure Protection	Sheltered, Outdoor
Hazard Barrier: • Gaskets for Watertight Doors	• Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission Product Barrier	Sheltered, Outdoor
Hazard Barrier: • Fire Wraps	• Fire Barrier	Sheltered
Elastomer: • Expansion Joint Seals	• Flood Barrier	Sheltered, Outdoor

Table 2.4-14 Component Groups Requiring Aging Management Review - Hazard Barriers (Continued)

Component Group	Component Intended Function	Environment
Elastomer: • Reactor Building Blowout Panel Seals	• Fission Product Barrier	Sheltered
Elastomer: • Reactor Building Metal Siding Gap Seals	• Fission Product Barrier	Sheltered
Elastomer: • Moisture Barrier Inside Drywell	• Flood Barrier	Sheltered

Aging management review results for hazard barriers are provided in Section 3.5.14.

2.4.15 Miscellaneous Steel

Description

The miscellaneous steel group includes platforms, grating, stairs, ladders, steel curbs, handrails, kick plates, decking, instrument tubing trays and manhole covers. These structural steel components are generally installed throughout PBAPS structures. Some structural steel components are exposed to the outdoor environment. These steel components are treated as a commodity group because of similarities in design, material and/or environment.

Component Groups Requiring Aging Management Review

Table 2.4-15 Component Groups Requiring Aging Management Review - Miscellaneous Steel

Component Group	Component Intended Function	Environment
Miscellaneous Steel • Platforms • Grating • Stairs • Ladders • Curbs (Steel) • Handrails • Kick Plates • Instrument Tubing Trays	• Structural Support • Structural Support to Non-S/R Components • Contain Fluid	Sheltered
Miscellaneous Steel • Manhole Covers (1)	• Shelter, Protection and/or Radiation Shielding • Contain Fluid	Outdoor

(1) Manhole covers are credited for preventing intrusion of flammable fluids into manholes containing fire safe shutdown equipment and cables.

Aging management review results for miscellaneous steel are provided in Section 3.5.15.

2.4.16 Electrical and Instrumentation Enclosures and Raceways

Description

The electrical and instrumentation enclosures and raceways group includes cable trays, cable tray covers, drip shields, rigid and flexible electrical conduits and fittings, wireway gutters, panels, electrical panels, cabinets and boxes installed in the reactor buildings and other PBAPS buildings. These electrical components are treated as a commodity group because of similarities in design, material and environment.

Component Groups Requiring Aging Management Review

Table 2.4-16 Component Groups Requiring Aging Management Review - Electrical and Instrumentation Enclosures and Raceways

Component Group	Component Intended Function	Environment
Electrical and Instrumentation Enclosures and Raceways • Cable Tray and Covers • Electrical Conduits and Fittings • Wireway Gutters • Panels • Cabinets • Boxes	• Structural Support • Shelter, Protection and/or Radiation Shielding	Sheltered
Raceways • Electrical Conduits and Fittings • Boxes	• Structural Support • Shelter, Protection and/or Radiation Shielding	Outdoor
• Drip shields	• Shelter, Protection and/or Radiation Shielding	Sheltered

Aging management review results for electrical and instrumentation enclosures and raceways are provided in Section 3.5.16.

2.4.17 Insulation

Description

The insulation commodity group includes all insulating materials within the scope of license renewal that are used in plant areas where temperature control is considered critical for system and component operation or where high room temperatures could impact environmental qualification. Plant areas that require temperature control include inside the drywell, inside the HPCI and RCIC pumprooms and the outboard MSIV rooms, and on heat traced outdoor piping and components for freeze protection.

The jacketing on outdoor insulation applications serves a leak-tight function by preventing moisture absorption of the insulation material that not only decreases the effectiveness of the insulation but also creates a corrosive environment in contact with the external piping or component surfaces.

Piping and equipment insulation materials used inside the drywell include stainless steel and aluminum mirror insulation and fiberglass blanket insulation with either stainless steel or aluminum jacketing. HPCI and RCIC pumproom and the outboard MSIV room piping insulation materials include calcium silicate or fiberglass blankets covered by an aluminum jacket. Equipment insulation consists of either calcium silicate blocks or removable ceramic fiber blankets. Anti-sweat insulation is fiberglass with an integral vapor barrier.

Outdoor piping insulation materials installed over electric heat tracing may consist of calcium silicate or fiberglass with an integral vapor barrier with either water-tight aluminum or reinforced mastic-plastic compound jacketing.

Component Groups Requiring Aging Management Review

Table 2.4-17 Component Groups Requiring Aging Management Review - Insulation

Component Group	Component Intended Function	Environment
Insulation	• Insulating Characteristics	Sheltered
Insulation (Jacketing)	• Insulation Jacket Integrity	Sheltered
Insulation	• Insulating Characteristics	Outdoor
Insulation (Jacketing)	• Insulation Jacket Integrity	Outdoor

Aging management review results for insulation is provided in Section 3.5.17.

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROLS

This section presents the results of the scoping and screening processes for electrical and instrument and control (I&C) components, and the station blackout system.

The components comprising the station blackout system were reviewed and the passive, long-lived components subject to an aging management review were identified.

For all other electrical and I&C components, the passive, long-lived electrical components subject to aging management review are identified as commodities. The guidance provided in NEI 95-10, Appendix B was used to define electrical commodities subject to aging management review. The guidance provided in NEI 95-10, Appendix B identifies the passive, long-lived electrical components potentially subject to an aging management review as:

Electrical portions of electrical and I&C penetration assemblies
High-voltage insulators
Insulated cables and connections (connectors, splices, terminal blocks)
Phase bus (e.g., isolated-phase bus, non-segregated-phase bus, bus duct)
Switchyard bus
Transmission conductors
Uninsulated ground conductors

After applying the scoping and screening criteria discussed in Sections 2.1.2 and 2.1.3, the electrical commodities requiring aging management reviews applicable to PBAPS were determined to be the following:

Insulated cables and connections (connectors, splices, terminal blocks)
Electrical portions of electrical and I&C penetration assemblies

Electrical portions of electrical and I&C penetration assemblies are a TLAA and addressed in Section 4.4

Electrical and I&C component groups were evaluated using the plant “spaces” approach, whereby aging effects are identified, and bounding environmental parameters are used to evaluate the identified aging effect(s) with respect to component intended function. This is further discussed in Section 3.6.

For each of the electrical and instrumentation and controls (I&C) commodities, this section provides the following information:

- A general description of the commodity,
- A listing of the components or component groups that require aging management review, associated component intended functions and environments.

For the station blackout system, this section provides the following information:

- A general description of the system,
- The intended functions of the system within the scope of license renewal,
- A reference to the applicable UFSAR section,
- A reference to the applicable license renewal boundary diagrams,
- A listing of the components or component groups that require aging management review, associated component intended functions and environments.

A discussion of component groups, component intended functions and environments is provided in Section 3.0.

For each commodity or system, the tables are sorted by component group and then by environment.

Section 3.6 provides the results of the aging management reviews for the component groups in each of these structures and commodities.

2.5.1 Cables

Description

There are approximately 39,000 installed cables at PBAPS, Units 2 & 3. Electrical cables were treated as a commodity group during the aging management review process. This group included all documented cables within the scope of license renewal that are used for power, control and instrumentation applications. The intended function of electrical cables is to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals. Although EQ cables are reviewed as TLAAs, all documented cables, whether EQ or non-EQ, were assumed in scope and required an aging management review.

Cable insulation material groups were assessed on the basis of common materials and their respective material aging characteristics for both safety-related and non-safety related cables.

A plant database was used as the primary tool to identify cable insulation groups and for screening electrical cables for the cables aging management review. The database contains a cable code. The cable code is defined by a specification that identifies a unique cable size, application (power, control, and instrumentation) and insulation. Cable insulation groups and the associated application were the determining factors in performing the assessment against bounding plant parameters.

Electrical cables were reviewed as a commodity group for all systems. The electrical cable aging management review for radiation and temperature utilized a plant "spaces" approach, whereby aging effects were identified, and bounding environmental parameters were used to evaluate the identified aging effect(s) with respect to component intended function. The spaces approach is additionally discussed in Section 3.6.

The stressors potentially affecting "Loss of Material Properties" for cables at PBAPS are moisture, temperature, and radiation.

Moisture is of concern because of a phenomenon called "water-treeing". To be identified as being susceptible to aging effects caused by moisture (water-treeing), a non-EQ cable must be exposed to long-term standing water, energized more than 25% of the time, be of medium voltage (4KV-13KV for PBAPS), and be constructed of insulation material containing a void or impurity (inclusion, flaw).

Since the industry and manufacturers recognized this issue in the late 70's, improved formulations (resistant to water-treeing) have been made available and used since 1980. PBAPS recognized this issue, and took a pro-active position. A cable replacement program was initiated in 1995 to replace "suspected" cables subjected to the water-treeing criteria described above. No cable failures have occurred at PBAPS since the cable replacement program was initiated.

Therefore, moisture is not an aging effect requiring management at PBAPS.

The remaining stressors affecting "loss of material properties" of cable insulation at PBAPS are temperature and radiation. Applying the "spaces" approach for the identification of the temperature and radiation stressors was a primary focus for the aging management review of cables. Maintaining adequate dielectric properties of the cable insulation is essential for ensuring that the electrical cables perform their intended function.

A review of cable insulation aging effects from radiation was performed by comparing the least radiation resilient cable insulation (PVC) with the highest radiation area where cables that support components within the scope of license renewal may be present in the plant. The value used for the highest radiation area was obtained by multiplying the existing radiation design value by 1.5 to obtain a 60-year value, and then adding the accident dose. All other cable insulation types were bounded by this analysis. No cables requiring aging management review as a result of radiation effects were identified.

A review of cable insulation aging effects from temperature required a more detailed elimination process. Cable populations were grouped according to their common cable insulation material type, and voltage application (power, control, and instrumentation). For each cable insulation material type, a 60-year limiting service temperature was established. Comparison of this value was made against the, bounding cable service temperature to determine if it was below the 60-year limiting service temperature. Ohmic heating was considered for power cables, and for control cables that are routed with power cables, where applicable to determine the bounding service temperature.

Figure 2.5-1 provides a summary flowchart overview of the temperature review process and conclusions based upon the cable groupings in the PBAPS cables database. A summary of each cable group review follows:

- Computer Cable Groups:
  Computer cable groups are not in the scope of license renewal and were eliminated from temperature review.

- Fiber Optic & Bare Ground Cable Groups:
  Fiber optic cable insulation material is unaffected by thermal aging. Bare ground cables have no insulation and were determined not to be within the scope of license renewal.

- Instrumentation Cable Groups:
  Instrumentation cable groups with cross linked polyethylene (XLPE), polyethylene, cross linked polyolefin (XLPO), hypalon, teflon-based, and polypropylene insulation were determined to have 60-year limiting service temperatures greater than the bounding ambient temperature of PBAPS. Two bounding ambient temperatures were determined; one bounding ambient temperature for containment and another bounding ambient temperature for all other plant areas with exception of containment.

- XLPE Power & Control Cable Groups:
  XLPE insulated cable groups can operate continuously at its bounding service temperature for greater than 60 years. The 60-year limiting service temperature is greater than bounding ambient temperature and its associated ohmic heating temperature rise.

- EPR Power and Control Cable Groups:
  EPR cables groups supplying loads not in the scope of license renewal were eliminated from review. The remaining EPR cable groups were determined to be routed in areas outside containment and have 60-year limiting service temperature greater than the bounding ambient temperature and its associated ohmic heating temperature rise.

- PE Power and Control Cable Groups:
  The routing of PE power and control cable groups was determined and local ambient temperature field measurements were conducted in bounding cases. The 60-year limiting service temperature for PE insulation groups were greater than the bounding ambient temperature and its associated ohmic heating temperature rise.

- PVC Cable Groups:
  PVC cables groups and individual cables from the remaining PVC cable groups supplying loads not in the scope of license renewal were eliminated from review. The remaining PVC cables were reviewed to identify cables with 60-year limiting service temperatures greater than the bounding service

temperature. Thirty cables relied upon for Fire Safe Shutdown (FSSD) were determined to require aging management.

- Miscellaneous Cable Groups:
  Miscellaneous cables groups not in the scope of license renewal loads were eliminated from review. Miscellaneous cable groups were also reviewed to delete cables with 60-year limiting service temperature greater than the bounding ambient temperature. Individual cables within the remaining group were reviewed to identify cables within the scope of the environmental qualification aging management activity or cables supplying loads not within the scope of license renewal. None of the miscellaneous cables were identified as requiring aging management.

Component Groups Requiring Aging Management Review

Table 2.5-1 Component Groups Requiring Aging Management Review - Cables

Component Group	Component Intended Function	Environment
Electrical Cables	• Electrical Continuity	Sheltered

Aging management review results for cables are provided in Section 3.6.1.

Figure 2.5-1
Cable Group Temperature Review Process Overview

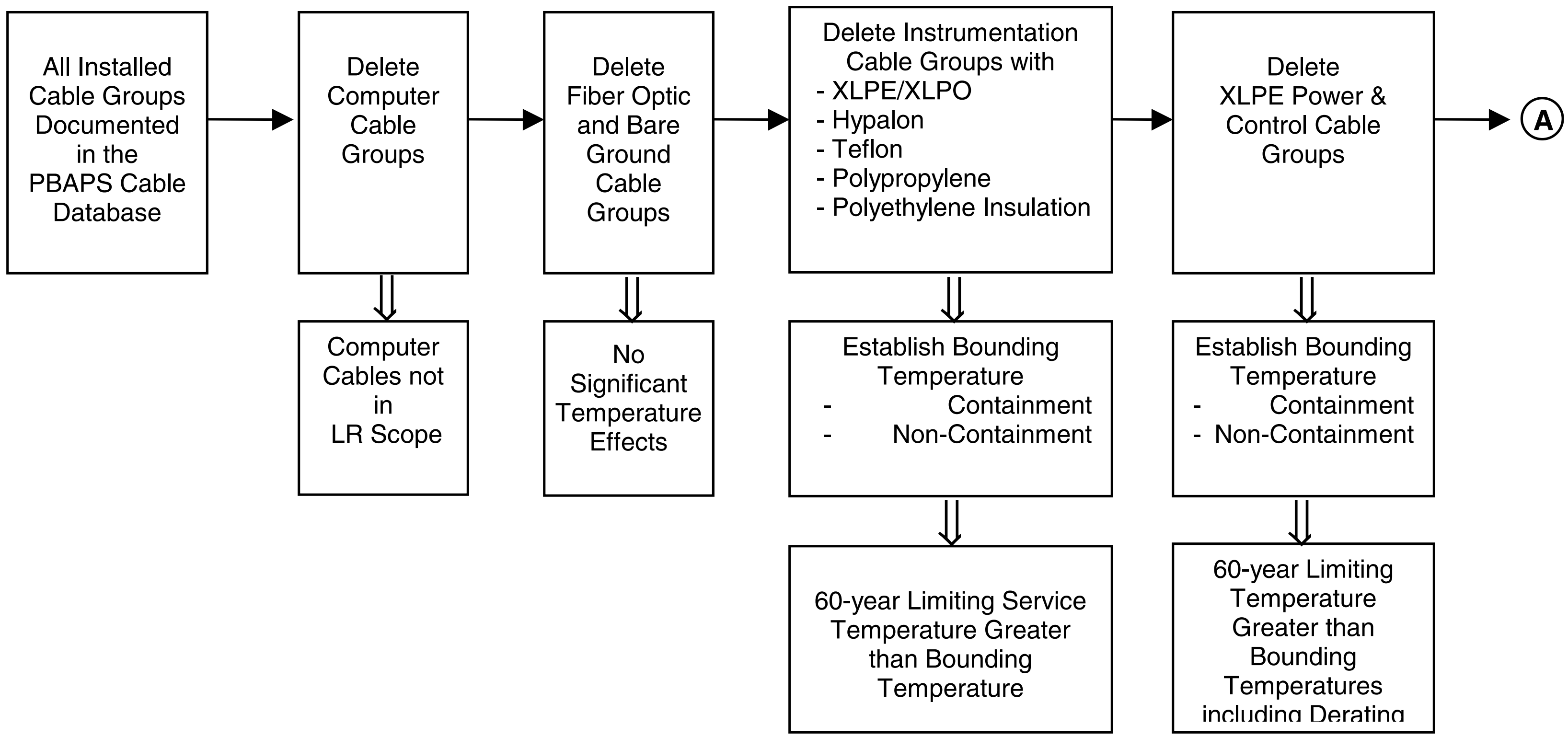
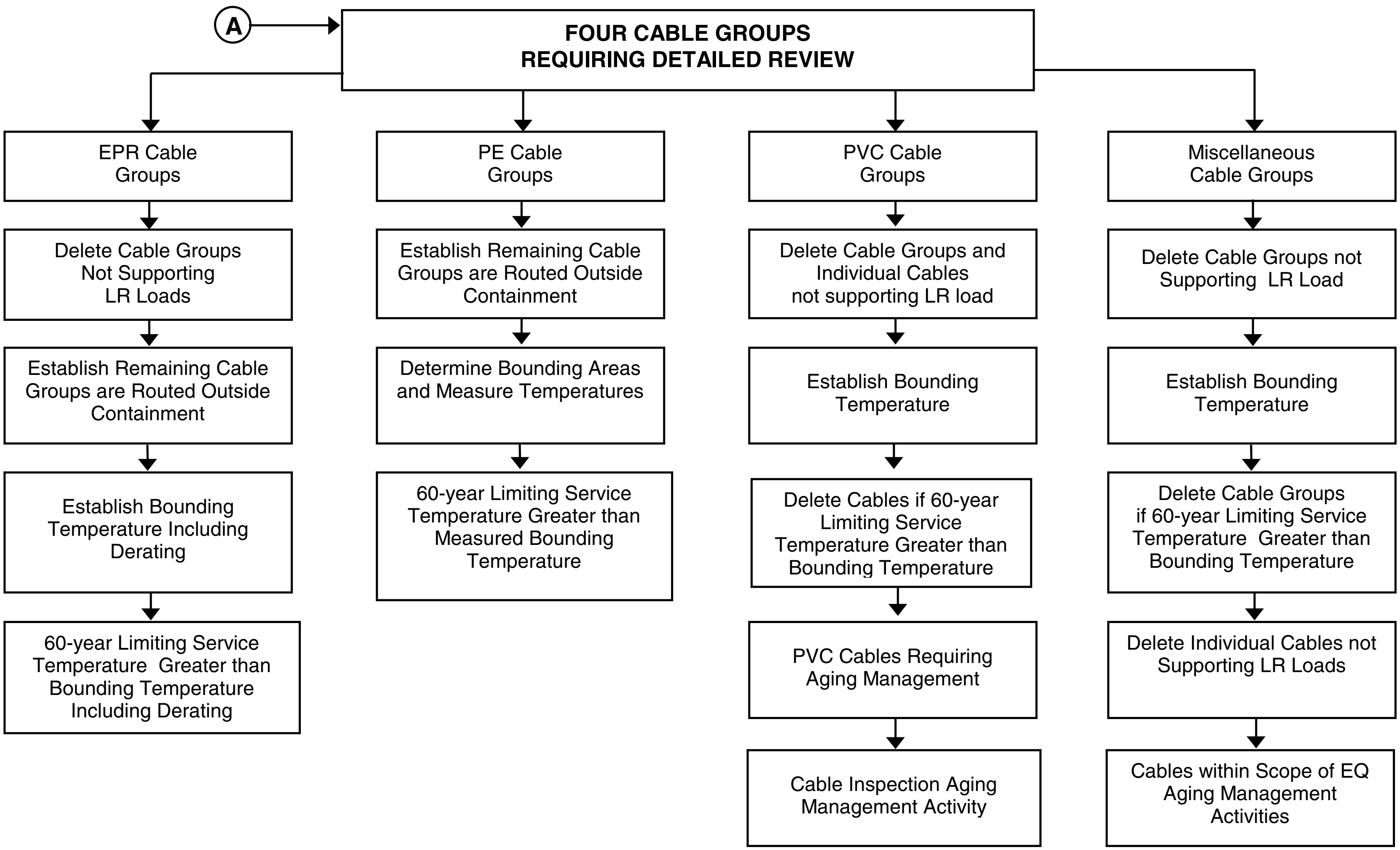


Figure 2.5-1 (Continued)
Cable Group Temperature Review Process Overview



2.5.2 Connectors, Splices, and Terminal Blocks

Description

The commodity group electrical connectors, splices and terminal blocks (terminations) includes electrical connectors, splices and terminal blocks used for power, control and instrumentation applications.

PBAPS connectors, splices and terminal blocks that are part of the environmental qualification program were reviewed as Time-Limited Aging Analyses and the results are provided in Section 4.4.

The intended function of electrical connectors, splices, and terminal blocks is to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals.

The electrical connector materials subject to aging are metal and insulation. The metals used for electrical connectors are copper, tinned copper, and aluminum. The connector insulation materials used are various elastomers and thermoplastics, and are bounded by the Cables aging management review discussed in Section 2.5.1.

The splice material subject to aging is insulation. The insulation materials used are various elastomers, and are bounded by the Cables aging management review discussed in Section 2.5.1.

The electrical terminal block materials subject to aging are metal and insulation. The metals used for terminal blocks are copper, tinned copper, brass, bronze and aluminum. The insulation materials used are phenolic compounds and nylon.

Components Requiring Aging Management Review

Table 2.5-2 Component Groups Requiring Aging Management Review - Connectors, Splices, and Terminal Blocks

Component Group	Component Intended Function	Environment
Electrical Connectors - Insulation	• Electrical Continuity	Sheltered
Electrical Connectors - metallic connector	• Electrical Continuity	Sheltered
Electrical Splices - Insulation	• Electrical Continuity	Sheltered
Electrical Terminations - Insulation	• Electrical Continuity	Sheltered
Electrical Terminations - Metallic	• Electrical Continuity	Sheltered

Aging management review results for connectors, splices, and terminal blocks are provided in Section 3.6.2.

2.5.3 Station Blackout System

Description

The Station Blackout System is defined as the Alternate AC (AAC) source required per NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors." The Station Blackout System for PBAPS is in compliance with 10CFR50.63, qualifies as an AAC power source per NUMARC 87-00, and is comprised of the following components:

- Conowingo Hydroelectric Plant (Dam)
- Susquehanna Substation
- Wooden Takeoff Pole
- Manholes at Conowingo and Peach Bottom
- Submarine Cable (Transmission Line)
- Station Blackout Substation at PBAPS

Conowingo Hydroelectric Plant (Dam)

The Conowingo Hydroelectric Plant (Dam) is located on the Susquehanna River approximately ten miles above the mouth of the river on the Chesapeake Bay, five miles below the Pennsylvania border, and approximately ten miles south of PBAPS. The Dam is the source of power to support the PBAPS SBO commitment. The Federal Energy Regulatory Commission (FERC) licenses the dam and associated power block. The Dam is constructed primarily of concrete and steel. The associated power block is comprised of reinforced concrete and structural steel.

Susquehanna Substation

The Susquehanna Substation is located adjacent to and receives power from the Conowingo Hydroelectric Plant. The substation delivers 34.5 KV power to PBAPS to support the SBO scenario. The substation is of industry standard power distribution design consisting of aluminum bus bar, insulators, circuit breakers, transformers, and associated foundations.

Wooden Pole

The takeoff tower for the transmission line from the Susquehanna Substation is a wooden pole. The pole is constructed of yellow pine, and chemically treated prior to installation. The installed pole has been analyzed to be able to withstand the severe weather conditions associated with the SBO event.

<u>Manholes</u>

Manholes exist at both the Conowingo and PBAPS locations to house the transition between the standard power cables from the substations at each location and the submarine cable. The manholes are constructed of reinforced concrete. Aging effects for concrete structures have concluded that no aging management activities are required, except for change of material properties, due to leaching of calcium hydroxide, in the emergency cooling tower and reservoir walls.

<u>Submarine Cable (Transmission Line)</u>

A 35KV Submarine cable exits the manhole at Conowingo and runs under the bed of the Susquehanna River from just north of the dam to a manhole just south of the SBO Substation. The submarine cable is comprised of copper phase conductors, ground conductors, EPR shielding and insulation, metallic shielding, and polyethylene (Okolene) jackets. The assembly of the submarine cable has three (3) individually shielded and jacketed conductors cabled together with two (2) ground conductors, and one (1) fiber optic cable, with polypropylene fillers as necessary. A polypropylene bedding covers the entire cable. Over the bedding, a layer of steel armor is applied. Each wire is jacketed with black polyethylene. A nylon serving is then applied, and an asphaltic solution is applied both under and over the armor and nylon serving.

<u>PBAPS SBO Substation</u>

The PBAPS SBO Substation is comprised of 34.5KV and 13.8 KV metalclad outdoor walk-in switchgear, a 15/20 MVA oil filled transformer, and associated breakers and control. The SBO Substation is designed as a “stand alone” facility with control power coming from within the switchgear. The switchgear is contained within a standard prefabricated metal enclosure. The enclosure and switchgear foundation are discussed in Section 2.4.6.

The station blackout system is further discussed in UFSAR Sections 8.1, 8.3, 8.4, and 8.5. License renewal boundary diagram reference for the station blackout system is LR-E-001.

Intended Functions within the Scope of License Renewal

<u>AC Power Source</u> - Provide AC power within one hour to essential switchgear busses upon loss of all off-site power coincident with the failure of all on-site power (EDGs).

Components Requiring Aging Management Review

Table 2.5-3 Component Groups Requiring Aging Management Review - Station Blackout System

Component Group	Component Intended Function	Environment
Wooden Pole	• Structural Support to Non-S/R Components	Outdoor, Buried
Conowingo Hydroelectric Plant	• Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Raw Water, Outdoor
Substation Foundations	• Structural Support to Non-S/R Components	Outdoor
Substation Busbar	• Structural Support to Non-S/R Components • Electrical Continuity	Outdoor
Substation Insulators	• Insulate	Outdoor
Submarine Cable	• Electrical Continuity	Raw Water

Aging management review results for the station blackout system are provided in Section 3.6.3.

SECTION 3.0 AGING MANAGEMENT REVIEW RESULTS

List of Tables

List of Figures

3.0 AGING MANAGEMENT REVIEW RESULTS

Introduction

10 CFR 54.21 (a)(3) requires a demonstration that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation. This section satisfies the requirement of 10 CFR 54.21 (a)(3).

This section discusses the layout of this application relative to aging management review results. Specifically, this section:

- identifies the component groups subject to aging management review and their component intended functions,
- identifies the environments and materials which result in aging effects,
- identifies the aging effects requiring management, and
- lists the activities that manage the identified aging effects.

Sections 3.1 through 3.6 present, in a six-column tabular format, the components and component groups subject to aging management review, the aging effects requiring management, and the activities credited to manage the aging effects. The tables are arranged to be consistent with the presentation suggested in the Draft Regulatory Guide DG 1104, "Standard Format and Content to Renew Nuclear Power Plant Operating Licenses" and NEI 95-10.

The tables in Sections 3.1 through 3.4 present a system-based overview of the aging management review results for each of the component groups requiring aging management review. Each row indicates the aging management activities that are credited to maintain the intended function of a component group operating in the defined environment for each aging effect acting on a specific material.

The tables in Section 3.5 present a structure-based overview of the aging management review results for each of the component groups requiring aging management review.

Selected components and component groups, common to several systems or structures, were evaluated as commodity groups. Commodity groups are,

- Component Supports
- Hazard Barriers and Elastomers (Doors, Penetration Seals, Fire Wrap, etc.)
- Miscellaneous Steel
- Electrical and Instrumentation Enclosures & Raceways

- Insulation
- Cables
- Connectors, Splices, and Terminal Blocks

The results of the aging management reviews for the commodity groups are presented in Sections 3.5 and 3.6 in the six-column table format.

Appendix B provides a discussion of the program elements of each aging management activity credited for aging management during the period of extended operation.

Aging Management Reviews

The results of the aging management reviews are presented in Sections 3.1 through 3.6 in tabular form. These tables provide the following items for each system or structure within the scope of license renewal:

- A component group derived from the scoping and screening process described in Sections 2.3 through 2.5.
- The component intended function(s).
- The environment being addressed in the evaluation.
- The materials of construction for the component group.
- The aging effects requiring management for the component group.
- The activities credited for managing the aging effects, with hypertext to the applicable activity in Appendix B where the elements of the aging management activity are described.

For each system or structure, the tables are sorted by component group, then by environment, and then by materials of construction. The aging management reviews considered all applicable intended functions, environments, materials of construction and aging effects for each component group. In general, results for each combination of intended function, environment, material and aging effect for a given component group are represented by an individual line item (row) in the table. Multiple intended functions, environments, materials or aging effects for a given component group may be addressed by a single line item (row) when the identified aging management activities apply to the combination.

Credited aging management activities are identified for each combination of intended function, environment, material and aging effect for a given component group. In some cases, a specific combination of component group, intended function, environment, material and aging effect may be listed in more than one row, with different aging management activities credited. The individual rows indicate that different components within the component group (i.e., different portions of the system) are addressed by different aging management activities.

Numbered footnotes are provided in the tables when appropriate for clarification. Footnotes are located at the end of each table.

<u>Component Group</u>

Component groups, including commodities, and associated components are listed in Column 1. In addition, some individual components are listed in Column 1. Examples of component groups, commodities, and associated components include:

Mechanical Systems:

- Casting and forging group (valve bodies, pump casings, strainer bodies, sprinkler heads, and hydrants)
- Heat exchanger group (heat exchangers, heaters, and coolers)
- Elastomer group (flex hoses)
- Piping group (piping, tubing, and fittings)
  Note: Fittings are considered with piping or tubing when made of the same material
- Piping specialties group (restricting orifices, flow elements and condensing chambers)
- Sheet metal group (louvers, plenums, ducts)
- Vessel group (tanks)
- Cranes and Hoists

Structures:

- Reinforced concrete (walls, slabs, beams, columns, foundations, pedestals, curbs, dikes)
- Unreinforced concrete
- Prestressed concrete
- Reinforced concrete block walls
- Reinforced concrete embedments
- Structural steel
- Component supports (bolts, anchors, lubrite plates, grout)
- Insulation
- Electrical and instrumentation enclosures and raceways
- Expansion bellows
- Metal siding and roof deck
- Blowout panels
- Hazards barriers (penetration seals, doors, fire wrap, elastomers)

Electrical:

- Cables
- Connectors, splices, and terminal blocks

Component Intended Function

Component intended functions for the mechanical, structural, and electrical components are included in Column 2 and listed in Table 2.1-1, "Component Intended Functions."

Environment

The aging management reviews for components and structures were evaluated based upon component groupings in common environments. Common environments are listed in Column 3.

The evaluations for mechanical, structural and electrical discipline components and commodities are performed based on their operating environment(s). Since aging degradation may result from contact with the internal process fluid (for mechanical system components) or the external environment, all environments that come in contact with a given component require review.

The aging management reviews were performed using the following environments:

Reactor Grade Water

Reactor grade water is water that has been demineralized, contains no added corrosion inhibitors, and has low conductivity and impurities.

This includes water from three sources. Due to the variations in chemistry activities, reactor grade water has been addressed in Column 3 as:

- **Reactor coolant**

Reactor coolant system water is demineralized and maintained in accordance with stringent chemistry parameters to mitigate corrosion.

- **Condensate storage water**

Condensate storage water is condensed nuclear boiler steam that has been filtered and demineralized but not deaerated.

- **Fuel pool water**

Fuel pool water is demineralized and maintained in accordance with stringent chemistry parameters to mitigate corrosion. Fuel pool water is normally maintained at temperatures less than 150°F.

Fuel Oil

The fuel oil is used to fuel an internal combustion engine. The fuel oil for the emergency diesel generators and the diesel driven fire pump is #2 fuel oil.

Lubricating Oil

Lubricating oil is an organic fluid used to reduce friction between moving parts.

Steam

Steam is produced in the reactor vessel from reactor grade water and has extremely low levels of impurities. The systems that are pertinent to this evaluation are the reactor pressure vessel and internals, main steam, HPCI, and RCIC systems. The steam exists as a two phase vapor, ranging from high quality steam in the main steam system to a low quality steam in the HPCI and RCIC systems. The HPCI and RCIC steam lines normally see little to no steam flow because these systems operate infrequently.

Torus Grade Water

The torus grade water quality is monitored periodically and maintained in accordance with station procedures that include recommendations from EPRI TR-103515, "BWR Water Chemistry Guidelines." Purity of the torus water is maintained by pumping the torus water through filters and demineralizers and through bleed and feed operations with the hotwell.

Some carbon steel pipes, located in the torus, pass through the surface of the torus water and are exposed to a water-gas interface. For lines equipped with vacuum breaker valves, the water-gas interface occurs at both the inside and outside diameter of the pipe. For other lines, a water-gas interface occurs only at the outside diameter because the inside of the pipe remains full of water.

Closed Cooling Water

The chemical makeup of the closed cooling water is maintained in accordance with EPRI TR-107396, “Closed Cooling Water Chemistry Guidelines”. Purity and chemical content is maintained by periodic sampling and batch chemical addition of corrosion inhibitors in accordance with plant procedures.

Borated Water

The sodium pentaborate solution of the Standby Liquid Control (SBLC) system can potentially induce corrosion due to solution chemistry (conductivity and pH). The normal makeup water used for mixing the SBLC borated water solution is demineralized water that is maintained within chemistry guidelines, but industry experience has shown that there is a potential for chlorides and sulfates in the boron material. Boron concentration and temperature of the SBLC water are maintained in accordance with PBAPS Technical Specifications.

Raw Water

Raw water is untreated fresh water taken from the Conowingo Pond, which is formed by the Susquehanna River. Raw water typically contains a dilute solution of mineral salt impurities, dissolved gases and biological organisms. These dissolved gases (oxygen and carbon dioxide) are the prime corrosion-initiating agents. Water samples show pH variation from 7.00 to 7.55, chloride content of 9 to 18 ppm and sulfate content from 1 to 46 ppm.

Sheltered

The sheltered environment consists of indoor ambient conditions where components are protected from outdoor moisture. Conditions outside the drywell consist of normal room air temperatures ranging from 65°F - 150°F and a relative humidity ranging from 10% - 90%. The warmest room outside the drywell is the steam tunnel, with an average temperature of 150°F (based on measured temperatures), and maximum normal fluctuation to 165°F.

The drywell is inerted with nitrogen to render the containment atmosphere non-flammable by maintaining the oxygen content to less than 4% oxygen. The drywell normal operating temperature ranges from 65°F - 150°F with a relative humidity from 10% - 90%.

The sheltered environment atmosphere is an air or nitrogen environment with humidity. Components in systems with external surface temperatures the same or higher than ambient conditions are expected to be dry. Lack of a liquid moisture source in direct contact with a given component precludes the concern of external surface corrosion degradation of metallic components as an effect requiring aging management. Note however that the sheltered environment is considered a corrosive environment for some non-metallic elastomer components.

Ventilation Atmosphere

The ventilation systems take their suction from either the building rooms or the outdoor environment. The resulting ventilation system internal temperature and humidity conditions are controlled and are similar to the sheltered environment conditions.

Outdoor

Outdoor environmental conditions consist of air temperatures typically ranging from 0°F - 100°F and an average annual precipitation of approximately 30 inches. Corrosion occurs in the presence of moisture and oxygen but is accelerated by contaminants such as sulfur compounds and salts.

Buried

The buried environment consists of granular bedding material of sand or rock fines, backfill of dirt and rock, and filler material of gravel or crushed stone. Chemical testing of the groundwater has shown a pH between 7.2 and 7.6, a chloride concentration ranging between 13.7 - 21.5 ppm, and sulfates ranging between 10.3 - 41 ppm. Soil is assumed to contain levels of oxygen, moisture including ground water, biological organisms, and contaminants. A buried environment may include such items as pipe, ductbanks and conduits.

Wetted Gas

Wetted gas environments include air, containment atmosphere, and diesel exhaust gas. Air is either ambient or compressed air without air dryers in the system. Containment atmosphere in the drywell and torus is inerted with nitrogen with only 4% oxygen but is assumed to have the same corrosive effects as ambient air. Diesel exhaust can contain sulfur residues and has the potential for moisture and sulfuric acid in exhaust system components.

Dry Gas

The dry gas environments include dried air, nitrogen, carbon dioxide, hydrogen, oxygen, and freon. These gases are considered inert with respect to corrosion potential because they have no significant moisture content.

Materials of Construction

Each of the component materials for the component groupings was identified during the aging management review process and is identified in Column 4.

Aging Effects

Applicable aging effects are listed in Column 5. The aging effects that require management during the period of extended operation were determined by reviewing the plant-specific materials of construction and applicable operating environments for each component and structure subject to aging management review.

The systematic assessment of aging effects was based on the collective experience of the nuclear power industry available in pertinent industry literature and specific PBAPS operating experience. Identification of those aging effects that require management incorporated information developed from available industry experience and PBAPS experience. The evaluation process included a review of pertinent industry operating experience as contained in NRC generic communications such as Information Notices, Generic Letters and Bulletins. In addition, PBAPS specific experience was reviewed including plant maintenance history, modifications, nonconformance reports, and Licensee Event Reports.

Each combination of environment, component groups and material was assessed to determine the aging effects that require aging management. If during the review of aging effects requiring management during the period of extended operation, it was determined that there were no applicable aging effects requiring aging management, the results are presented in the table by noting "None" in Column 5 and "Not Applicable" in Column 6. For example, there are no aging effects for the dry gas environment or for metallic components in the ventilation environment because the low moisture content would not initiate corrosion degradation. In addition, there are no aging effects for stainless steel in a wetted gas environment because of its resistance to general corrosion and the absence of pooling of moisture where contaminants could concentrate. Similarly, the aging effects of concrete in all environments were determined non-significant and require no aging management; except for change in material properties due to leaching of calcium hydroxide. The concrete mix design meets air content and water-to-cement ratio specified in ACI 318 and is constructed with the guidance of ACI 201.2R. Also the concrete is not exposed to aggressive environment (pH<5.5), or to chloride or sulfate solutions, which exceed allowable limits (chlorides > 500 ppm, or sulfates > 1500 ppm) (Ref. NUREG-1557).

Aging Management Activities

Column 6 lists the aging management activities that are credited to manage the identified aging effects for the given material. These aging management activities have been evaluated to assure that the aging effects identified will be adequately managed such that the intended functions of the components and structures will be maintained consistent with the current licensing basis through the period of extended operation. Descriptions of each of these credited activities are provided in Appendix B. References and hypertext are provided to appropriate Appendix B sections.

There are a few activities listed in Column 6 where the aging management activity title has been shortened for presentation purposes in the table. Full titles of activities are described in Appendix B. An example of this is Column 6 identifies Oil Quality Testing as an aging management activity where the full title of Lubricating and Fuel Oil Quality Testing activities is described in Appendix B.

The relationship between the summary information presented in the six-column tables in Sections 3.1 through 3.6 and the detailed information in the various sections of the application is depicted in Figure 3.0-1 "Correlation of Six Column Tables to Sections in the Application."

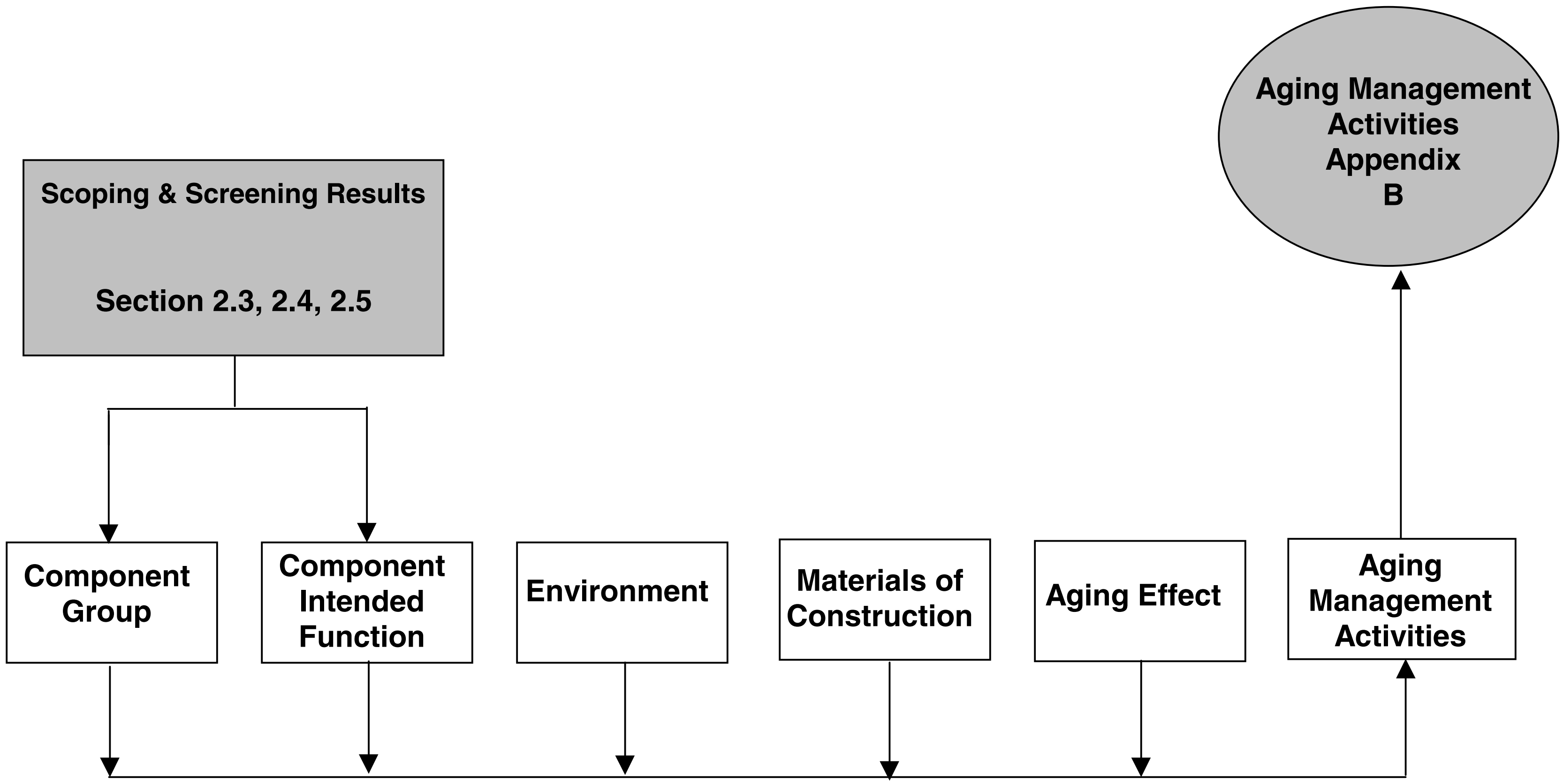


Figure 3.0-1 Correlation of Six Column Tables to Sections in the Application

3.1 AGING MANAGEMENT OF REACTOR COOLANT SYSTEM

The following Tables provide the results of the aging management reviews for each of the reactor coolant systems within the scope of license renewal. Aging management activities that are credited to manage the identified aging effects for the given material are discussed in Appendix B.

3.1.1 Reactor Pressure Vessel and Internals

Table 3.1-1 Aging Management Review Results for Component Groups for the Reactor Pressure Vessel and Internals

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Top Head	• Pressure Boundary	Steam	Low Alloy Steel	Loss of Material	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Bottom Head	• Structural Support • Pressure Boundary	Reactor Coolant	Low Alloy Steel	None (1)	• Not Applicable
Shell Courses	• Pressure Boundary	Reactor Coolant	Low Alloy Steel	Loss of Fracture Toughness	• Reactor Materials Surveillance Program (B.1.12)
Flanges	• Pressure Boundary	Reactor Coolant	Low Alloy Steel	None (1)	• Not Applicable
Closure Studs	• Pressure Boundary	Sheltered, Reactor Coolant	Low Alloy Steel	Cracking	• ISI Program (B.1.8)
Closure Studs	• Pressure Boundary	Sheltered	Low Alloy Steel	Cumulative Fatigue Damage - Evaluated as a TLAA - See Section 4.3	• Fatigue Management Activities (B.4.2)
Closure Nuts	• Pressure Boundary	Sheltered,	Low Alloy Steel	None	• Not Applicable
Stabilizer Bracket	• Structural Support	Sheltered	Low Alloy Steel	None	• Not Applicable

Table 3.1-1 Aging Management Review Results for Component Groups for the Reactor Pressure Vessel and Internals (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Support Skirt	• Structural Support	Sheltered	Low Alloy Steel	Cumulative Fatigue Damage - Evaluated as a TLAA - See Section 4.3	• Fatigue Management Activities (B.4.2)
Feedwater Nozzle, other Nozzles	• Pressure Boundary	Reactor Coolant	Low Alloy Steel	Cumulative Fatigue Damage - Evaluated as a TLAA - See Section 4.3	• Fatigue Management Activities (B.4.2)
Feedwater Nozzles	• Pressure Boundary	Reactor Coolant	Low Alloy Steel	Cracking	• RPV and Internals ISI Program (B.2.7)
Nozzle Safe Ends (including Core ΔP/SLC Nozzle Safe End)	• Pressure Boundary	Reactor Coolant	Stainless Steel and Nickel Base Alloys	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Core Spray Attachments, Jet Pump Riser Brace Attachments, Shroud Support Attachment	• Structural Support	Reactor Coolant	Stainless Steel and Nickel Base Alloys	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Other Attachments	• Structural Support	Steam, Reactor Coolant	Stainless Steel and Nickel Base Alloys	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
CRD Stub Tube Penetrations, ICM Housing Penetrations, and Instrument Penetrations	• Pressure Boundary	Reactor Coolant	Stainless Steel and Nickel Base Alloys	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)

Table 3.1-1 Aging Management Review Results for Component Groups for the Reactor Pressure Vessel and Internals (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Shroud	• Structural Support • Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Shroud Support	• Structural Support • Pressure Boundary	Reactor Coolant	Alloy 600 and Alloy 182 Weldments	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Access Hole Cover	• Pressure Boundary	Reactor Coolant	Alloy 600 and Alloy 182 Weldments	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Core Support Plate, Top Guide	• Structural Support	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Core ΔP/SLC Line, Core Spray Line and Core Spray Spargers	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Jet Pump Assemblies	• Structural Support • Pressure Boundary	Reactor Coolant	Cast Austenitic Stainless Steel	None (2)	• Not Applicable
Jet Pump Assemblies	• Structural Support • Pressure Boundary	Reactor Coolant	Alloy X-750	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
Jet Pump Assemblies	• Structural Support • Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)

Table 3.1-1 Aging Management Review Results for Component Groups for the Reactor Pressure Vessel and Internals (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Orificed Fuel Support, CRD Guide Tube Base	• Structural Support	Reactor Coolant	Cast Austenitic Stainless Steel	None (2)	• Not Applicable
CRDH Stub Tubes	• Structural Support	Reactor Coolant	Alloy 600	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
CRDH Guide Tubes	• Structural Support	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)
In-Core Housing Guide Tubes, LPRM and WRNMS Dry Tubes	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • RPV and Internals ISI Program (B.2.7)

(1). Per BWRVIP-74, Table 3-1, no age related degradation mechanism are identified.
(2). Delta ferrite < 20%.

3.1.2 Fuel Assemblies

Table 3.1-2 Aging Management Review Results for Component Groups for Fuel Assemblies

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
• None (1)	• Not Applicable	Not Applicable	Not Applicable	Not Applicable	• Not Applicable

(1) Fuel assemblies do not require aging management review because they are short-lived.

3.1.3 Reactor Pressure Vessel Instrumentation System

Table 3.1-3 Aging Management Review Results for Component Groups for the Reactor Pressure Vessel Instrumentation System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)

Table 3.1-3 Aging Management Review Results for Component Groups for the Reactor Pressure Vessel Instrumentation System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Condensing Chamber	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Condensing Chamber	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Condensing Chamber • Restricting Orifice	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable
Piping Specialties • Condensing Chamber	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Condensing Chamber	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)

(1) The ISI Program is credited for only the Class 1 piping or components in the component group.

3.1.4 Reactor Recirculation System

Table 3.1-4 Aging Management Review Results for Component Groups in the Reactor Recirculation System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Pump Casings	• Pressure Boundary	Reactor Coolant	Cast Austenitic Stainless Steel	Loss of Fracture Toughness	• ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Sheltered	Stainless Steel, Carbon Steel, Cast Austenitic Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Stainless Steel, Carbon Steel	None	• Not Applicable

Table 3.1-4 Aging Management Review Results for Component Groups in the Reactor Recirculation System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Flow Elements • Thermowells	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Flow Elements • Thermowells	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Flow Elements • Thermowells • Restricting Orifice	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable

3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES SYSTEMS

The following Tables provide the results of the aging management reviews for each of the Engineered Safety Features Systems within the scope of license renewal. Aging management activities that are credited to manage the identified aging effects for the given material are discussed in Appendix B.

3.2.1 High Pressure Coolant Injection System

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies • Filter Bodies	• Pressure Boundary	Lubricating Oil	Brass and Bronze	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies • Filter Bodies	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Lubricating Oil	Cast Iron	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies • Pump Casings • Filter Bodies • Turbine Casing	• Pressure Boundary	Sheltered	Cast Iron, Carbon Steel, Stainless Steel, Brass and Bronze	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Casting and Forging • Pump Casings	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Turbine Casing	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• HPCI and RCIC Turbine Inspection (B.2.10)
Elastomer • Flex Hoses	• Pressure Boundary	Lubricating Oil	Neoprene and Rubber	Loss of Properties	• HPCI and RCIC Turbine Inspection (B.2.10)
Elastomer • Flex Hoses	• Pressure Boundary	Sheltered	Neoprene and Rubber	None	• Not Applicable
Heat Exchanger • HPCI Gland Seal Condenser (Tubes)	• Pressure Boundary	Condensate Storage Water	Admiralty	Loss of Material	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Gland Seal Condenser (Tubes)	• Pressure Boundary	Condensate Storage Water	Admiralty	Cracking	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Gland Seal Condenser (Tubes)	• Heat Transfer	Condensate Storage Water	Admiralty	Reduction of Heat Transfer	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Tubes)	• Pressure Boundary	Condensate Storage Water	Admiralty	Loss of Material	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Tubes)	• Pressure Boundary	Condensate Storage Water	Admiralty	Cracking	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Tubes)	• Heat Transfer	Condensate Storage Water	Admiralty	Reduction of Heat Transfer	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Gland Seal Condenser (Channel, Tube Sheet)	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Gland Seal Condenser (Channel, Tube Sheet)	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Cracking	• Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Gland Seal Condenser (Channel, Tube Sheet)	• Heat Transfer	Condensate Storage Water	Carbon Steel	Reduction of Heat Transfer	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Channel, Tube Sheet)	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Channel, Tube Sheet)	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Cracking	• Heat Exchanger Inspection (B.2.12))
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Channel, Tube Sheet)	• Heat Transfer	Condensate Storage Water	Carbon Steel	Reduction of Heat Transfer	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Tube)	• Pressure Boundary	Lubricating Oil	Admiralty	Loss of Material	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Tube)	• Pressure Boundary	Lubricating Oil	Admiralty	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Tube)	• Heat Transfer	Lubricating Oil	Admiralty	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Shell, Tubesheet)	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Shell, Tubesheet)	• Pressure Boundary	Lubricating Oil	Carbon Steel	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPCI Turbine Lube Oil Cooler (Shell, Tubesheet)	• Heat Transfer	Lubricating Oil	Carbon Steel	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPCI Pump Rooms Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Loss of Material	• ISI Program (B.1.8)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • HPCI Pump Rooms Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Cracking	• ISI Program (B.1.8) •
Heat Exchanger HPCI Pump Rooms Cooling Coils (2) (Tubes)	• Pressure Boundary	Raw Water	Copper	Flow Blockage (N/A for abandoned coils)	• GL 89-13 Activities (B.2.8)
Heat Exchanger • HPCI Pump Room Cooling Coils (Fins)	• Pressure Boundary	Sheltered	Aluminum	None	• Not Applicable
Heat Exchanger • HPCI Gland Seal Condenser • HPCI Turbine Lube Oil Cooler	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable
Heat Exchanger • HPCI Pump Room Cooling Coils (Tubes)	• Pressure Boundary	Sheltered	Copper	None	• Not Applicable
Heat Exchanger • HPCI Pump Room Cooling Coils (no flow) (Tube Sheet and Frames)	• Pressure Boundary	Sheltered	Galvanized Carbon Steel	None	• Not Applicable

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • HPCI Gland Seal Condenser (Impingement plates at shell inlets)	• Pressure Boundary	Steam	304 Stainless Steel	Cracking	• RCS Chemistry (B.1.2)
Heat Exchanger • HPCI Gland Seal Condenser (Tube)	• Pressure Boundary	Steam	Admiralty	Cracking	• RCS Chemistry (B.1.2)
Heat Exchanger • HPCI Gland Seal Condenser (Tube Sheet, Shell, Baffles, Tube Supports)	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping • Pipe	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping • Fittings	• Pressure Boundary	Lubricating Oil	Brass, Brass Alloys	Loss of Material	• Oil Quality Testing (B.2.1)
Piping • Pipe	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Tubing	• Pressure Boundary	Lubricating Oil	Stainless Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • FAC Program (B.1.1) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered	Stainless Steel, Carbon Steel, Brass Alloys	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5) • Torus Piping Inspection (B.3.1)
Piping • Pipe • Tubing	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe. • Tubing	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Piping • Pipe	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Piping Specialties • Thermowell • Flow Elements	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Restricting Orifice	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping Specialties • Restricting Orifice	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping Specialties • Steam Trap	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2)

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Thermowell • Flow Elements • Restricting Orifice • Steam Trap • Rupture Disc	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping Specialties • Sparger	• Spray	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Piping Specialties • Steam Trap	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Wetted Gas	Stainless Steel	None	• Not Applicable

Table 3.2-1 Aging Management Review Results for Component Groups in the High Pressure Coolant Injection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Rupture Disc	• Pressure Boundary • Throttle	Wetted Gas	Stainless Steel	None	• Not Applicable
Vessel • Lubricating Oil Tanks	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1) • HPCI and RCIC Turbine Inspection (B.2.10)
Vessel • Lubricating Oil Tanks	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable

(1) The ISI Program is credited only for the Class 1 piping or components in the component group.
(2) One of two trains is abandoned in-place and the inlet to the cooler is isolated.

3.2.2 Core Spray System

Table 3.2-2 Aging Management Review Results for Component Groups in the Core Spray System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Carbon Steel, Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Sheltered	Stainless Steel, Carbon Steel	None	• Not Applicable
Casting and Forging • Pump Casings	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)

Table 3.2-2 Aging Management Review Results for Component Groups in the Core Spray System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Casing)	• Pressure Boundary	Lubricating Oil	Cast iron	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Casing)	• Heat Transfer	Lubricating Oil	Cast Iron	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Lubricating Oil	Stainless Steel	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Coil)	• Heat Transfer	Lubricating Oil	Stainless Steel	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • Core Spray Pump Rooms Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Loss of Material	• ISI Program (B.1.8)
Heat Exchanger • Core Spray Pump Rooms Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Cracking	• ISI Program (B.1.8)
Heat Exchanger • Core Spray Pump Rooms Cooling Coils (1) (Tubes)	• Pressure Boundary	Raw Water	Copper	Flow Blockage (N/A for abandoned coils)	• GL 89-13 Activities (B.2.8)

Table 3.2-2 Aging Management Review Results for Component Groups in the Core Spray System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • Core Spray Pump Rooms Cooling Coils (Tubes)	• Heat Transfer (N/A for abandoned coils)	Raw Water	Copper	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • Core Spray Pump Motor Oil Cooler (Coil)	• Heat Transfer	Raw Water	Stainless Steel	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • Core Spray Pump Rooms Cooling Coils (Fins)	• Heat Transfer (N/A for abandoned coils)	Sheltered	Aluminum	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)

Table 3.2-2 Aging Management Review Results for Component Groups in the Core Spray System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • Core Spray Pump Motor Oil Cooler	• Pressure Boundary	Sheltered	Cast Iron	None	• Not Applicable
Heat Exchanger • Core Spray Pump Rooms Cooling Coils (Tubes)	• Heat Transfer (N/A for abandoned coils)	Sheltered	Copper	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • Core Spray Pump Rooms Cooling Coils (Tube Sheet and Frames)	• Heat Transfer (N/A for abandoned coils)	Sheltered	Galvanized Carbon Steel	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping • Pipe	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping • Pipe	• Pressure Boundary	Dry Gas	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Stainless Steel, Carbon Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)

Table 3.2-2 Aging Management Review Results for Component Groups in the Core Spray System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5) • Torus Piping Inspection (B.3.1)
Piping • Pipe • Tubing	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping • Pipe • Tubing	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Piping Specialties • Restricting Orifices	• Pressure Boundary • Throttle	Dry Gas	Stainless Steel	None	• Not Applicable
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Flow Elements • Thermowells • Restricting Orifice • Cyclone Separators	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Flow Elements • Thermowells	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)

Table 3.2-2 Aging Management Review Results for Component Groups in the Core Spray System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Cyclone Separators • Restricting Orifices	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Cyclone Separators • Restricting Orifices	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)

(1) One of two trains is abandoned in-place and the inlet to the cooler is isolated.

3.2.3 Primary Containment Isolation System

Table 3.2-3 Aging Management Review Results for Component Groups in the Primary Containment Isolation System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Loss of Material	• CCW Chemistry (B.1.3)
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Carbon Steel Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Cast Austenitic Stainless Steel	Loss of Fracture Toughness	• ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forgings • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Primary Containment Leakage Rate Testing Program (B.1.10)
Castings and Forgings • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Cast Austenitic Stainless Steel	None	• Not Applicable
Castings and Forgings • Valve Bodies	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Loss of Material	• CCW Chemistry (B.1.3)
Piping • Pipe	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable

Table 3.2-3 Aging Management Review Results for Component Groups in the Primary Containment Isolation System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Primary Containment Leakage Rate Testing Program (B.1.10)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping Specialties • Flow Elements	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2)

Table 3.2-3 Aging Management Review Results for Component Groups in the Primary Containment Isolation System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Flow Elements	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping Specialties • Restricting Orifice • Flow Elements	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable

(1) The ISI Program is credited only for the Class 1 piping or components in the component group.

3.2.4 Reactor Core Isolation Cooling System

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Lubricating Oil	Brass and Bronze	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Turbine Casing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Brass and Bronze, Alloy Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8))

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Turbine Casing	• Pressure Boundary	Wetted Gas	Alloy Steel	Loss of Material	• HPCI and RCIC Turbine Inspection (B.2.10)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Bronze	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Tube)	• Pressure Boundary	Condensate Storage Water	Admiralty	Loss of Material	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12))
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Tube)	• Pressure Boundary	Condensate Storage Water	Admiralty	Cracking	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Tube)	• Heat Transfer	Condensate Storage Water	Admiralty	Reduction of Heat Transfer	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Channel, Tubesheet)	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Channel, Tubesheet)	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Cracking	• Heat Exchanger Inspection (B.2.12)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Channel, Tubesheet)	• Heat Transfer	Condensate Storage Water	Carbon Steel	Reduction of Heat Transfer	• CST Chemistry (B.1.4) • Heat Exchanger Inspection (B.2.12)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Tube)	• Pressure Boundary	Lubricating Oil	Admiralty	Loss of Material	• Oil Quality Testing (B.2.1)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Tube)	• Pressure Boundary	Lubricating Oil	Admiralty	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Tube)	• Heat Transfer	Lubricating Oil	Admiralty	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Shell, Tube Sheet)	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Shell, Tube Sheet)	• Pressure Boundary	Lubricating Oil	Carbon Steel	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • RCIC Turbine Lube Oil Cooler (Shell, Tube Sheet)	• Heat Transfer	Lubricating Oil	Carbon Steel	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1)
Heat Exchanger • RCIC Pump Rooms Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Loss of Material	• ISI Program (B.1.8)
Heat Exchanger • RCIC Pump Rooms Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Cracking	• ISI Program (B.1.8)
Heat Exchanger RCIC Pump Rooms Cooling Coils (2) (Tubes)	• Pressure Boundary	Raw Water	Copper	Flow Blockage (N/A for abandoned coolers)	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RCIC Pump Room Cooling Coils (Fins)	• Pressure Boundary	Sheltered	Aluminum	None	• Not Applicable
Heat Exchanger • RCIC Turbine Lube Oil Cooler	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable
Heat Exchanger • RCIC Pump Room Cooling Coils (Tubes)	• Pressure Boundary	Sheltered	Copper	None	• Not Applicable

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • RCIC Pump Room Cooling Coils (Tube Sheet and Frame)	• Pressure Boundary	Sheltered	Galvanized Carbon Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping • Fittings	• Pressure Boundary	Lubricating Oil	Brass, Brass Alloys	Loss of Material	• Oil Quality Testing (B.2.1)
Piping • Pipe	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Piping • Tubing	• Pressure Boundary	Lubricating Oil	Stainless Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • FAC Program (B.1.1) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered	Carbon Steel, Brass Alloys, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe • Tubing	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5) • Torus Piping Inspection (B.3.1)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Piping Specialties • Thermowell • Flow Element	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Y-Strainer Body	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Y-Strainer Screens	• Filter	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Y-Strainer Screens	• Filter	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping Specialties • Restricting Orifice	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping Specialties • Restricting Orifice	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping Specialties • Steam Trap	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping Specialties • Restricting Orifice • Thermowells • Y Strainer Bodies • Steam Trap • Rupture Disc	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Piping Specialties • Steam Trap	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)

Table 3.2-4 Aging Management Review Results for Component Groups in the Reactor Core Isolation Cooling System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Steam Traps	• Pressure Boundary • Throttle	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Piping Specialties • Rupture Disc	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable
Piping Specialties • Restricting Orifices	• Pressure Boundary • Throttle	Wetted Gas	Stainless Steel	None	• Not Applicable
Vessel • Tank (Barometric Condenser)	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Vessel • Tank (Barometric Condenser)	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable

(1) The ISI Program is credited only for the Class 1 piping or components in the component group.
(2) One of two trains is abandoned in-place and the inlet to the cooler is isolated.

3.2.5 Residual Heat Removal System

Table 3.2-5 Aging Management Review Results for Component Groups in the Residual Heat Removal System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Primary Containment Leakage Rate Testing Program (B.1.10)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable

Table 3.2-5 Aging Management Review Results for Component Groups in the Residual Heat Removal System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • RHR Heat Exchangers (Tube, Tube Sheet)	• Pressure Boundary	Raw Water	304 Stainless Steel	Loss of Material	• HPSW Radioactive Monitoring Activities (B.1.7) • GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube, Tube Sheet)	• Pressure Boundary	Raw Water	304 Stainless Steel	Cracking	• HPSW Radioactive Monitoring Activities (B.1.7) • GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube, Tube Sheet)	• Pressure Boundary	Raw Water	304 Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube, Tube Sheet)	• Heat Transfer	Raw Water	304 Stainless Steel	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Channel)	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Channel)	• Pressure Boundary	Raw Water	Carbon Steel	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Channel)	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Channel)	• Heat Transfer	Raw Water	Carbon Steel	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)

Table 3.2-5 Aging Management Review Results for Component Groups in the Residual Heat Removal System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • RHR Pump Room Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Loss of Material	• ISI Program (B.1.8)
Heat Exchanger • RHR Pump Room Cooling Coils (Tubes)	• Pressure Boundary	Raw Water	Copper	Cracking	• ISI Program (B.1.8)
Heat Exchanger • RHR Pump Room Cooling Coils (1) (Tubes)	• Pressure Boundary	Raw Water	Copper	Flow Blockage (N/A for abandoned coils)	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Pump Room Cooling Coils (Tubes)	• Heat Transfer (N/A for abandoned coils)	Raw Water	Copper	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Pump Room Cooling Coils (Fins)	• Heat Transfer (N/A for abandoned coils)	Sheltered	Aluminum	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable

Table 3.2-5 Aging Management Review Results for Component Groups in the Residual Heat Removal System (Continued)

Component Group	**Component Intended Function**	**Environment**	**Materials of Construction**	**Aging Effect**	**Aging Management Activity**
Heat Exchanger • RHR Pump Room Cooling Coils (Tubes)	• Heat Transfer (N/A for abandoned coils)	Sheltered	Copper	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Pump Room Cooling Coils (Tube Sheet and Frames)	• Heat Transfer (N/A for abandoned coils)	Sheltered	Galvanized Carbon Steel	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube Sheets, Shell, Baffles, Nozzles, Internals)	• Pressure Boundary	Torus Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5) • GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube Sheets, Shell, Baffles, Nozzles, Internals)	• Pressure Boundary	Torus Water	Carbon Steel	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube Sheets, Shell, Baffles, Nozzles, Internals)	• Heat Transfer	Torus Water	Carbon Steel	Reduction of Heat Transfer	• IST Program (B.1.11) • Torus Water Chemistry (B.1.5) • GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube)	• Pressure Boundary	Torus Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5) • GL 89-13 Activities (B.2.8)

Table 3.2-5 Aging Management Review Results for Component Groups in the Residual Heat Removal System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • RHR Heat Exchangers (Tube)	• Pressure Boundary	Torus Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • RHR Heat Exchangers (Tube)	• Heat Transfer	Torus Water	Stainless Steel	Reduction of Heat Transfer	• IST Program (B.1.11) • Torus Water Chemistry (B.1.5) • GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping • Pipe	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping • Pipe	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)

Table 3.2-5 Aging Management Review Results for Component Groups in the Residual Heat Removal System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Tubing	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping • Tubing	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Piping • Pipe	• Pressure Boundary	Torus Grade Water (Gas Interface)	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5) • Torus Piping Inspection (B.3.1)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Primary Containment Leakage Rate Testing Program (B.1.10)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable
Piping Specialties • Thermowells • Flow Elements • Cyclone Separators • Restricting Orifices	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Flow Elements	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Thermowells	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Cyclone Separators	• Pressure Boundary	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Cyclone Separators	• Pressure Boundary	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)

Table 3.2-5 Aging Management Review Results for Component Groups in the Residual Heat Removal System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Restricting Orifices	• Pressure Boundary • Throttle	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Restricting Orifices	• Pressure Boundary • Throttle	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping Specialties • Suction Strainers	• Filter	Torus Grade Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)

(1) One of two trains is abandoned in-place and the inlet to the cooler is isolated.

3.2.6 Containment Atmosphere Control and Dilution System

Table 3.2-6 Aging Management Review Results for Component Groups in the Containment Atmosphere Control and Dilution System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Pump Casings	• Pressure Boundary	Dry Gas	Aluminum	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Brass	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Carbon Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Aluminum, Brass	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Primary Containment Leakage Rate Testing Program (B.1.10)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Dry Gas	Carbon Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable

Table 3.2-6 Aging Management Review Results for Component Groups in the Containment Atmosphere Control and Dilution System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Primary Containment Leakage Rate Testing Program (B.1.10)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable
Piping Specialty • Nitrogen Electric Vaporizers	• Pressure Boundary	Dry Gas, Sheltered	Carbon Steel	None	• Not Applicable
Vessel • Nitrogen Storage Tanks	• Pressure Boundary	Dry Gas, Sheltered	Carbon Steel	None	• Not Applicable
Vessel • H_2 and O_2 Detection Chambers	• Pressure Boundary	Dry Gas, Sheltered	Stainless Steel	None	• Not Applicable

3.2.7 Standby Gas Treatment System

Table 3.2-7 Aging Management Review Results for Component Groups in the Standby Gas Treatment System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Carbon Steel, Stainless Steel, Bronze, Brass	None	• Not Applicable
Elastomer • Fan Flex Connections	• Pressure Boundary	Ventilation Atmosphere, Sheltered	Fiberglass Impregnated Neoprene	Change in Material Properties	• Ventilation System Inspection and Testing (B.2.3)
Elastomer • Filter Plenum Access Door Seals	• Pressure Boundary	Ventilation Atmosphere, Sheltered	Sponge Neoprene Rubber	Change in Material Properties	• Ventilation System Inspection and Testing (B.2.3)
Piping • Pipe	• Pressure Boundary	Buried	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Copper, Dielectric Unions	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Piping • Fittings	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel, Dielectric Unions	None	• Not Applicable
Piping • Tubing	• Pressure Boundary	Ventilation Atmosphere	Copper, Stainless Steel	None	• Not Applicable

Table 3.2-7 Aging Management Review Results for Component Groups in the Standby Gas Treatment System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Flow Elements • Pressure Elements • Temperature Element Couplings	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Carbon Steel, Stainless Steel, Anodized Aluminum	None	• Not Applicable
Sheet Metal • Ducting • Plenums • Fan Enclosures • Damper Enclosures	• Pressure Boundary	Sheltered	Carbon Steel, Galvanized Steel	None	• Not Applicable
Sheet Metal • Plenums	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Sheet Metal • Fan Enclosures	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable
Sheet Metal • Ducting • Damper Enclosures	• Pressure Boundary	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable

3.2.8 Secondary Containment System

Table 3.2-8 Aging Management Review Results for Component Groups in the Secondary Containment System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Piping • Tubing	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Stainless Steel	None	• Not Applicable
Sheet Metal • Ducting	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable

3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

The following Tables provide the results of the aging management reviews for each of the Auxiliary Systems within the scope of license renewal. Aging management activities that are credited to manage the identified aging effects for the given material are discussed in Appendix B.

3.3.1 Fuel Handling System

Table 3.3-1 Aging Management Review Results for Component Groups in the Fuel Handling System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Fuel Preparation Machines	• Structural Support	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Fuel Preparation Machines	• Structural Support	Fuel Pool Water	Aluminum	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Refueling Platform (assembly)	• Structural Support	Sheltered	Stainless Steel	None	• Not Applicable
Refueling Platform (assembly)	• Structural Support	Sheltered	Carbon Steel	None	• Not Applicable
Refueling Platform (rails)	• Structural Support	Sheltered	Carbon Steel	None	• Not Applicable
Refueling Platform (mast)	• Structural Support	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Refueling Platform (mast)	• Structural Support	Fuel Pool Water	Chrome Plated Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)

3.3.2 Fuel Pool Cooling and Cleanup System

Table 3.3-2 Aging Management Review Results for Component Groups in the Fuel Pool Cooling and Cleanup System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Fuel Pool Water	Carbon Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Casting and Forging • Valve Bodies	• Pressure Boundary	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Casting and Forging • Valve Bodies	• Pressure Boundary	Fuel Pool Water	Stainless Steel	Cracking	• Fuel Pool Chemistry (B.1.6)
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Fuel Pool Water	Carbon Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Piping • Pipe	• Pressure Boundary	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Piping • Pipe	• Pressure Boundary	Fuel Pool Water	Stainless Steel	Cracking	• Fuel Pool Chemistry (B.1.6)
Piping • Pipe	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Vacuum Breakers • Restricting Orifice	• Pressure Boundary	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Piping Specialties • Vacuum Breakers • Restricting Orifice	• Pressure Boundary	Fuel Pool Water	Stainless Steel	Cracking	• Fuel Pool Chemistry (B.1.6)
Piping Specialties • Vacuum Breakers • Restricting Orifice	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable

3.3.3 Control Rod Drive System

Table 3.3-3 Aging Management Review Results for Component Groups in the Control Rod Drive System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Carbon Steel, Stainless Steel	None	• Not Applicable
Castings and Forgings • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Castings and Forgings • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping • Pipe	• Pressure Boundary	Dry Gas	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)

Table 3.3-3 Aging Management Review Results for Component Groups in the Control Rod Drive System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Filter Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping Specialties • Filter Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping Specialties • Rupture Disc	• Pressure boundary	Dry Gas	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Filter Bodies • Rupture Disc	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Vessel • Accumulators	• Pressure Boundary	Condensate Storage Water	Carbon Steel, Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Vessel • Accumulators	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Vessel • Accumulators	• Pressure boundary	Dry Gas	Carbon Steel, Stainless Steel	None	• Not Applicable
Vessel • Accumulators	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable

3.3.4 Standby Liquid Control System

Table 3.3-4 Aging Management Review Results for Component Groups in the Standby Liquid Control System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Borated Water	Stainless Steel	Loss of Material	• ISI Program (B.1.8)
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Borated Water	Stainless Steel	Cracking	• ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Borated Water	Stainless Steel	Loss of Material	• SBLC System Surveillance (B.1.13)
Casting and Forging • Valve Bodies	• Pressure Boundary	Borated Water	Stainless Steel	Cracking	• SBLC System Surveillance (B.1.13)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Casting and Forging • Pump Casing • Valve Bodies	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable
Piping • Pipe • Tubing	• Pressure Boundary	Borated Water	Stainless Steel	Loss of Material	• ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Borated Water	Stainless Steel	Cracking	• ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Borated Water	Stainless Steel	Loss of Material	• SBLC System Surveillance (B.1.13)

Table 3.3-4 Aging Management Review Results for Component Groups in the Standby Liquid Control System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Borated Water	Stainless Steel	Cracking	• SBLC System Surveillance (B.1.13)
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable
Piping Specialties • Thermowells	• Pressure Boundary	Borated Water	Stainless Steel	Loss of Material	• ISI Program (B.1.8)
Piping Specialties • Thermowells	• Pressure Boundary	Borated Water	Stainless Steel	Cracking	• ISI Program (B.1.8)
Piping Specialties • Thermowells	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable
Vessel • Accumulators	• Pressure Boundary	Borated Water	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Vessel • Solution Tank	• Pressure Boundary	Borated Water	Stainless Steel	Loss of Material	• SBLC System Surveillance (B.1.13)
Vessel • Solution Tank	• Pressure Boundary	Borated Water	Stainless Steel	Cracking	• SBLC System Surveillance (B.1.13)
Vessel • Accumulators	• Pressure Boundary	Dry Gas	Carbon Steel	None	• Not Applicable
Vessel • Accumulators • Solution Tank	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable

3.3.5 High Pressure Service Water System

Table 3.3-5 Aging Management Review Results for Component Groups in the High Pressure Service Water System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Pump Casings • Strainer Bodies • Valve Bodies	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Casting and Forging • Pump Casings • Strainer Bodies • Valve Bodies	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Pump Casings (External)	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Pump Casings	• Pressure Boundary	Raw Water	Cast Iron	Flow Blockage	• GL 89-13 Activities (B.2.8)
Casting and Forging • Pump Casings	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Pump Casings (External) (Bowls and Suction Bell)	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)

Table 3.3-5 Aging Management Review Results for Component Groups in the High Pressure Service Water System (Continued**)**

Component Group	**Component Intended Function**	**Environment**	**Materials of Construction**	**Aging Effect**	**Aging Management Activity**
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Strainer Screens	• Filter	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8)
Casting and Forging • Strainer Screens	• Filter	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8)
Casting and Forging • Strainer Screens	• Filter	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Casting and Forging • Strainer Bodies • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Heat Exchanger • HPSW Pump Motor Oil Cooler (Casing)	• Pressure Boundary	Lubricating Oil	Cast Iron	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPSW Pump Motor Oil Cooler (Casing)	• Heat Transfer	Lubricating Oil	Cast Iron	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • Oil Quality Testing (B.2.1)
Heat Exchanger • HPSW Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Lubricating Oil	Copper	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPSW Pump Motor Oil Cooler (Coil)	• Heat Transfer	Lubricating Oil	Copper	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • Oil Quality Testing (B.2.1)
Heat Exchanger • HPSW Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Raw Water	Copper	Loss of Material	• Oil Quality Testing (B.2.1)

Table 3.3-5 Aging Management Review Results for Component Groups in the High Pressure Service Water System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • HPSW Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Raw Water	Copper	Cracking	• Oil Quality Testing (B.2.1)
Heat Exchanger • HPSW Pump Motor Oil Cooler (Coil)	• Pressure Boundary	Raw Water	Copper	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • HPSW Pump Motor Oil Cooler (Coil)	• Heat Transfer	Raw Water	Copper	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • HPSW Pump Motor Oil Cooler	• Pressure Boundary	Sheltered	Cast Iron	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Buried	Carbon Steel	Loss of Material	• ISI Program (B.1.8) • Outdoor, Buried and Submerged Component Inspection (B.2.5)
Piping • Pipe	• Pressure Boundary	Raw Water	Alloy Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Alloy Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Tubing	• Pressure Boundary	Raw Water	Stainless Steel	None	• Not Applicable

Table 3.3-5 Aging Management Review Results for Component Groups in the High Pressure Service Water System (Continued**)**

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Alloy Steel	None	• Not Applicable
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water	Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)

Table 3.3-5 Aging Management Review Results for Component Groups in the High Pressure Service Water System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Flow Elements • Restricting Orifice	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable

3.3.6 Emergency Service Water System

Table 3.3-6 Aging Management Review Results for Component Groups in the Emergency Service Water System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• IST Program (B.1.11) • GL 89-13 Activities (B.2.8)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Pump Casings (External)	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Pump Casings	• Pressure Boundary	Raw Water	Cast Iron	Flow Blockage	• IST Program (B.1.11) • GL 89-13 Activities (B.2.8)
Casting and Forging • Pump Casings	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Pump Casings (External) (Bowls and Suction Bell)	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)

Table 3.3-6 Aging Management Review Results for Component Groups in the Emergency Service Water System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Buried	Carbon Steel	Loss of Material	• ISI Program (B.1.8) • Outdoor, Buried and Submerged Component Inspection (B.2.5)
Piping • Pipe	• Pressure Boundary	Raw Water	Alloy Steel	Flow Blockage	• IST Program (B.1.11) • GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Alloy Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• IST Program (B.1.11) • GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Copper	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Copper	Flow Blockage	• IST Program (B.1.11) • GL 89-13 Activities (B.2.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Copper	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• IST Program (B.1.11) • GL 89-13 Activities (B.2.8)

Table 3.3-6 Aging Management Review Results for Component Groups in the Emergency Service Water System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Tubing	• Pressure Boundary	Raw Water	Stainless Steel	None	• Not Applicable
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Copper, Alloy Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Thermowells	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8)
Piping Specialties • Thermowells	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Flow Element • Expansion Joints	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Flow Element • Expansion Joints	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• IST Program (B.1.11) • GL 89-13 Activities (B.2.8)
Piping Specialties • Flow Element • Expansion Joints	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Thermowells • Flow Element • Expansion Joints	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable

3.3.7 Fire Protection System

Table 3.3-7 Aging Management Review Results for Component Groups in the Fire Protection System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Buried	Cast Iron	Loss of Material	• Fire Protection Activities (B.2.9) • Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Sprinkler Heads	• Pressure Boundary • Spray	Dry Gas	Bronze	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Bronze, Brass, Carbon Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Fuel Oil	Brass and Bronze	Cracking	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Fuel Oil	Brass, Bronze, Cast Iron	Loss of Material	• Oil Quality Testing (B.2.1) • Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Strainer Screens	• Pressure Boundary • Filter (Strainer Screens Only)	Fuel Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Bronze	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Cast Iron	Loss of Material	• Fire Protection Activities (B.2.9)

Table 3.3-7 Aging Management Review Results for Component Groups for the Fire Protection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Hydrants	• Pressure Boundary	Outdoor	Cast Iron	Loss of Material	• Fire Protection Activities (B.2.9)
Casting and Forging • Pump Casings (External) (Bowls and Suction Bell)	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Brass	Cracking	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Brass	Flow Blockage	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Brass	Loss of Material	• Fire Protection Activities (B.2.9)
Casting and Forging • Sprinkler Heads	• Pressure Boundary • Spray	Raw Water	Brass and Chrome Plated Brass	Loss of Material	• Fire Protection Activities (B.2.9)
Casting and Forging • Sprinkler Heads	• Pressure Boundary • Spray	Raw Water	Brass and Chrome Plated Brass	Cracking	• Fire Protection Activities (B.2.9)
Casting and Forging • Sprinkler Heads	• Pressure Boundary • Spray	Raw Water	Brass and Chrome Plated Brass	Flow Blockage	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies • Strainer Bodies	• Pressure Boundary	Raw Water	Bronze	Cracking	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies • Strainer Bodies	• Pressure Boundary	Raw Water	Bronze	Flow Blockage	• Fire Protection Activities (B.2.9)

Table 3.3-7 Aging Management Review Results for Component Groups for the Fire Protection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies • Strainer Bodies	• Pressure Boundary	Raw Water	Bronze	Loss of Material	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies • Strainer Bodies	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies • Strainer Bodies	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• Fire Protection Activities (B.2.9)
Casting and Forging • Pump Casings (External)	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Hydrants	• Pressure Boundary	Raw Water	Cast Iron	Flow Blockage	• Fire Protection Activities (B.2.9)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Hydrants	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• Fire Protection Activities (B.2.9)
Casting and Forging • Strainer Screens	• Filter	Raw Water	Stainless Steel	Cracking	• Fire Protection Activities (B.2.9)
Casting and Forging • Strainer Screens	• Filter	Raw Water	Stainless Steel	Flow Blockage	• Fire Protection Activities (B.2.9)
Casting and Forging • Strainer Screens	• Filter	Raw Water	Stainless Steel	Loss of Material	• Fire Protection Activities (B.2.9)

Table 3.3-7 Aging Management Review Results for Component Groups for the Fire Protection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Sprinkler Heads	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Cast Iron, Chrome-plated Brass, Brass and Bronze	None	• Not Applicable
Elastomer • Flexible Hoses	• Pressure Boundary	Fuel Oil	Neoprene and Rubber	Change in Material Properties	• Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Buried	Lined Cast Iron	Loss of Material	• Fire Protection Activities (B.2.9) • Outdoor, Buried and Submerged Component Inspection (B.2.5)
Piping • Pipe	• Pressure Boundary	Dry Gas	Carbon Steel	None	• Not Applicable
Piping • Fittings	• Pressure Boundary	Fuel Oil	Brass, Brass Alloys	Cracking	• Fire Protection Activities (B.2.9)
Piping • Fittings	• Pressure Boundary	Fuel Oil	Brass, Brass Alloys	Loss of Material	• Oil Quality Testing (B.2.1) • Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Fuel Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Piping • Tubing	• Pressure Boundary	Fuel Oil	Stainless Steel	Cracking	• Fire Protection Activities (B.2.9)
Piping • Tubing	• Pressure Boundary	Fuel Oil	Stainless Steel	Loss of Material	• Oil Quality Testing (B.2.1) • Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Outdoor	Carbon Steel	None	• Not Applicable

Table 3.3-7 Aging Management Review Results for Component Groups for the Fire Protection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Outdoor	Malleable Iron	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Raw Water	Black Steel	Flow Blockage	• Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Raw Water	Black Steel	Loss of Material	• Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• Fire Protection Activities (B.2.9)
Piping • Tubing	• Pressure Boundary	Raw Water	Copper	Cracking	• Fire Protection Activities (B.2.9)
Piping • Tubing	• Pressure Boundary	Raw Water	Copper	Flow Blockage	• Fire Protection Activities (B.2.9)
Piping • Tubing	• Pressure Boundary	Raw Water	Copper	Loss of Material	• Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Raw Water	Lined Cast Iron	Flow Blockage	• Fire Protection Activities (B.2.9)
Piping • Pipe	• Pressure Boundary	Raw Water	Lined Cast Iron	Loss of Material	• Fire Protection Activities (B.2.9)
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Copper, Brass Alloys, Malleable Iron	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Fire Protection Activities (B.2.9)

Table 3.3-7 Aging Management Review Results for Component Groups for the Fire Protection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Discharge Nozzles	• Pressure Boundary • Spray	Dry Gas	Bronze	None	• Not Applicable
Piping Specialties • Strainer Bodies • Y Strainer Body	• Pressure Boundary	Dry Gas	Bronze, Carbon Steel, Cast Iron, Aluminum	None	• Not Applicable
Piping Specialties • Strainer Screens	• Filter	Dry Gas	Carbon Steel	None	• Not Applicable
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water	Carbon Steel	Flow Blockage	• Fire Protection Activities (B.2.9)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Raw Water	Carbon Steel	Loss of Material	• Fire Protection Activities (B.2.9)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• Fire Protection Activities (B.2.9)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• Fire Protection Activities (B.2.9)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• Fire Protection Activities (B.2.9)
Piping Specialties • Strainer Bodies • Y Strainer Body • Discharge Nozzles • Restricting Orifice • Flow Elements • Metal Flex Connection	• Pressure Boundary	Sheltered	Bronze, Carbon Steel, Cast Iron, Aluminum, Stainless Steel	None	• Not Applicable

Table 3.3-7 Aging Management Review Results for Component Groups for the Fire Protection System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Metal Flex Connection	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Fire Protection Activities (B.2.9)
Vessel • Cardox Tank	• Pressure Boundary	Dry Gas	Carbon Steel	None	• Not Applicable
Vessel • Fuel Tank	• Pressure Boundary	Fuel Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Vessel • Cardox Tank • Fuel Tank • Muffler	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable
Vessels • Muffler	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Fire Protection Activities (B.2.9)

3.3.8 Control Room Ventilation System

Table 3.3-8 Aging Management Review Results for Component Groups in the Control Room Ventilation System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Stainless Steel, Brass	None	• Not Applicable
Elastomer • Fan Flex Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Fiberglass Impregnated Neoprene	Change in Material Properties	• Ventilation System Inspection and Testing (B.2.3)
Elastomer • Filter Plenum Access Door Seals	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Sponge Neoprene Rubber	Change in Material Properties	• Ventilation System Inspection and Testing (B.2.3)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Copper, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Piping • Tubing	• Pressure Boundary	Ventilation Atmosphere	Copper, Stainless Steel	None	• Not Applicable
Piping Specialties • Flow Elements	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Stainless Steel	None	• Not Applicable
Sheet Metal • Ducting • Damper Enclosures • Plenums • Fan Enclosures	• Pressure Boundary	Sheltered	Carbon Steel, Galvanized Steel	None	• Not Applicable
Sheet Metal • Plenums • Fan Enclosures	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable

Table 3.3-8 Aging Management Review Results for Component Groups in the Control Room Ventilation System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable
Sheet Metal • Ducting • Damper Enclosures	• Pressure Boundary	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable

3.3.9 Battery and Emergency Switchgear Ventilation System

Table 3.3-9 Aging Management Review Results for Component Groups in the Battery and Emergency Switchgear Ventilation System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Stainless Steel	None	• Not Applicable
Elastomer • Fan Flex Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Fiberglass Impregnated Neoprene	Change in Material Properties	• Ventilation System Inspection and Testing (B.2.3)
Piping • Tubing	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Stainless Steel	None	• Not Applicable
Sheet Metal • Bird Screens	• Filter	Outdoor, Ventilation Atmosphere	Galvanized Steel Mesh	None	• Not Applicable
Sheet Metal • Exhaust Hoods	• Pressure Boundary	Outdoor, Ventilation Atmosphere	Galvanized Steel with Galvanized Casing	None	• Not Applicable
Sheet Metal • Ducting • Plenums • Damper Enclosures • Fan Enclosures	• Pressure Boundary	Sheltered	Carbon Steel, Galvanized Steel	None	• Not Applicable
Sheet Metal • Fan Enclosures	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable

Table 3.3-9 Aging Management Review Results for Component Groups in the Battery and Emergency Switchgear Ventilation System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Sheet Metal • Ducting • Plenums • Damper Enclosures	• Pressure Boundary	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable

3.3.10 Diesel Generator Building Ventilation System

Table 3.3-10 Aging Management Review Results for Component Groups in the Diesel Generator Building Ventilation System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Elastomer • Fan Flex Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Fiberglass Impregnated Neoprene	Change in Mechanical Properties	• Ventilation System Inspection and Testing (B.2.3)
Sheet Metal • Ducting • Damper Enclosures • Fan Enclosures	• Pressure Boundary	Sheltered	Carbon Steel, Galvanized Steel	None	• Not Applicable
Sheet Metal • Fan Enclosures	• Pressure Boundary	Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Sheet Metal • Ducting • Damper Enclosures	• Pressure Boundary	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable

3.3.11 Pump Structure Ventilation System

Table 3.3-11 Aging Management Review Results for Component Groups in the Pump Structure Ventilation System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Brass	None	• Not Applicable
Elastomer • Fan Flex Connections	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Fiberglass Impregnated Neoprene	Change in Material Properties	• Ventilation System Inspection and Testing (B.2.3)
Piping • Tubing	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Copper	None	• Not Applicable
Sheet Metal • Fan Enclosures	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Carbon Steel	None	• Not Applicable
Sheet Metal • Ducting • Damper Enclosures	• Pressure Boundary	Sheltered, Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable
Sheet Metal • Louvers	• Throttle	Ventilation Atmosphere	Galvanized Steel	None	• Not Applicable
Sheet Metal • Bird Screens	• Filter	Ventilation Atmosphere, Outdoor	Galvanized Steel Mesh	None	• Not Applicable

3.3.12 Safety Grade Instrument Gas System

Table 3.3-12 Aging Effects and Aging Management Activities for component groups in the Safety Grade Instrument Gas System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Dry Gas	Stainless Steel, Brass	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Sheltered, Dry Gas	Stainless Steel	None	• Not Applicable
Piping Specialties • Flexible Hoses	• Pressure Boundary	Sheltered, Dry Gas	Stainless Steel	None	• Not Applicable

3.3.13 Backup Instrument Nitrogen to ADS System

Table 3.3-13 Aging Effects and Aging Management Activities for component groups in the Backup Instrument Nitrogen to ADS System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered, Dry Gas	Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Sheltered, Dry Gas	Stainless Steel	None	• Not Applicable
Piping Specialties • Flexible Hoses • Flow Element	• Pressure Boundary	Sheltered, Dry Gas	Stainless Steel	None	• Not Applicable
Vessel • Accumulators	• Pressure Boundary	Sheltered, Dry Gas	Stainless Steel	None	• Not Applicable

3.3.14 Emergency Cooling Water System

Table 3.3-14 Aging Management Review Results for Component Groups in the Emergency Cooling Water System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Stainless Steel	Loss of Material	• ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Stainless Steel	Cracking	• ISI Program (B.1.8)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Pump Bodies (External)	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Pump Casings	• Pressure Boundary	Raw Water	Cast Iron	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Casting and Forging • Pump Casings	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Pump Bodies (External) (Bowls and Suction Bell)	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Lined Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Lined Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)

Table 3.3-14 Aging Management Review Results for Component Groups in the Emergency Cooling Water System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Casting and Forging • Valve Bodies	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• ISI Program (B.1.8) • GL 89-13 Activities (B.2.8)
Casting and Forging • Valve Bodies • Pump Casings	• Pressure Boundary	Sheltered	Carbon Steel, Cast Iron, Lined Carbon Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Buried	Carbon Steel	Loss of Material	• ISI Program (B.1.8) • Outdoor, Buried and Submerged Component Inspection (B.2.5)
Piping • Pipe	• Pressure Boundary	Outdoor	Stainless Steel	Loss of Material	• ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Outdoor	Stainless Steel	Cracking	• ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Outdoor	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Alloy Steel	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Piping • Pipe	• Pressure Boundary	Raw Water	Alloy Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Piping • Pipe	• Pressure Boundary	Raw Water	Carbon Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Tubing	• Pressure Boundary	Raw Water	Stainless Steel	None	• Not Applicable

Table 3.3-14 Aging Management Review Results for Component Groups in the Emergency Cooling Water System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Piping • Pipe	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Alloy Steel	None	• Not Applicable
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Flow Blockage	• GL 89-13 Activities (B.2.8) • IST Program (B.1.11)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Loss of Material	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Flow Elements	• Pressure Boundary	Raw Water	Stainless Steel	Cracking	• GL 89-13 Activities (B.2.8) • ISI Program (B.1.8)
Piping Specialties • Flow Elements	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable

3.3.15 Condensate Storage System

Table 3.3-15 Aging Management Review Results for Component Groups in the Condensate Storage System

Component Groupings	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Stainless Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Stainless Steel	Cracking	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Loss of Material	• CST Chemistry (B.1.4)
Piping • Pipe • Tubing	• Pressure Boundary	Condensate Storage Water	Stainless Steel	Cracking	• CST Chemistry (B.1.4)
Piping • Pipe	• Pressure Boundary	Outdoor	Stainless Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Piping • Pipe	• Pressure Boundary	Outdoor	Stainless Steel	Cracking	• Outdoor, Buried and Submerged Component Inspection (B.2.5)

Table 3.3-15 Aging Management Review Results for Component Groups in the Condensate Storage System (Continued)

Component Groupings	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable
Vessel • Condensate Storage Tanks	• Pressure Boundary	Condensate Storage Water	Carbon Steel	Loss of Material	• CST Chemistry (B.1.4)
Vessel • Condensate Storage Tanks	• Pressure Boundary	Outdoor	Carbon Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Vessel • Condensate Storage Tanks (Tank Nozzles)	• Pressure Boundary	Outdoor	Stainless Steel	Loss of Material	• Outdoor, Buried and Submerged Component Inspection (B.2.5)
Vessel • Condensate Storage Tanks (Tank Nozzles)	• Pressure Boundary	Outdoor	Stainless Steel	Cracking	• Outdoor, Buried and Submerged Component Inspection (B.2.5)

3.3.16 Emergency Diesel Generator

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Closed Cooling Water	Aluminum	Loss of Material	• CCW Chemistry (B.1.3)
Casting and Forging • Valve Bodies	• Pressure Boundary	Closed Cooling Water	Brass	Loss of Material	• CCW Chemistry (B.1.3)
Casting and Forging • Pump Casings • Valve Bodies	• Pressure Boundary	Closed Cooling Water	Bronze	Loss of Material	• CCW Chemistry (B.1.3)
Casting and Forging • Valve Bodies	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Loss of Material	• CCW Chemistry (B.1.3)
Casting and Forging • Pump Casings	• Pressure Boundary	Closed Cooling Water	Cast Iron	Loss of Material	• CCW Chemistry (B.1.3)
Casting and Forging • Valve Bodies	• Pressure Boundary	Closed Cooling Water	Stainless Steel	Cracking	• CCW Chemistry (B.1.3)
Casting and Forging • Valve Bodies	• Pressure Boundary	Closed Cooling Water	Stainless Steel	Loss of Material	• CCW Chemistry (B.1.3)
Casting and Forging • Valve Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Aluminum	Cracking	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Aluminum	Loss of Material	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Aluminum Alloys	Cracking	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Aluminum Alloys	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Brass	Cracking	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Casting and Forging • Valve Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Brass and Bronze	Loss of Material	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Strainer Screens	• Pressure Boundary • Filter (Strainer Screens Only)	Lubricating and Fuel Oil	Carbon Steel	Cracking	• Emergency Diesel Generator Inspection (B.2.4)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies • Strainer Screens	• Pressure Boundary • Filter (Strainer Screens Only)	Lubricating and Fuel Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Cast Iron	Cracking	• Emergency Diesel Generator Inspection (B.2.4)
Casting and Forging • Valve Bodies • Pump Casings • Strainer Bodies	• Pressure Boundary	Lubricating and Fuel Oil	Cast Iron	Loss of Material	• Oil Quality Testing (B.2.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Outdoor	Stainless Steel	None	• Not Applicable

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Pump Casings • Valve Bodies • Strainer Bodies	• Pressure Boundary	Sheltered	Brass and Bronze, Aluminum, Aluminum Alloys, Stainless Steel Carbon Steel, Cast Iron	None	• Not Applicable
Casting and Forging • Strainer Screens	• Filter	Wetted Gas	Carbon Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Emergency Diesel Generator Inspection (B.2.4)
Casting and Forging • Strainer Bodies	• Pressure Boundary	Wetted Gas	Cast Iron	Loss of Material	• Emergency Diesel Generator Inspection (B.2.4)
Elastomer • Flexible Hoses	• Pressure Boundary	Closed Cooling Water	Neoprene and Rubber	Change in Material Properties	• Emergency Diesel Generator Inspection (B.2.4)
Elastomer • Flexible Hoses	• Pressure Boundary	Lubricating and Fuel Oil	Neoprene and Rubber	Change in Material Properties	• Emergency Diesel Generator Inspection (B.2.4)
Elastomer • Flexible Hoses	• Pressure Boundary	Sheltered	Neoprene and Rubber	None	• Not Applicable
Elastomer • Flexible Hoses	• Pressure Boundary	Wetted Gas	Neoprene	Change in Material Properties	• Emergency Diesel Generator Inspection (B.2.4)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • EDG Jacket Coolant Cooler (Tube)	• Pressure Boundary	Closed Cooling Water	Admiralty	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube)	• Pressure Boundary	Closed Cooling Water	Admiralty	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube)	• Heat Transfer	Closed Cooling Water	Admiralty	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • CCW Chemistry (B.1.3)
Heat Exchanger • EDG Air Coolant Cooler (Tube)	• Pressure Boundary	Closed Cooling Water	Admiralty	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube)	• Pressure Boundary	Closed Cooling Water	Admiralty	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube)	• Heat Transfer	Closed Cooling Water	Admiralty	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • CCW Chemistry (B.1.3)
Heat Exchanger • EDG Jacket Coolant Cooler (Shell and internals)	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • EDG Jacket Coolant Cooler (Shell and internals)	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Shell and internals)	• Heat Transfer	Closed Cooling Water	Carbon Steel	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • CCW Chemistry (B.1.3)
Heat Exchanger • EDG Air Coolant Cooler (Shell and internals)	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Shell and internals)	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Shell and internals)	• Heat Transfer	Closed Cooling Water	Carbon Steel	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • CCW Chemistry (B.1.3)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube Sheet)	• Pressure Boundary	Closed Cooling Water	Muntz Metal	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube Sheet)	• Pressure Boundary	Closed Cooling Water	Muntz Metal	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket	• Heat Transfer	Closed Cooling Water	Muntz Metal	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • CCW Chemistry (B.1.3)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Coolant Cooler (Tube Sheet)					
Heat Exchanger • EDG Air Coolant Cooler (Tube Sheet)	• Pressure Boundary	Closed Cooling Water	Muntz Metal	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube Sheet)	• Pressure Boundary	Closed Cooling Water	Muntz Metal	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube Sheet)	• Heat Transfer	Closed Cooling Water	Muntz Metal	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8) • CCW Chemistry (B.1.3)
Heat Exchanger • EDG Lube Oil Coolers (Tube)	• Pressure Boundary	Lubricating Oil	Admiralty	Loss of Material	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube)	• Pressure Boundary	Lubricating Oil	Admiralty	Cracking	• GL 89-13 Activities (B.2.8) • Oil Quality Testing (B.2.1)
Heat Exchanger • EDG Lube Oil Coolers (Tube)	• Heat Transfer	Lubricating Oil	Admiralty	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Cooler (Shell, Baffles, and	• Pressure Boundary	Lubricating Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Tube Supports)					
Heat Exchanger • EDG Lube Oil Coolers (Shell, Baffles, and Tube Supports)	• Pressure Boundary	Lubricating Oil	Carbon Steel	Cracking	• GL 89-13 Activities (B.2.8) • Oil Quality Testing (B.2.1)
Heat Exchanger • EDG Lube Oil Coolers (Shell, Baffles, and Tube Supports)	• Heat Transfer	Lubricating Oil	Carbon Steel	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube Sheet)	• Pressure Boundary	Lubricating Oil	Muntz Metal	Loss of Material	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube Sheet)	• Pressure Boundary	Lubricating Oil	Muntz Metal	Cracking	• GL 89-13 Activities (B.2.8) • Oil Quality Testing (B.2.1)
Heat Exchanger • EDG Lube Oil Coolers (Tube Sheet)	• Heat Transfer	Lubricating Oil	Muntz Metal	Reduction of Heat Transfer	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube)	• Pressure Boundary	Raw Water	Admiralty	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket	• Pressure Boundary	Raw Water	Admiralty	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Coolant Cooler (Tube)					
Heat Exchanger • EDG Jacket Coolant Cooler (Tube)	• Pressure Boundary	Raw Water	Admiralty	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube)	• Heat Transfer	Raw Water	Admiralty	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube)	• Pressure Boundary	Raw Water	Admiralty	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube)	• Pressure Boundary	Raw Water	Admiralty	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube)	• Pressure Boundary	Raw Water	Admiralty	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube)	• Heat Transfer	Raw Water	Admiralty	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube)	• Pressure Boundary	Raw Water	Admiralty	Loss of Material	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • EDG Lube Oil Coolers (Tube)	• Pressure Boundary	Raw Water	Admiralty	Cracking	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube)	• Pressure Boundary	Raw Water	Admiralty	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube)	• Heat Transfer	Raw Water	Admiralty	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Channel)	• Heat Transfer	Raw Water	Cast Iron	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • EDG Air Coolant Cooler (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Channel)	• Heat Transfer	Raw Water	Cast Iron	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Loss of Material	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Cracking	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Channel)	• Pressure Boundary	Raw Water	Cast Iron	Flow Blockage	• GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • EDG Lube Oil Coolers (Channel)	• Heat Transfer	Raw Water	Cast Iron	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Jacket Coolant Cooler (Tube Sheet)	• Heat Transfer	Raw Water	Muntz Metal	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Loss of Material	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Cracking	• CCW Chemistry (B.1.3) • GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • EDG Air Coolant Cooler (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Air Coolant Cooler (Tube Sheet)	• Heat Transfer	Raw Water	Muntz Metal	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Loss of Material	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Cracking	• Oil Quality Testing (B.2.1) • GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube Sheet)	• Pressure Boundary	Raw Water	Muntz Metal	Flow Blockage	• GL 89-13 Activities (B.2.8)
Heat Exchanger • EDG Lube Oil Coolers (Tube Sheet)	• Heat Transfer	Raw Water	Muntz Metal	Reduction of Heat Transfer	• GL 89-13 Activities (B.2.8)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Heat Exchanger • EDG Jacket Coolant Cooler • EDG Air Coolant Cooler • Lube Oil Cooler	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Buried	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1) • Outdoor, Buried and Submerged Component Inspection (B.2.5)
Piping • Pipe	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Loss of Material	• CCW Chemistry (B.1.3)
Piping • Pipe • Tubing	• Pressure Boundary	Closed Cooling Water	Stainless Steel	Loss of Material	• CCW Chemistry (B.1.3)
Piping • Pipe • Tubing	• Pressure Boundary	Closed Cooling Water	Stainless Steel	Cracking	• CCW Chemistry (B.1.3)
Piping • Fittings	• Pressure Boundary	Lubricating and Fuel Oil	Brass, Brass Alloys	Cracking	• Emergency Diesel Generator Inspection (B.2.4)
Piping • Fittings	• Pressure Boundary	Lubricating and Fuel Oil	Brass, Brass Alloys	Loss of Material	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Piping • Pipe	• Pressure Boundary	Lubricating and Fuel Oil	Carbon Steel	Cracking	• Emergency Diesel Generator Inspection (B.2.4)
Piping • Pipe	• Pressure Boundary	Lubricating and Fuel Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1)
Piping • Tubing	• Pressure Boundary	Lubricating and Fuel Oil	Copper, Copper Alloys	Cracking	• Emergency Diesel Generator Inspection (B.2.4)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Tubing	• Pressure Boundary	Lubricating and Fuel Oil	Copper, Copper Alloys	Loss of Material	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Piping • Tubing	• Pressure Boundary	Lubricating and Fuel Oil	Stainless Steel	Cracking	• Emergency Diesel Generator Inspection (B.2.4)
Piping • Tubing	• Pressure Boundary	Lubricating and Fuel Oil	Stainless Steel	Loss of Material	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Piping • Pipe	• Pressure Boundary	Outdoor	Carbon Steel	None	• Not Applicable
Piping • Pipe • Tubing • Fittings	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel, Brass Alloys, Copper Alloys	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Wetted Gas	Stainless Steel	Loss of Material	• Emergency Diesel Generator Inspection (B.2.4)
Piping Specialties • Thermowells	• Pressure Boundary	Closed Cooling Water	Brass	Loss of Material	• CCW Chemistry (B.1.3)
Piping Specialties • Thermocouple Cap	• Pressure Boundary	Closed Cooling Water	Brass	Loss of Material	• CCW Chemistry (B.1.3)
Piping Specialties • Thermocouple Cap	• Pressure Boundary	Closed Cooling Water	Cast Iron	Loss of Material	• CCW Chemistry (B.1.3)
Piping Specialties • Restricting Orifices	• Pressure Boundary	Closed Cooling Water	Stainless Steel	Loss of Material	• CCW Chemistry (B.1.3)
Piping Specialties • Restricting Orifices	• Pressure Boundary	Closed Cooling Water	Stainless Steel	Cracking	• CCW Chemistry (B.1.3)
Piping Specialties • Expansion Joints	• Pressure Boundary	Closed Cooling Water	Stainless Steel	Loss of Material	• CCW Chemistry (B.1.3)
Piping Specialties	• Pressure	Closed Cooling Water	Stainless Steel	Cracking	• CCW Chemistry (B.1.3)

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
• Expansion Joints	Boundary				
Piping Specialties • Expansion Joints • Thermowells • Thermowell Caps • Restricting Orifice • Drain Traps	• Pressure Boundary	Sheltered	Carbon Steel, Cast Iron, Brass, Stainless Steel	None	• Not Applicable
Piping Specialties • Drain Traps	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Emergency Diesel Generator Inspection (B.2.4)
Piping Specialties • Expansion Joints	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Emergency Diesel Generator Inspection (B.2.4))
Vessel • Expansion Tank	• Pressure Boundary	Closed Cooling Water	Carbon Steel	Loss of Material	• CCW Chemistry (B.1.3)
Vessel • Fuel Oil Day Tank	• Pressure Boundary	Fuel Oil	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4))
Vessel • Fuel Oil Storage Tank	• Pressure Boundary	Fuel Oil, Buried	Carbon Steel	Loss of Material	• Oil Quality Testing (B.2.1) • Emergency Diesel Generator Inspection (B.2.4)
Vessel • Lubricating Oil Tank	• Pressure Boundary	Lubricating Oil	Carbon Steel	None	• Not Applicable
Vessel • Lubricating Oil Tank • Expansion Tank • Fuel Oil Day Tank • Air Receivers • Silencers	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable

Table 3.3-16 Aging Management Review Results for Component Groups for the Emergency Diesel Generator (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Vessel • Air Receivers	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Emergency Diesel Generator Inspection (B.2.4)
Vessel • Silencers	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Emergency Diesel Generator Inspection (B.2.4)

3.3.17 Suppression Pool Temperature Monitoring System

Table 3.3-17 Aging Management Review Results for Component Groups in the Suppression Pool Temperature Monitoring System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
• Penetration Sleeves (Thermowells)	• Pressure Boundary • Fission Product Barrier	Torus Water	Stainless Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
• Penetration Sleeves (Thermowells)	• Pressure Boundary • Fission Product Barrier	Sheltered	Stainless Steel	None	• Not Applicable

3.3.18 Cranes and Hoists

Table 3.3-18 Aging Management Review Results for Component Groups for Cranes and Hoists

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Cranes and Hoists • Circulating Water Pump Structure Crane 35 Ton Gantry (Structural Members, Rails, Rail Clips, and Rail Bolts)	• Structural Support to Non-S/R Components	Outdoor	Carbon Steel, Low-Alloy Steel	Loss of Material	• Crane Inspection Activities (B.1.14)
Cranes and Hoists • Reactor Building Overhead Bridge Cranes (Rails, Rail Clips and Rail Bolts)	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel, Low-Alloy Steel	Loss of Material (1)	• Crane Inspection Activities (B.1.14)
Cranes and Hoists • Other Cranes and Hoists (Rails, Monorail Flanges, Rail Clips, and Rail Bolts)	• Structural Support to Non-S/R Components	Sheltered	Carbon Steel, Low-Allow Steel	Loss of Material (1)	• Crane Inspection Activities (B.1.14)

(1) Loss of material due to mechanical wear.

3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEMS

The following Tables provide the results of the aging management reviews for each of the Steam and Power Conversion Systems within the scope of license renewal. Aging management activities that are credited to manage the identified aging effects for the given material are discussed in Appendix B.

3.4.1 Main Steam System

Table 3.4-1 Aging Management Review Results for component groups in the Main Steam System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Dry Gas	Brass Carbon Steel Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered	Brass, Carbon Steel, Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• ISI Program (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Stainless Steel	None	• Not Applicable
Casting and Forging • Valve Bodies	• Pressure Boundary	Wetted Gas	Stainless Steel	Cracking	• ISI Program (B.1.8)
Piping • Pipe	• Pressure Boundary	Dry Gas	Copper	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable

Table 3.4-1 Aging Management Review Results for Component Groups in the Main Steam System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Copper, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • FAC Program (B.1.1) • ISI Program (1) (B.1.8)
Piping • Pipe • Tubing	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • Pipe	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping • SRV Tailpipe	• Pressure Boundary	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)
Piping • SRV Tailpipe	• Pressure Boundary	Torus Grade Water (Gas Interface)	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5) • Torus Piping Inspection (B.3.1)
Piping • Pipe	• Pressure Boundary	Wetted Gas	Carbon Steel	Loss of Material	• Torus Piping Inspection (B.3.1)
Piping • Pipe (RPV Head Flange Leakoff)	• Pressure Boundary	Wetted Gas	Stainless Steel	Cracking	• ISI Program (B.1.8)
Piping Specialties • Dashpot	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable
Piping Specialties • Flexible Hoses	• Pressure Boundary	Dry Gas	Stainless Steel	None	• Not Applicable

Table 3.4-1 Aging Management Review Results for Component Groups in the Main Steam System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Flow Elements • Dashpot • Y Strainer • Condensing Chamber • Restricting Orifice • Flexible Hoses	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Flow Elements (body)	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Y Strainer	• Pressure Boundary	Steam	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping Specialties • Flow Elements (throat)	• Throttle	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping Specialties • Flow Elements (throat)	• Throttle	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2)
Piping Specialties • Condensing Chambers	• Pressure Boundary	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Condensing Chambers	• Pressure Boundary	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping Specialties • Restricting Orifice	• Pressure Boundary • Throttle	Steam	Stainless Steel	Cracking	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Piping Specialties • Spargers	• Spray	Torus Grade Water	Carbon Steel	Loss of Material	• Torus Water Chemistry (B.1.5)

Table 3.4-1 Aging Management Review Results for Component Groups in the Main Steam System (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Piping Specialties • Restricting Orifice (RPV Head Flange Leakoff)	• Pressure Boundary • Throttle	Wetted Gas	Stainless Steel	Cracking	• ISI Program (B.1.8)
Vessel • Accumulators	• Pressure Boundary	Dry Gas, Sheltered	Stainless Steel	None	• Not Applicable

(1) The ISI Program is credited only for the Class 1 piping or components in the component group.

3.4.2 Main Condenser

Table 3.4-2 Aging Management Review Results for Component Groups in the Main Condenser

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect (1)	Aging Management Activities (1)
Main Condenser (Waterbox)	• Containment, Holdup and Plateout	Raw Water	Carbon Steel	None	• Not Applicable
Main Condenser (Feedwater Heater Shell) (Drain Cooler Shell)	• Containment, Holdup and Plateout	Steam	Carbon Steel	None	• Not Applicable
Main Condenser (Nozzles)	• Containment, Holdup and Plateout	Steam	Carbon Steel, Stainless Steel	None	• Not Applicable
Main Condenser (Expansion Joint)	• Containment, Holdup and Plateout	Steam	Stainless Steel	None	• Not Applicable
Main Condenser (Shell)	• Containment, Holdup and Plateout	Steam, Reactor Coolant	Carbon Steel	None	• Not Applicable
Main Condenser (Tubes) (Tubesheet)	• Containment, Holdup and Plateout	Steam, Raw Water	Titanium	None	• Not Applicable

(1) Aging management of the main condenser is not based on analysis of materials, environments and aging effects. Condenser integrity required to perform post accident intended function (holdup and plateout of MSIV leakage) is continuously confirmed by normal plant operation. No traditional aging management review or aging management program is required. The main condenser must perform a significant pressure boundary function (maintain vacuum) to allow continued plant operation. The post-accident intended function of the main condenser is to provide a holdup volume and plateout surface for MSIV leakage. This intended function does not require the condenser to be leak-tight, and the post-accident conditions in the condenser will be essentially atmospheric. Under post-accident conditions, there will be no challenge to the pressure boundary integrity of the condenser. Since normal plant operation assures adequate condenser pressure boundary integrity, the post-accident intended function to provide holdup volume and plateout surface is assured.

3.4.3 Feedwater System

Table 3.4-3 Aging Management Review Results for Component Groups in the Feedwater System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • ISI Program (1) (B.1.8)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2)
Casting and Forging • Valve Bodies	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2)
Casting and Forging • Valve Bodies	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping • Pipe	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • FAC Program (B.1.1) • ISI Program (1) (B.1.8)
Piping • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Cracking	• RCS Chemistry (B.1.2)
Piping • Tubing	• Pressure Boundary	Reactor Coolant	Stainless Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping • Pipe • Tubing	• Pressure Boundary	Sheltered	Carbon Steel, Stainless Steel	None	• Not Applicable
Piping Specialties • Flow Elements	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2) • FAC Program (B.1.1)
Piping Specialties • Thermowell	• Pressure Boundary	Reactor Coolant	Carbon Steel	Loss of Material	• RCS Chemistry (B.1.2)
Piping Specialties • Flow Elements • Thermowells	• Pressure Boundary	Sheltered	Carbon Steel	None	• Not Applicable

(1) The ISI Program is credited only for the Class 1 piping or components in the component group.

3.5 AGING MANAGEMENT OF STRUCTURES AND COMPONENT SUPPORTS

The following tables provide the results of aging management reviews for structural component groups in each of the structures within the scope of license renewal. This section also provides the results of the aging management reviews for the structural commodities. Aging management activities that are credited to manage the identified aging effects for the given material are discussed in Appendix B.

3.5.1 Containment Structure

Table 3.5-1 Aging Management Review Results for component groups in the Containment Structure

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Reactor Pedestal • Foundation • Floor Slab	• Structural Support • Shelter, Protection and/or Radiation Shielding	Sheltered	Concrete	None	• Not Applicable
Unreinforced Concrete • Sacrificial Shield Wall (1)	• Shelter, Protection and/or Radiation Shielding	Sheltered	Concrete	None	• Not Applicable
Drywell • Shell • Head	• Pressure Boundary • Structural Support • Shelter, Protection and/or Radiation Shielding • Fission Product Barrier	Sheltered	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Drywell • CRD Removal Hatch • Equipment Hatch • Personnel Airlock • Access Manhole and Inspection Ports • Penetrations	• Pressure Boundary • Fission Product Barrier	Sheltered	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Drywell • Penetration Bellows	• Pressure Boundary • Fission Product Barrier	Sheltered	Stainless Steel	Cumulative Fatigue Damage	• TLAA (4.6.4)

Table 3.5-1 Aging Management Review Results for component groups in the Containment Structure (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Drywell • Gaskets and O-Rings	• Pressure Boundary	Sheltered	Silicone Rubber, and EPDM	Change In Material Properties Cracking	• Primary Containment Leakage Rate Testing Program (B.1.10)
Pressure Suppression Chamber • Shell	• Pressure Boundary • Structural Support • Fission Product Barrier	Sheltered, Torus Water	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Pressure Suppression Chamber • Shell	• Pressure Boundary • Structural Support • Fission Product Barrier	Sheltered, Torus Water	Carbon Steel	Cumulative Fatigue Damage	• TLAA (4.6.1)
Pressure Suppression Chamber • Ring Girders	• Structural Support	Sheltered, Torus Water	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Pressure Suppression Chamber • Column and Saddle Supports • Seismic Restraints	• Structural Support	Sheltered	Carbon Steel	None	• Not Applicable
Pressure Suppression Chamber • Lubrite Plates	• Structural Support	Sheltered	Bronze / Graphite	None (2)	• Not Applicable
Pressure Suppression Chamber • Access Hatches	• Pressure Boundary • Fission Product Barrier	Sheltered	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Pressure Suppression Chamber • Penetrations	• Pressure Boundary • Fission Product Barrier	Sheltered, Torus Water	Carbon Steel, Stainless Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Pressure Suppression Chamber • Penetrations	• Pressure Boundary • Fission Product Barrier	Sheltered, Torus Water	Carbon Steel, Stainless Steel	Cumulative Fatigue Damage	• TLAA (4.6.1)

Table 3.5-1 Aging Management Review Results for component groups in the Containment Structure (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Pressure Suppression Chamber • Elastomers (Gaskets)	• Pressure Boundary	Sheltered	EPDM	Change In Material Properties and Cracking	• Primary Containment Leakage Rate Testing Program (B.1.10)
Vent System • Vent Lines	• Pressure Boundary • Fission Product Barrier	Sheltered	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Vent System • Vent Lines	• Pressure Boundary • Fission Product Barrier	Sheltered	Carbon Steel	Cumulative Fatigue Damage	• TLAA (4.6.1)
Vent System • Vent Line Bellows	• Pressure Boundary • Fission Product Barrier	Sheltered	Stainless Steel	Cumulative Fatigue Damage	• TLAA (4.6.3)
Vent System • Header and Downcomers	• Pressure Boundary	Sheltered, Torus Water	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Vent System • Downcomer Bracing • Vent System Supports	• Structural Support	Sheltered, Torus Water	Carbon Steel	Loss of Material	• Primary Containment Inservice Inspection Program (B.1.9)
Structural Steel • Reactor Vessel Pedestal Steel • Sacrificial Shield Wall Steel • Sacrificial Shield Wall Stabilizer • Radial Beam Seats • Lubrite Plates	• Structural Support	Sheltered	Carbon Steel, Bronze / Graphite (Lubrite Plates) (2)	None	• Not Applicable
Structural Steel • Jet Impingement Shields	• HELB Shielding	Sheltered	Carbon Steel	None	• Not Applicable

Table 3.5-1 Aging Management Review Results for component groups in the Containment Structure (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Structural Steel • Pipe Whip Restraints	• Pipe Whip Restraint	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Missile Barriers	• Missile Barrier	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Radiation Shields	• Shelter, Protection and/or Radiation Shielding	Sheltered	Carbon Steel	None	• Not Applicable

(1) Concrete is encased in carbon steel plate and is designed to provide radiation shielding only.
(2) Loss of material due to mechanical wear is non-significant because of infrequent cyclic loading.
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3.5.2 Reactor Building Structure

Table 3.5-2 Aging Management Review Results for component groups in the Reactor Building Structure

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission product barrier • Missile Barrier • HELB Shielding • Structural Support to Non-S/R Components • Contain Fluids	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • HELB Shielding • Structural Support to Non-S/R Components	Sheltered	Masonry Block	None	• Not Applicable
Fuel Pool Liner	• Pressure Boundary	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Fuel Pool Liner	• Pressure Boundary	Sheltered	Stainless Steel	None	• Not Applicable

Table 3.5-2 Aging Management Review Results for component groups in the Reactor Building Structure (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Fuel Pool Gates	• Pressure Boundary	Fuel Pool Water	Aluminum	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Fuel Pool Gates	• Pressure Boundary	Sheltered	Aluminum	None	• Not Applicable
Fuel Storage Racks	• Structural Support	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Boraflex Absorbers	• Absorb Neutrons	Fuel Pool Water	Boraflex	Change in Material Properties	• Boraflex Management Activities (B.2.2)
Component Supports	• Structural Support	Fuel Pool Water	Stainless Steel	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Component Supports	• Structural Support	Fuel Pool Water	Aluminum	Loss of Material	• Fuel Pool Chemistry (B.1.6)
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Pipe Whip Restraints	• Pipe Whip Restraint	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Missile Barrier	• Missile Barrier	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Metal Siding (1)	• Fission Product Barrier	Outdoor	Carbon Steel	Loss of Material	• Maintenance Rule Structural Monitoring Program (B.1.16)
Structural Steel • Blowout Panels	• Fission Product Barrier • Over-Pressure Protection	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Blowout Panels	• Fission Product Barrier • Over-Pressure Protection	Outdoor	Carbon Steel	Loss of Material	• Maintenance Rule Structural Monitoring Program (B.1.16)

Table 3.5-2 Aging Management Review Results for component groups in the Reactor Building Structure (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Structural Steel • Roof Deck (1)	• Fission Product Barrier	Sheltered	Carbon Steel	None	• Not Applicable

(1) Reactor building metal siding and roof deck are a part of the secondary containment pressure boundary..

3.5.3 Radwaste Building and Reactor Auxiliary Bay

Table 3.5-3 Aging Management Review Results for component groups in the Radwaste Building and Reactor Auxiliary Bay

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • HELB Shielding • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered	Masonry Block	None	• Not Applicable
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable

Table 3.5-3 Aging Management Review Results for component groups in the Radwaste Building and Reactor Auxiliary Bay (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Structural Steel • Jet Impingement Shields	• HELB Shielding	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Missile Barrier	• Missile Barrier	Sheltered	Carbon Steel	None	• Not Applicable

3.5.4 Turbine Building and Main Control Room Complex

Table 3.5-4 Aging Management Review Results for component groups in the Turbine Building and Main Control Room Complex

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • HELB Shielding • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered	Masonry Block	None	• Not Applicable
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Missile Barrier	• Missile Barrier	Sheltered	Carbon Steel	None	• Not Applicable

3.5.5 Emergency Cooling Tower and Reservoir

Table 3.5-5 Aging Management Review Results for component groups in the Emergency Cooling Tower and Reservoir

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls	• Structural Support	Raw Water, Outdoor	Concrete	Change in Material Properties	• Maintenance Rule Structural Monitoring Program (B.1.16)
Reinforced Concrete • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Prestressed Concrete • Roof Slab	• Structural Support • Shelter, Protection and/or Radiation Shielding	Outdoor	Concrete	None	• Not Applicable
Reinforced Concrete Block Walls	• Structural Support • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered	Masonry Block	None	• Not Applicable
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable

3.5.6 Station Blackout Structure and Foundation

Table 3.5-6 Aging Management Review Results for component groups in the Station Blackout Structure and Foundation

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Foundation	• Structural Support to Non-S/R Components	Buried, Outdoor	Concrete	None	• Not Applicable
Structural Steel • Metal Siding	• Shelter, Protection and/or Radiation Shielding	Outdoor	Carbon Steel	Loss of Material	• Maintenance Rule Structural Monitoring Program (B.1.16)
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable

3.5.7 Yard Structures

Table 3.5-7 Aging Management Review Results for component groups in the Yard Structures

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slabs • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor	Concrete	None	• Not Applicable
Condensate Storage Tanks Foundation	• Structural Support	Buried	Gravel, Sand	None	• Not Applicable
Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable

3.5.8 Stack

Table 3.5-8 Aging Management Review Results for component groups in the Stack

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete	• Structural Support	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable

3.5.9 Nitrogen Storage Building

Table 3.5-9 Aging Management Review Results for component groups in the Nitrogen Storage Building

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slab • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable

3.5.10 Diesel Generator Building

Table 3.5-10 Aging Management Review Results for component groups in the Diesel Generator Building

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable
Steel Foundation Piles	• Structural Support	Buried	Carbon Steel	None (1)	• Not Applicable

(1) Steel piles driven in undisturbed soils have been unaffected by corrosion (Ref. NUREG-1557)

3.5.11 Circulating Water Pump Structure

Table 3.5-11 Aging Management Review Results for component groups in the Circulating Water Pump Structure

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Flood Barrier • Missile Barrier • Structural Support to Non-S/R Components	Raw Water, Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Reinforced Concrete Block Walls	• Structural Support • Fire Barrier • Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Sheltered	Masonry Block	None	• Not Applicable
Structural Steel • Structural Steel • Reinforced Concrete Embedments	• Structural Support • Structural Support to Non-S/R Components • Flood Barrier	Sheltered	Carbon Steel	None	• Not Applicable
Structural Steel • Sluice Gates	• Pressure Boundary	Raw Water, Sheltered	Carbon Steel, Cast Iron	None (1)	• Not Applicable

(1) Sluice gates are designed to operate in raw water environment for extended period of time without loss function. Industry and PBAPS experience substantiate their operating performance.

3.5.12 Recombiner Building

Table 3.5-12 Aging Management Review Results for component groups in the Recombiner Building

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Reinforced Concrete • Walls • Slabs • Columns • Beams • Foundation	• Structural Support to Non-S/R Components	Buried, Outdoor, Sheltered	Concrete	None	• Not Applicable
Structural Steel • Structural Steel	• Structural Support to Non-S/R Components	Sheltered	Carbon Steel	None	• Not Applicable

3.5.13 Component Supports

Table 3.5-13 Aging Management Review Results for Component Supports

Component Group	Component Intended Function	Environment	Materials Of Construction	Aging Effect	Aging Management Activity
Anchors (Emergency Cooling Water)	• Structural Support	Outdoor	Carbon Steel	Loss of Material	• Maintenance Rule Structural Monitoring Program (B.1.16)
Anchors	• Structural Support	Sheltered	Stainless Steel, Carbon Steel, Alloy Steel	None	• Not Applicable
Grout	• Structural Support	Sheltered	Grout	None	• Not Applicable
Lubrite Plates	• Structural Support	Sheltered	Bronze, Graphite	None	• Not Applicable
Support Members	• Structural Support	Raw Water, Torus Water	Carbon Steel, Alloy Steel, Stainless Steel	Loss of Material	• ISI Program (B.1.8)
Support Members	• Structural Support	Torus Water	Stainless Steel	Cracking	• Torus Water Chemistry (B.1.5)
Support Members	• Structural Support	Sheltered	Aluminum, Galvanized Steel, Stainless Steel, Carbon Steel, Alloy Steel	None	• Not Applicable
Support Members (Emergency Cooling Water)	• Structural Support	Outdoor	Carbon Steel	Loss of Material	• ISI Program (B.1.8)

3.5.14 Hazard Barriers and Elastomers

Table 3.5-14 Aging Management Review Results for Hazard Barriers and Elastomers

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Hazard Barrier: • Fire Barrier Penetration Seals	• Fire Barrier	Sheltered, Outdoor	Silicone, Boot Fabric (BISCO), Fire Stop Putty, Grout/Cement, Alumina Silica, Resin, Adhesive	Cracking, Delamination and Separation, Change in Material Properties	• Fire Protection Activities (B.2.9)
Hazard Barrier: • Other Penetration Seals	• Flood Barrier • Fission Product Barrier • HELB Shielding	Sheltered, Outdoor	Silicone, Boot Fabric (BISCO), Fire Stop Putty, Grout/Cement, Alumina Silica, Resin, Adhesive	Cracking, Delamination and Separation, Change in Material Properties	• Maintenance Rule Structural Monitoring Program (B.1.16)
Hazard Barrier: • Fire Barrier Doors	• Fire Barrier	Sheltered, Outdoor	Carbon Steel (1)	Loss of Material	• Fire Protection Activities (B.2.9)

Table 3.5-14 Aging Management Review Results for Hazard Barriers and Elastomers (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Hazard Barrier: • Other Hazard Barrier Doors	• Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission Product Barrier • Missile Barrier • HELB Shielding • Over-pressure Protection	Outdoor	Carbon Steel	Loss of Material	• Door Inspection Activities (B.2.6)
Hazard Barrier: • Other Hazard Barrier Doors	• Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission Product Barrier • Missile Barrier • HELB Shielding • Over-pressure Protection	Sheltered	Carbon Steel	None	• Not Applicable
Hazard Barrier: • Gaskets for Watertight Doors	• Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission Product Barrier	Sheltered	Neoprene	Cracking, Change in Material Properties	• Door Inspection Activities (B.2.6)

Table 3.5-14 Aging Management Review Results for Hazard Barriers and Elastomers (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Hazard Barrier: • Gaskets for Watertight Doors	• Shelter, Protection and/or Radiation Shielding • Flood Barrier • Fission Product Barrier	Outdoor	Neoprene	Change in Material Properties	• Door Inspection Activities (B.2.6)
Hazard Barrier: • Fire Wraps	• Fire Barrier	Sheltered	Subliming compound with and without steel mesh or fiberglass cloth (rigid fiber board, trowelable or sprayed on fire proofing) Cementitious fireproofing (sprayed on fire proofing)	Change in Material Properties, Loss of Material	• Fire Protection Activities (B.2.9)
Elastomer: • Expansion Joint Seals	• Flood Barrier	Sheltered, Outdoor	Rubber, Neoprene, Silicone	Cracking, Change in Material Properties	• Maintenance Rule Structural Monitoring Program (B.1.16)
Elastomer: • Reactor Building Blowout Panel Seals	• Fission Product Barrier	Sheltered	Neoprene	None	• Not Applicable

Table 3.5-14 Aging Management Review Results for Hazard Barriers and Elastomers (Continued)

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Elastomer: • Reactor Building Metal Siding Gap Seals	• Fission Product Barrier	Sheltered	Silicone	None	• Not Applicable
Elastomer: • Moisture Barrier Inside Drywell	• Flood Barrier	Sheltered	Polysulfide Sealant	Loss of Sealing	• Primary Containment Inservice Inspection Program (B.1.9)

(1) Fire barrier doors in sheltered environment are subject to non-significant loss of material. Aging management activity is conservatively specified for them to maintain UL fire test qualification.

3.5.15 Miscellaneous Steel

Table 3.5-15 Aging Management Review Results for Miscellaneous Steel

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Miscellaneous Steel • Platforms • Grating • Stairs • Ladders • Curbs (Steel) • Handrails • Kick Plates • Instrument Tubing Trays	• Structural Support • Structural Support to Non-S/R Components • Contain Fluid	Sheltered	Carbon Steel	None	• Not Applicable
Miscellaneous Steel • Manhole Covers	• Shelter, Protection and/or Radiation Shielding • Contain Fluid	Outdoor	Carbon Steel	None (1)	• Not Applicable

(1) Manhole covers are designed for outdoor environment.

3.5.16 Electrical and Instrumentation Enclosures and Raceways

Table 3.5-16 Aging Management Review Results for Electrical and Instrumentation Enclosures and Raceways

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Electrical and Instrumentation Enclosures and Raceways • Cable Tray and Covers • Electrical Conduits and Fittings • Wireway Gutters • Panels • Cabinets • Boxes	• Structural Support • Shelter, Protection and/or Radiation Shielding	Sheltered	Carbon Steel, Aluminum, Galvanized Carbon Steel	None	• Not Applicable
Raceways • Electrical Conduits and Fittings • Boxes	• Structural Support • Shelter, Protection and/or Radiation Shielding	Outdoor	Aluminum, Galvanized Carbon Steel	None (1)	• Not Applicable
• Drip Shields	• Shelter, Protection and/or Radiation Shielding	Sheltered	Carbon Steel	None	• Not Applicable

(1) Engineering evaluation concluded loss of material due to corrosion of the conduits and boxes is non-significant and will not impact the intended function.

3.5.17 Insulation

Table 3.5-17 Aging Management Review Results for Insulation

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activities
Insulation	• Insulating Characteristics	Sheltered	Aluminum & Stainless Steel (Mirror), Calcium Silicate, Ceramic Fiber, Fiberglass	None	• Not Applicable
Insulation (Jacketing)	• Insulation Jacket Integrity	Sheltered	Aluminum and Stainless Steel Jacketing	None	• Not Applicable
Insulation	• Insulating Characteristics	Outdoor	Calcium Silicate	None	• Not Applicable
Insulation (Jacketing)	• Insulation Jacket Integrity	Outdoor	Aluminum Jacketing with Stainless Steel Straps	Insulation Degradation	• Outdoor, Buried and Submerged Component Inspection Activities (B.2.5)

3.6 AGING MANAGEMENT OF ELECTRICAL AND INSTRUMENTATION AND CONTROLS

The following tables provide the results of the aging management reviews for the Station Blackout System and electrical commodities within the scope of license renewal that are subject to an aging management review. Because commodities are not associated with one particular system, but could be in any in-scope system, they were evaluated using a “spaces” approach.

In the spaces approach, the evaluation was based on areas where bounding service environmental parameters were identified. An example of a bounding service environmental parameter, such as temperature, is the highest average service temperature present in the defined space taking into account the ambient temperature, and ohmic heating, where applicable. This bounding value is then compared to the 60-year limiting service temperature. The 60-year limiting service temperature is that value where the insulation material experiences no aging effect which would cause the insulation material to lose its intended function for the period of extended operation.

The process used to perform an aging management review of a commodity or component group for a specific environmental stressor is:

- Identification of component group materials of construction
- Identification of aging effects for the component group when exposed to the environmental stressor
- Determination of the value of the bounding service environmental parameter to which the component groups in the area to be reviewed are exposed
- Comparison of the aging characteristics of the identified materials in the bounding service environmental parameter against the 60-year limiting service environmental parameter, and determination if the component groups are able to maintain their intended function during the period of extended operation

Aging management activities that are credited to manage the identified aging effects for the given material are discussed in Appendix B.

3.6.1 Cables

Table 3.6-1 Aging Management Review Results for Cable

Component Group	• Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Electrical Cables	• Electrical Continuity	Sheltered	Metallic conductor with cross-linked polyethylene(XLPO) and polyolefin (XLPE) insulation	None (1)	• Not Applicable
Electrical Cables	• Electrical Continuity	Sheltered	Metallic conductor with ethylene propylene (rubber) (EPR) and silicon rubber (SR) insulation	None (1)	• Not Applicable
Electrical Cables	• Electrical Continuity	Sheltered	Metallic conductor with polyethylene (PE) and polyolefin (PO) insulation	None (1)	• Not Applicable
Electrical Cables	• Electrical Continuity	Sheltered	Metallic conductor with chlorsulfinated polyethylene (Hypalon) (CSPE) insulation	None (1)	• Not Applicable
Electrical Cables	• Electrical Continuity	Sheltered	Metallic conductor with teflon-based insulation materials (ETFE, ETTC, FEP, TFE) insulation	None (1)	• Not Applicable
Electrical Cables	• Electrical Continuity	Sheltered	Metallic conductor with nylon insulation	None (1)	• Not Applicable
Electrical Cables (fiber optic only)	• Electrical Continuity	Sheltered	Fiberglass	None (2)	• Not Applicable
Electrical Cables	• Electrical Continuity	Sheltered	Metallic conductor with polyvinyl chloride (PVC) insulation	Loss of Material Properties	• FSSD Cable Inspection (B.3.2)

(1) 60-year limiting service temperature greater than the bounding service temperature (design ambient temperature plus ohmic heating, as applicable.)
(2) No aging effects for fiberglass cables.

3.6.2 Connectors, Splices, and Terminal Blocks

Table 3.6-2 Aging Management Review Results for Connectors, Splices, and Terminal Blocks

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Electrical Connectors - Insulation	• Electrical Continuity	Sheltered	Connector insulations bounded by Cables AMR discussed in Section 2.5.1	None (1)	• Not Applicable
Electrical Connectors - Metallic Connector	• Electrical Continuity	Sheltered	Copper, tinned copper, and aluminum.	None (2)	• Not Applicable.
Electrical Splices - Insulation	• Electrical Continuity	Sheltered	Modified Polyolefin (XLPO, XLPE)	None (1)	• Not Applicable
Electrical Terminal Blocks - Insulation	• Electrical Continuity	Sheltered	Phenolic and nylon insulation	None (1)	• Not Applicable
Electrical Terminal Blocks-Metallic	• Electrical Continuity	Sheltered	Copper, tinned copper, brass, bronze & aluminum	None (2)	• Not Applicable

(1) 60-year limiting service temperature greater than the bounding service temperature (design ambient temperature plus ohmic heating, as applicable.)
(2) No aging effects identified for PBAPS.

3.6.3 Station Blackout System

Table 3.6-3 Aging Management Review Results for the Station Blackout System

Component Group	Component Intended Function	Environment	Materials of Construction	Aging Effect	Aging Management Activity
Wooden Pole	• Structural Support to Non-S/R Components	Outdoor	Wood	Loss of Material	• Wooden Pole Inspection (B.2.11)
Wooden Pole	• Structural Support to Non-S/R Components	Outdoor, Buried	Wood	Change in Material Properties	• Wooden Pole Inspection (B.2.11)
Conowingo Hydroelectric Plant	• Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Raw Water, Outdoor	Reinforced Concrete, Steel	Loss of Material	• Conowingo Hydroelectric Plant (Dam) Aging Management Program (B.1.15)
Conowingo Hydroelectric Plant	• Shelter, Protection and/or Radiation Shielding • Structural Support to Non-S/R Components	Raw Water, Outdoor	Reinforced Concrete, Steel	Change in Material Properties	• Conowingo Hydroelectric Plant (Dam) Aging Management Program (B.1.15)
Substation Foundations	• Structural Support to Non-S/R Components	Outdoor	Concrete	None (See Section 3.5.6)	• Not Applicable
Substation Busbar	• Structural Support to Non-S/R Components • Electrical Continuity	Outdoor	Aluminum	None (1)	• Not Applicable
Substation Insulators	• Insulate	Outdoor	Porcelain	None (1)	• Not Applicable
Submarine Cable	• Electrical Continuity	Raw Water	EPR Insulation	None (2)	• Not Applicable

(1) No aging effects identified for PBAPS
(2) Designed to operate in its environment

SECTION 4.0 TIME-LIMITED AGING ANALYSES

List of Tables

4.0 TIME LIMITED AGING ANALYSES

4.1 INTRODUCTION

Under the 10 CFR 54 License Renewal Rule (the Rule), an analysis, calculation, or evaluation is a "Time-Limited Aging Analysis" (TLAA) only if it meets all six of the defining criteria per 10CFR54.3(a):

> *Time-limited aging analyses*, for the purposes of this part, are those licensee calculations and analyses that
> (1) Involve systems, structures, and components within the scope of license renewal;
> (2) Consider the effects of aging;
> (3) Involve time-limited assumptions defined by the current operating term, for example, 40 years;
> (4) Were determined to be relevant by the licensee in making a safety determination;
> (5) Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions…; and
> (6) Are contained or incorporated by reference in the CLB [current licensing basis].

4.1.1 Identification of TLAAs

The methods used to identify PBAPS plant-specific TLAAs are consistent with the NRC draft "Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants" (SRP) and with NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule."

The Rule requires a list of TLAAs, including license exemptions which are based on TLAAs, be included in a license application. There are no exemptions granted that are based upon time-limited aging analyses.

Exelon assembled a list of generic potential TLAAs from the SRP and from industry guidance, performed a search of PBAPS current licensing basis (CLB) and supporting documents to confirm the occurrence of plant-specific instances of TLAAs suggested by the NRC and industry guidance, and to identify additional potential plant-specific (or unit-specific) TLAAs. Exelon then screened the resulting list of potential TLAAs against the six 10 CFR 54.3 criteria, above.

The Rule requires that these TLAAs then be evaluated to demonstrate that

(i) The analyses remain valid for the period of extended operation;
(ii) The analyses have been projected to the end of the period of extended operation; or
(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

[10 CFR 54.21(c)]

Exelon dispositioned each TLAA by one of these three methods. This section provides the list of TLAAs, a summary of each evaluation, and a description of each disposition.

4.1.2 Summary of Results

This review identified six general categories of TLAAs applicable to PBAPS. They are described in Sections 4.2 through 4.7 of this Section, with their dispositions, and are listed in Table 4.1-1, List of Time-Limited Aging Analyses (TLAAs).

Table 4.1-1 List of Time-Limited Aging Analyses (TLAAs)

TLAA	Description	Disposition Category	Section
1.	Reactor Vessel Neutron Embrittlement		4.2
	10 CFR 50 Appendix G Reactor Vessel Rapid Failure Propagation and Brittle Fracture Considerations: Charpy Upper-Shelf Energy (USE) Reduction and RTNDT Increase, Reflood Reshock Analysis	Revision of the Analysis and Validation of the Analysis for the period of Extended Operation	4.2.1
	Reactor Vessel Thermal Limit Analyses: Operating Pressure-Temperature Limit (P-T Limit) Curves	Revision of the Analysis	4.2.2
	Reactor Vessel Circumferential Weld Examination Relief	Revision of the Analysis	4.2.3
	Reactor Vessel Axial Weld Failure Probability	Validation of the Analysis for the period of Extended Operation	4.2.4
2.	Metal Fatigue		4.3
	Reactor Vessel Fatigue	Management of the Aging Effect	4.3.1
	Reactor Vessel Internals Fatigue and Embrittlement		4.3.2
	Reactor Vessel Internals Fatigue Analyses	Validation of the Analysis for the period of Extended Operation and Management of the aging effect	4.3.2.1
	Reactor Vessel Internals Embrittlement Analyses	Validation of the Analysis for the period of Extended Operation	4.3.2.2
	Effect of Fatigue and Embrittlement on End-of-Life Reflood Thermal Shock Analysis	Validation of the analysis for the period of extended operation	4.3.2.3

Table 4.1-1 List of Time-Limited Aging Analyses (TLAAs) (Continued)

TLAA	Description	Disposition Category	Section
	Piping and Component Fatigue and Thermal Cycles		4.3.3
	Fatigue Analyses of Group I Primary System Piping	Management of the aging effect	4.3.3.1
	Assumed Thermal Cycle Count for Allowable Secondary Stress Range Reduction in Group II and III Piping and Components	Validation of the analysis for the period of extended operation	4.3.3.2
	Design of the RHR System for a Finite Number of Cycles	Validation of the analysis for the period of extended operation	4.3.3.3
	Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping (Generic Safety Issue 190)	Management of the aging effect	4.3.4
3	Environmental Qualification of Electrical Equipment	Management of the aging effect	4.4
4.	Loss of Prestress in Concrete Containment Tendons Not Applicable. (PBAPS containments do not have prestress tendons.)	Not Applicable	4.5

Table 4.1-1 List of Time-Limited Aging Analyses (TLAAs) (Continued)

TLAA	Description	Disposition Category	Section
5.	Containment Fatigue		4.6
	Fatigue Analyses of Containment Boundaries: New Loads Analysis of Tori, Torus Vents, and Torus Penetrations	Validation of the analysis for the period of extended operation and Management of the aging effect	4.6.1
	New Loads Fatigue Analysis of SRV Discharge Lines and External Torus-Attached Piping	Validation of the analysis for the period of extended operation	4.6.2
	Expansion Joint and Bellows Fatigue Analyses - Drywell to Torus Vent Bellows	Validation of the analysis for the period of extended operation	4.6.3
	Expansion Joint and Bellows Fatigue Analyses - Containment Penetration Bellows	Validation of the analysis for the period of extended operation	4.6.4
6.	Other Plant Specific TLAAs		4.7
	Reactor Vessel Corrosion Allowances	Validation of the analysis for the period of extended operation	4.7.1

Table 4.1-1 List of Time-Limited Aging Analyses (TLAAs) (Continued)

TLAA	Description	Disposition Category	Section
	Generic Letter 81-11 Crack Growth Analysis to Demonstrate Conformance to the Intent of NUREG-0619, “BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking”	Management of the aging effect	4.7.2
	Fracture Mechanics of ISI-Reportable Indications for Group I Piping: As-forged laminar tear in a Unit 3 Main Steam elbow near weld 1-B-3BC-LDO discovered during preservice UT	Validation of the analysis for the period of extended operation	4.7.3

4.1.3 Identification of Exemptions

The rule requires a list of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on time-limited aging analyses as defined in §54.3.

A search of docketed correspondence, the operating licenses, and the Updated Final Safety Analyses Report (UFSAR) identified and listed all exemptions in effect. Each exemption in effect was then evaluated to determine if it involved a TLAA as defined in 10 CFR 54.3.

There are no exemptions granted that are based upon time-limited aging analyses.

4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The PBAPS Unit 2 and 3 reactor vessels are described in UFSAR Chapter 4. Reactor vessel materials are subject to embrittlement, primarily due to exposure to neutron radiation. “Embrittlement” means the material will adsorb less energy during a crack or rupture, and therefore that a crack could more easily propagate under load.

In addition, adsorbed energy is temperature dependent. In most materials adsorbed energy increases with temperature up to a maximum (the “upper-shelf energy,” USE). Neutron embrittlement decreases USE. Because fracture energy is low at low temperature, operating pressure-temperature limit curves (P-T curves) are included in Technical Specifications which dictate the limit to which the vessel can be pressurized at a given temperature. RT_{NDT}, nil-ductility transition reference temperature, is determined for vessel materials before irradiation and indicates temperatures above which impact tests will demonstrate an acceptable USE. Neutron embrittlement raises this transition temperature. This increase (• RT_{NDT}) means that higher temperatures are required for the material to continue to act in a ductile fashion. The P-T curves are determined by the RT_{NDT} and • RT_{NDT} calculations for the licensed operating period.

These limits and effects are calculated on the basis of lifetime neutron fluence, are part of the licensing basis, and support safety determinations. Their calculations are therefore TLAAs. The supporting calculation of vessel neutron fluence is similarly a TLAA. The increases in neutron fluence and RT_{NDT} (• RT_{NDT}) also affect the bases for relief from circumferential weld inspection and its associated supporting calculation of limiting axial weld conditional failure probability. Circumferential weld examination relief and axial weld failure probability are thereby also TLAAs.

4.2.1 10 CFR 50 Appendix G Reactor Vessel Rapid Failure Propagation and Brittle Fracture Considerations: Charpy Upper-Shelf Energy (USE) Reduction and RT_{NDT} Increase, Reflood Thermal Shock Analysis

Although the scope of reactor vessel embrittlement concerns includes the heads, nozzles, nozzle safe ends, and closure studs, the neutron fluence is highest in the beltline region of the vessel shell. Differences in vessel materials at different locations might somewhat offset or balance this effect, but for the PBAPS vessels the limiting USE occurs in the beltline region.

Fluence, USE, and RT_{NDT}

The tests done on vessel materials under the code of record supplied limited Charpy impact data. It was therefore not possible to develop original Charpy upper shelf energy values using the ASME III NB-2300, S'1972 (et seq.) methods invoked by 10 CFR 50 Appendix G. A 10 CFR 50 Appendix G equivalent margin analysis was therefore used to demonstrate compliance with the 40-year USE requirement, and to support the RT_{NDT} determinations.

The predicted rise in RT_{NDT} due to temperature-dependent precipitation and neutron fluence, and the consequent operating margins, were calculated for a 40 year design with 32 effective full-power years (EFPY) of operating life.

Reflood Thermal Shock Analysis

An end-of-life thermal shock analysis for a recirculation line break followed by ECCS injection was performed on a typical BWR-4 reactor vessel [Reference 4.19]. A subsequent analysis for BWR-6 vessels is equally applicable to BWR-4 vessels [Reference 4.20]. These analyses assume end-of-life material toughness, which in turn depends on end-of-life adjusted reference temperature and therefore, end-of-life neutron fluence. These analyses are therefore TLAAs.

Analysis

Fluence, USE, and RT_{NDT}

An acceptable minimum vessel end-of-life USE will be confirmed using the Boiling Water Reactor Vessel and Internals Program Report 74 methodology [BWRVIP-74, Ref. 16].

The vessel end-of-life RT_{NDT} will be recalculated for a 60-year licensed operating life (54 EFPY) under Code Case N640.

Exelon has not yet performed these calculations. Exelon will initiate these calculations after the GE fluence methodology has been approved by the NRC.

Reflood Thermal Shock Analysis

The critical location for the fracture mechanics analysis is at ¼ of vessel thickness from the inside. For this event, the peak stress intensity occurs approximately 300 seconds after LOCA. At 300 seconds, this analysis shows that the temperature of the vessel wall at 1.5 inches deep (which bounds the PBAPS case) is approximately 400 °F. Even after 60 years of irradiation, the vessel beltline material adjusted reference temperature will be low enough to ensure that at 400 °F, the material is in the Charpy upper shelf region. Therefore, the analysis remains bounding and valid for the license renewal term.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

Revised end-of-life fluence, USE, and RT_{NDT} will be calculated for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii). These calculations will be completed and acceptable values will be confirmed prior to the end of the initial operating license term for PBAPS.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The reflood thermal shock analysis was examined and remains valid and bounding for the period of extended operation.

4.2.2 Reactor Vessel Thermal Limit Analyses: Operating Pressure-Temperature Limit (P-T Limit) Curves

PBAPS Units 2 and 3 Technical Specifications, Section 3.4.9, contain P-T limit curves for heatup, cooldown, and inservice leakage and hydrostatic testing, and also limit the maximum rate of change of reactor coolant temperature. The criticality curve provides limits for both heatup and criticality, calculated for a 40 year design, 32 EFPY operating period. The P-T curves are not presently limited by beltline neutron fluence embrittlement.

Analysis

Exelon will perform these calculations for a 60 year, 54 EFPY operating period. Exelon will initiate these calculations after the GE fluence methodology has been approved by the NRC.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

Revised vessel P-T limit curves will be calculated for the extended licensed operating period, in accordance with 10 CFR 54.21(c)(1)(ii). These calculations will be completed and acceptable values will be confirmed prior to the end of the initial operating license term for PBAPS.

4.2.3 Reactor Vessel Circumferential Weld Examination Relief

Relief from RPV circumferential weld examination requirements under Generic Letter 98-05 is based on probabilistic risk assessments which predict an acceptable probability of failure per reactor operating year, with vessel metallurgical conditions and indication sizes and frequencies assumed to be those expected at the end of a licensed operating period, nominally 32 EFPY for the original 40-year term.

The additional changes in metallurgy and additional growth of indications expected over an extended licensed operating period make any such relief a TLAA, if the relief is extended.

Exelon has been granted relief from the requirements for inspection of RPV circumferential welds for the remainder of the current 40-year licensed operating period [Reference 4.14 and 4.15]. The justification is consistent with BWRVIP-05 guidelines, showing metal chemistry limits and predicted effects at 32 EFPY within the limits assumed by the generic BWRVIP-05 analysis.

Analysis

Exelon will apply for an extension of this relief for the 60-year extended licensed operating period, with justification based on the guidelines of BWRVIP-74 when approved, or based on the guidelines of BWRVIP-05.

The procedures and training that will be used to limit the frequency of cold over-pressure events to the number specified in the relief request extension, during the license renewal term, are the same as those used in the current licensed operating period. Details of these procedural and training provisions are provided in the relief request for the current licensed operating period [Ref. 4.13].

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

Exelon will apply for an extension of the existing relief from circumferential weld inspection for the 60-year extended licensed operating period. This extension will require revision of supporting analyses and evaluations for the 60-year extended licensed operating period, in accordance with 10 CFR 54.21(c)(1)(ii). Exelon will apply for this extension in time for it to be granted prior to the end of the initial operating license term for PBAPS.

4.2.4 Reactor Vessel Axial Weld Failure Probability

The Boiling Water Reactor Owner's Group Vessel and Internals Program recommendations for inspection of reactor vessel shell welds [BWRVIP 05, Ref. 4.15] contain generic analyses supporting an NRC SER conclusion that the generic-plant axial weld failure rate is no more than 5×10^{-6} per reactor year.

BWRVIP-05 showed that this axial weld failure rate of 5×10^{-6} per reactor year is orders of magnitude greater than the 40-year end-of-life circumferential weld failure probability, and used this analysis to justify relief from inspection of the circumferential welds, as described in Section 4.2.3.

Analysis

Supporting calculations of expected 60-year neutron fluence, USE, and RT_{NDT} will be completed before the current 40-year operating license expires. Exelon has not yet performed these calculations. Exelon will initiate these calculations after the GE fluence methodology has been approved by the NRC. Exelon has reasonable assurance that the PBAPS vessel parameters will permit a demonstration that the expected failure probability of the limiting axial weld in each unit will still remain less than the 5×10^{-6} per reactor year.

The operator training and procedures that will be used to limit the frequency of cold over-pressure events during the license renewal term are the same as those currently used, as described in the "Analysis" of "Reactor Vessel Circumferential Weld Examination Relief," Subsection 4.2.3, above.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

Supporting analyses will be completed to confirm that the assumed limit on the axial weld failure probability remains valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i). Exelon will complete these analyses prior to the end of the initial operating license term for PBAPS.

4.3 METAL FATIGUE

4.3.1 Reactor Vessel Fatigue

Reactor Vessel Fatigue Analyses, RPV Nozzle Thermal Cycle Count, and Reactor Vessel Stud Fatigue Analyses

The PBAPS Unit 2 and Unit 3 reactor vessel fatigue analyses, which include the vessel shell, head, nozzles, nozzle safe ends, and closure studs, depend on cycle count assumptions that assume a 40-year operating period. Applicable analyses have been revised to incorporate licensing changes for power uprate and other operational changes. The analyses demonstrate that the 40-year cumulative usage factors (CUFs) for the critical components of the vessel are below the ASME Code Section III design value of 1.0, except for the closure studs which are included in a fatigue management program that provides for dispositioning if that program indicates the code design value will be exceeded. The current analyses of record are TLAAs.

Analysis

The existing program maintains a count of cumulative reactor pressure vessel thermal and pressure cycles to ensure that licensing and design basis assumptions are not exceeded. An improved program is being implemented which will use temperature, pressure, and flow data to calculate and record accumulated usage factors for critical RPV locations and subcomponents.

Existing reactor vessel fatigue analyses have been reviewed to establish a bounding set of RPV locations for inclusion in the fatigue management program. All locations with 40-year CUFs expected to exceed 0.4 are included. CUF equations will be updated as necessary to incorporate any analysis revisions, and plant transient events will be tracked to ensure that the CUF remains less than 1.0 for all monitored components.

The following information on the Core ΔP/SBLC Nozzle is included because of a commitment to BWRVIP-27 [Ref. 4.17]. Exelon is using the license renewal Appendix B of the BWRVIP-27 guidelines for inspection and flaw evaluation of the standby liquid control system and core plate • P lines and their common nozzles. This appendix commits each applicant who invokes it to list fatigue of this nozzle (core • P/SBLC nozzle) as a TLAA, and to describe the usage factor and aging management plan or other disposition.

The original PBAPS design analysis found that the stresses and the expected number of significant cycles in the core • P/SBLC nozzles were in accordance with Section III, Paragraph N-415.1 of the code of record, and were therefore less than those that required a fatigue analysis. Therefore, no CUF was calculated. Any CUF which might be calculated would be negligible. The fatigue management program will monitor other, higher-usage factor locations. Any potentially-significant increase in the CUF for these core • P/SBLC nozzles will be indicated by a significant increase, above predicted values, in the CUFs monitored in these other locations.

Generic Letter 81-11 Crack Growth Analysis to Demonstrate Conformance to the Intent of NUREG-0619, “BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking” is discussed in Section 4.7.2.

Disposition: Aging Management, 10CFR54.21(c)(1) (iii)

This TLAA will require management of the aging effects (10 CFR 54.21(c)(1)(iii)). Refer to Appendix B, Section B.4.2, Fatigue Management Activities. The required implementing actions will be completed prior to the end of the initial operating license term for PBAPS.

The fatigue management program will monitor at least the reactor vessel, reactor vessel internals, and piping components listed in Table 4.3.1-1 (in both units, except as indicated).

Table 4.3.1-1: Fatigue Monitoring Program Locations

Location
Reactor Pressure Vessel (RPV) Feedwater nozzles (Loops A and B)
RPV support skirt
RPV closure studs
RPV shroud support
RPV Core Spray nozzle safe end
RPV Recirculation inlet nozzle
RPV Recirculation outlet nozzle
RPV Refueling containment skirt
RPV Jet Pump shroud support
Residual Heat Removal (RHR) 24” return line (Loop A)
RHR 20” supply line (Loops A and B)
RHR Tee (Loop A)
RHR Tee (Loop B)
Feedwater piping (Node 754)
Main Steam piping (Node 606)
Torus Penetrations Unit 2
Torus Penetrations Unit 3
Torus Shell

4.3.2 Reactor Vessel Internals Fatigue and Embrittlement

This discussion of fatigue in the reactor vessel internals also includes evaluation of radiation embrittlement.

4.3.2.1 Reactor Vessel Internals Fatigue Analyses

Original Core Shroud, Shroud Support and Jet Pump Assembly Evaluation: Fatigue in these components is from two sources, system cycles and vibrations. The vibration effects were based on tests and analysis of standard vessel internals under forced recirculation flow. Vibration effects in the core shrouds, shroud supports, and jet pump assemblies were evaluated in a standard-plant analysis applicable to PBAPS. The design analysis was based on the cyclic stress criteria of ASME Section III.

The core shroud and jet pump assembly analysis was performed for a plant where the configuration (leg type shroud support) applies to PBAPS. Therefore, the calculated fatigue usage is expected to be a reasonable approximation for this plant. The limiting 40 year cumulative fatigue usage factor is 0.35.

Revised Core Shroud Support Analysis: Fatigue analyses of the core shroud supports were reevaluated for effects of increased recirculation pump starts with the loop outside thermal limits. The reevaluation used conservative estimates of the expected number of these starts in 40 years, and conservative methods of estimating the fatigue usage factor. The evaluation resulted in an estimated upper bound on the 40-year usage factor of 0.834.

Unit 3 Core Spray Pipe to Tee Box Weld Crack Repair Bracket: Repair brackets and attachment welds to the piping installed in PBAPS Unit 3 in 1985 were analyzed in accordance with the requirements of ASME Section III Article NB-3200.

Section III of the ASME code does not strictly apply to internals, which are not code pressure boundary items, and is used as a guide only. However, comparison to the code design CUF of 1.0 was used to support safety determinations.

Analysis

Core Shroud, and Jet Pump Assembly: Maximum CUF for the original analyses of vibration and fatigue in the core shroud and jet pump assembly is 0.35 for a 40-year life. Therefore, the predicted 60-year CUF would not exceed 0.525 (0.35CUFx1.5), which is less than the code design value of 1.0 CUF, and no aging management activity is required.

Core Shroud Supports: The usage factor at the critical core shroud support locations will be managed by the fatigue management program cycle counting and fatigue usage factor tracking program used by the fatigue management program described in Section B.4.2. The fatigue management program will ensure that the fatigue effects in the shroud supports will be adequately managed and will be maintained within the code design value for the period of extended operation. The critical shroud support locations monitored by the fatigue management program are 'RPV shroud support' and the 'RPV Jet Pump shroud support' in Table 4.3.1-1.

Unit 3 Core Spray Pipe to Tee Box Weld Crack Repair Bracket: The greatest contributor to the high usage factor in the Unit 3 Core Spray pipe to tee box weld crack repair bracket fatigue analysis is not dependent on the licensed operating period but is due to a single seismic event. The usage factor will not change significantly with an increase in the licensed operating period, and no aging management activity is required.

Disposition: Validation, 10 CFR 54.21(c)(1)(i); and Aging Management, 10 CFR 54.21(c)(1)(iii)

The core shroud, jet pump assembly, and Unit 3 Core Spray pipe to tee box weld crack repair bracket fatigue evaluations have been reviewed and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Fatigue in the critical locations of the Jet Pump shroud support and the RPV shroud support will be managed by the fatigue management program. (10 CFR 54.21(c)(1)(iii)). Refer to Section B.4.2, Fatigue Management Activities. The required implementing actions will be completed prior to the end of the initial operating license term for PBAPS.

4.3.2.2 Reactor Vessel Internals Embrittlement Analyses

These analyses affect the core shroud and top guides. The fluences expected for 40 years may cause shroud and top guide embrittlement or irradiation-assisted stress corrosion cracking (IASCC), and must therefore be addressed for the 60 year period. The expected 40-year fluence of the most irradiated point on the inner surface of the shroud is 2.7×10^{20} nvt (>1 Mev).

Analysis

BWRVIP-26 [Ref. 4.18] lists 5×10^{20} nvt as the threshold fluence beyond which the components will be significantly affected [Ref. 4.18 § 2.1.1].

Shroud: The expected 60-year fluence on the shroud,

$$2.7 \times 10^{20} \text{ nvt} \times 60/40 = 4.5 \times 10^{20} \text{ nvt},$$

is below the 5×10^{20} nvt damage threshold.

Top Guide: License Renewal Appendix C to BWRVIP-26 states that the generic fluence for 60 years on the top guide is 6×10^{21} nvt. Although this 60-year fluence will be above the 5×10^{20} nvt damage threshold, the tensile stresses in this component are very low. At these low stresses a fracture is not a concern, and embrittlement is, therefore, not a threat to the intended function. These critical locations in the top guide are exempt from inspection under the approved BWRVIP-26 and no aging management activity is required.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The reactor vessel internals embrittlement analyses have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.2.3 Effect of Fatigue and Embrittlement on End-of-Life Reflood Thermal Shock Analysis

Radiation embrittlement and fatigue usage may affect the ability of certain internals, particularly the core shroud support plate, to withstand an end-of-life reflood thermal shock following a recirculation line break.

These thermal shock analyses assume end-of-life fatigue and embrittlement effects and are considered TLAAs.

Analysis

The effects of embrittlement and fatigue on the end-of-life reflood thermal shock analyses were evaluated. The thermal shock analyses were validated for the 60-year extended operating term. The effects of embrittlement are not significant at higher usage factor locations, and the effects of fatigue are not significant at locations where embrittlement is significant. The net effect in each analyzed location is acceptable. The thermal shock analyses are, therefore, acceptable for the extended operating period.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The effect of fatigue and embrittlement on end-of-life reflood thermal shock analyses have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.3 Piping and Component Fatigue and Thermal Cycles

This section includes fatigue-related TLAAs arising within design analyses of:

- Group I, II, and III piping and components, except the reactor vessel and internals (Group I, II, and III are described in UFSAR App. A)
  - Group I piping with an ASME III Class 1 Fatigue Analysis
  - Group I, II and III piping to USAS-B31.1 (ANSI-B31.1)
  - Group II and III components to ASME III Class C (1965) - ASME VIII Division 2 Alternative Rules
- Residual Heat Removal (RHR) system operating cycles

RHR components are treated separately because specific analyses for the RHR system and its components were identified as TLAAs.

4.3.3.1 Fatigue Analyses of Group I Primary System Piping

All Group I piping was originally designed in accordance with USAS B31.1, 1967 Edition. The Recirculation and RHR piping in Group 1 was replaced under the GL 88-01 IGSCC Correction Program. The replacement piping was analyzed to ASME Section III Class 1 rules. ASME Section III requires an explicit fatigue analysis for Class 1 components. The ASME Code limits the design CUF to less than 1.0.

USAS B31.1 does not require an explicit fatigue analysis. Therefore, CUF values were not originally calculated for the remainder of the PBAPS Group I piping designed to this code. However, a simplified fatigue analysis was developed to estimate CUFs and to construct the algorithms used by the fatigue management program to estimate current CUFs from operating data.

Both the ASME Section III Class 1 fatigue analyses and the fatigue management program analyses of USAS B31.1 piping are TLAAs.

Analysis

Group I piping fatigue issues will be managed by the fatigue management program. Additional evaluations have been developed to establish a comprehensive and bounding set of Group I piping locations for inclusion in the fatigue management program. All locations with 40-year CUFs expected to exceed 0.4 will be included. The CUF modeling equations will be updated as necessary in the future to incorporate any analysis revisions, and all necessary plant transient events will be tracked to ensure that the CUF remains less than 1.0 for all monitored locations.

Disposition: Aging Management, 10 CFR 54.21(c)(1) (iii)

This TLAA will require management of the aging effects (10 CFR 54.21(c)(1)(iii)). Refer to Section B.4.2, Fatigue Management Activities. The required implementing actions will be completed prior to the end of the initial operating license term for PBAPS.

4.3.3.2 Assumed Thermal Cycle Count for Allowable Secondary Stress Range Reduction in Group II and III Piping and Components

The original piping codes used in the design of Group II and III piping required the use of a stress range reduction factor in the evaluation of calculated stresses due to thermal expansion. The reduction factors were based on the anticipated number of equivalent full-temperature cycles over the 40 year life of the plant. The assumed thermal cycle count is therefore a TLAA applicable to all piping systems designed to these codes.

Analysis

The number of equivalent full-temperature cycles involved in the extended operation of PBAPS is significantly less than the 7,000 cycles used as the threshold number for applying stress range reduction factors in the applicable code piping analyses. The 40 year life expected total number of cycles associated with these transients is 700. For conservatism, additional cycles were added for feedwater temperature changes due to load changes. Based on the accumulated cycles to date, an additional 1,000 cycles is appropriate to cover these types of feedwater transients. Therefore, the total number of cycles assumed for the 40-year plant life is conservatively less than 2,000. For the extended licensed operating period the total number of thermal cycles for piping analyses would, proportionately, be less than 3,000 during the entire plant life, which is still significantly less than the 7,000-cycle threshold. Therefore, the code stress range reduction factor remains at 1 and the stress range reduction factor used in all the original piping analyses will not be affected by extending the operating period to 60 years. The existing piping analyses within the scope of license renewal containing assumed thermal cycle counts are valid for the period of extended operation.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The existing piping analyses containing assumed thermal cycle counts have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.3.3 Design of the RHR System for a Finite Number of Cycles

The NSSS vendor specified the RHR System for a 40-year design life, and specified a finite number of cycles for each of its elevated-temperature operating modes. The specified number of cycles for each mode was based on BWR operating experience and engineering judgment at the time the plant was designed.

No description of these design operating cycles of the RHR systems was found in the PBAPS licensing basis documents. However, the design requirements of the RHR piping system are described in UFSAR Appendix A, Sections A.1 and A.9. Thermal cycles of the RHR piping and valves are, therefore, treated as TLAAs.

Analysis for RHR Valve and Piping Thermal Cycles

Group II RHR piping, and some Group I RHR piping, is designed to an ANSI B31.1 or USAS B31.1 allowable secondary stress range determined by a finite number of maximum-range thermal cycles, without a detailed fatigue analysis.

The ANSI B31.1 threshold number for applying a reduction factor for RHR valves is 7,000 equivalent full-temperature cycles. The total number of cycles assumed for the original 40-year plant life is, conservatively, less than 1,000. For the period of extended operation, the number of thermal cycles for piping analyses would be proportionately increased to 1,500, which is still significantly less than the 7,000 cycle threshold. The code stress range reduction factor therefore remains at 1.0 and is not affected by extending the operating period to 60 years.

Group I RHR piping inside the Drywell, which was analyzed to ASME Section III Class 1 rules, is discussed in Section 4.3.3.1.

Disposition for RHR Valve and Piping Thermal Cycles: Validation, 10 CFR 54.21(c)(1)(i)

The RHR valve and piping thermal cycle analyses have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.4 Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping (Generic Safety Issue 190)

ASME Section III uses stress versus design cycle curves (S-N curves) based on tests in air to determine fatigue usage factor. The environment of a stressed component can affect fatigue life. This concern was the subject of a series of NRC communications, including three Generic Safety Issues (GSIs). Of these GSI 190 [Ref. 4.3] identified NRC staff concerns about the potential effects of reactor water environments on component fatigue life during the period of extended operation. GSI-190 was closed in December 1999 [Ref. 4.4]. The NRC staff concluded that environmental effects have a negligible impact on core damage frequency and no generic regulatory action is required. However, as part of the closure of GSI-190, the staff also concluded that applicants for license renewal should address the effects of reactor coolant environment on component fatigue life as part of their aging management programs.

Analysis of Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping

Much of the conservatism in the design basis calculation process is due to design basis transient definitions. Exelon evaluated the effect of the reactor coolant environment on fatigue life, based on the EPRI fatigue study most applicable to PBAPS [Ref. 4.5]. The evaluation found that the effect of conservative design basis transient definitions, by themselves, provides a design margin, which encompasses any potential increase in fatigue usage factor due to reactor water environmental effects.

The evaluation found that a revised calculation would predict 60-year cumulative fatigue usage factors (CUFs), with environmental effects, that would be at least an order of magnitude less than the originally-calculated design basis 40-year CUFs, without environmental effects. At the sample location with the least difference between the revised and original calculation, the revised value would be only about eight per cent of the calculated design basis CUF. At all other sample locations the revised CUFs would be less than five per cent of the original CUFs. See Table 4.3.4-2.

Latest Environmental Fatigue Methodology

Exelon evaluated the effect of the reactor coolant environment on fatigue life based on EPRI Report TR-110356 [Ref. 4.5], the EPRI fatigue study most applicable to PBAPS. The NRC staff raised some issues [Ref. 6] with respect to the generic studies published by EPRI, including EPRI Report TR-110356. Those issues were considered in the assessment of the environmental fatigue at PBAPS.

Fatigue data have been generated by Argonne National Laboratory (ANL) in simulated reactor water environments since the EPRI generic studies. These data have resulted in improved environmental correction factor (F_{en}) correlations, which are documented in NUREG/CR-6583 for carbon and low-alloy steel [Ref. 4.7], and in NUREG/CR-5704 for stainless steel [Ref. 4.8]. These improved correlations were not available at the time all of the EPRI generic studies were performed. The NRC was concerned that the EPRI correlations do not reflect the Argonne data and are not as conservative as the NUREG correlations.

The improved NUREG/CR-6583 correlations for carbon and low-alloy steels do not differ substantially from those used in the EPRI generic studies. However, the change in strain threshold has a potentially significant effect, and that effect was therefore evaluated. The environmental effect on carbon steel was recalculated for one of the examples of EPRI TR-105759 [Ref. 4.9]. This is a carbon steel BWR feedwater piping location with a design basis 40-year CUF of 0.1409.

The EPRI TR-105759 method used an alternating *stress* threshold of 30 ksi, equivalent to a NUREG/CR-6583 alternating *strain* threshold of about 0.10%, to adjust the incremental fatigue usage. At this location this threshold included eight out of thirty-one load pairs, giving an additional (environmental) fatigue usage of 0.0477, for a 40-year adjusted total of 0.1886. The overall environmental multiplier (F_{en}) in this case was 1.34 (1.66 for the eight affected load pairs).

The NUREG/CR-6583 correlation would reduce the alternating strain threshold to 0.07%. This can be approximated in the EPRI TR-105769 methods by reducing the alternating stress threshold to 21 ksi. which would require an environmental adjustment for six additional load pairs, for a total design fatigue usage of 0.0803, before environmental effects, for the fourteen load pairs. Assuming that the F_{en} multiplier of 1.66 would continue to apply for the fourteen affected load pairs, the estimate for the adjusted fatigue usage factor would be 0.1409 - 0.0803 + 1.66 (0.0803) = 0.194. The overall correction factor F_{en} multiplier increases from 1.34 to only 1.38, or about 4 per cent.

Therefore, because the additional load pairs that would have to be included contribute relatively small increments to the total CUF, the change in the strain range threshold under the NUREG/CR-6583 correlation does not cause a significant increase in the CUF calculated by EPRI TR-105769 methods. Therefore, the results of the EPRI TR-105769 generic studies provide a reasonable estimate of potential environmental fatigue effects for carbon and low-alloy steel components, and remain valid without further modification.

For austenitic stainless steels, the differences between the NUREG/CR-5704 correlation and the EPRI generic studies are more significant. For the case of relatively low temperature (<200°C), a low (bounding) strain rate, and either high or low dissolved oxygen, the environmental correction factor is 2.55. For relatively high temperature (>200°C), low dissolved oxygen, and a low (bounding) strain rate, the environmental correction factor may be as high as 15.35, although there is a reduction above 250°C where the environmental factor decreases to about 3.20 at 340°C. These factors are higher than those obtained from the methods of the EPRI generic studies.

For most of the component locations evaluated in the EPRI generic studies, the Argonne data and NUREG/ CR-5704 correlation would still demonstrate that the 60-year CUF is less than 1.0, including reactor water environmental effects. Using a detailed, temperature-dependent F_{en} environmental correction factor approach has an advantage for these cases, since most of the penalizing thermal transients lie below the 200°C threshold. The calculated environmental shift is therefore relatively low provided separate multipliers are used for the portions of the transient which are above and below 200°C. However, for locations most sensitive to environmental effects the environmentally-adjusted CUF still increases over that calculated in the EPRI generic studies by a factor of about two. For BWR stainless steel materials a conservative, analysis correction factor of 2.0 was therefore applied to the EPRI generic study results to account for the more recent laboratory data and correlation. See Table 4.3.4-2.

Application of the EPRI Generic Studies to PBAPS

As mentioned earlier, the most applicable evaluation for PBAPS with respect to the EPRI generic studies is EPRI Report No. TR-110356. Those results are considered directly applicable to PBAPS. First, the results documented in that report apply to a BWR-4, which is identical to the PBAPS design. Therefore, the Class 1 systems associated with the plants are the same, which defines the characteristics of the thermal transients in these systems. These similarities are most clearly observed in the plant heat balance diagrams and thermal cycle definitions. In particular, the thermal cycle definitions for the RPV nozzles provide a good measure of the thermal characteristic similarities between plants, because they represent fluid variations based on the combinations of several plant systems prior to entering the RPV. The heat balance diagram and several key thermal cycle diagrams for the generic BWR-4 evaluated in EPRI Report No. TR-110356 were compared to similar diagrams for PBAPS. Comparison of these diagrams allows the following conclusions to be made:

- The feedwater inlet temperatures are within 2°F of each other (381.4°F for PBAPS vs. 383°F for generic BWR-4).
- The feedwater flow rates are within 5% of each other (14.247 Mlb/hr for PBAPS vs. 13.574 Mlb/hr for generic BWR-4). A similar situation exists for the steam and core flow rates.

- The recirculation inlet temperatures are within 2°F of each other (531.4°F for PBAPS vs. 529°F for generic BWR-4).
- The recirculation flow rates are the same for both plants (34.2 Mlb/hr for both plants).
- The dome pressures are within 3% of each other (1,050 psig for PBAPS vs. 1,020 psig for generic BWR-4).
- All like transients have the same profiles (i.e., they have the same "size and shape").

Further similarities between PBAPS and the generic BWR-4 evaluated in EPRI Report No. TR-110356 is demonstrated in Table 4.3.4-1, where the design basis transient types and quantities for both plants are compared.

As a result of the above comparisons, the design basis transient definitions associated with the plants are very similar, as expected for similar BWR-type plants. Therefore, it is reasonable to utilize the results and conclusions documented in EPRI Report No. TR-110356 for PBAPS, with some modification to incorporate the results of more recent laboratory testing (as described above).

Table 4.3.4-2 shows the CUF results from EPRI Report TR-110356, with modifications to account for the more recent data in NUREG/CR-6583 and NUREG/CR-5704, as described above. The original design basis CUF for each of the TR-110356 sample plant locations is also shown for comparison. Table 4.3.4-2 clearly demonstrates that the conservatism of design basis transient definitions encompasses all environmental effects. The marginal effect of the reactor coolant environment on CUF, projected to 60 years, is at least a factor of 12.9 below the original design basis CUF for all locations.

The BWR-4 evaluated in EPRI Report TR-110356 did not consider hydrogen water chemistry (HWC), as evidenced by the plots of dissolved oxygen in that report. Both units at PBAPS have implemented HWC. The maximum effect of the change in dissolved oxygen as a result of HWC implementation is adequately addressed by the conservative penalty factors described above.

Two materials issues may affect the application of the EPRI TR-110356 BWR-4 generic study to PBAPS. First, EPRI Report TR-110356 conservatively assumed the sulfur content, where applicable, was a maximum. Second, although the material types (i.e. stainless versus carbon or low-alloy steel) are similar between the two plants, differences were identified and were considered appropriately in all fatigue evaluations. Material types of most BWRs are very similar, as evidenced by the Table 4.3.4-3 comparison between PBAPS and the older vintage BWR-4 evaluated in NUREG/CR-6260 [Ref. 4.10]. Therefore, differences in materials do not have any effect on the application of the results of EPRI TR-110356 to PBAPS.

The six locations investigated in NUREG/CR-6260 for the older vintage BWR are listed in Table 4.3.4-3. The older vintage BWR results are applicable to PBAPS because the design transients and B31.1 piping design methodology are similar. The equivalent locations are included in the PBAPS fatigue management program, and the projected 60-year CUF values (using design basis transient severity to encompass environmental effects) are shown in Table 4.3.4-3. The CUF estimates for each location are based on plant operational data evaluated through November 12, 2000.

Table 4.3.4-3 shows that all BWR locations from NUREG/CR-6260 are included in the fatigue management program at PBAPS. The CUF values for all monitored locations, except for the Unit 3 RPV support skirt (CUF_{60} = 1.02), are projected to remain within the allowable value of 1.0 for the duration of the license renewal period. For the PBAPS Unit 3 RPV support skirt location, continued refinement of CUF estimates as additional operating experience is collected by the fatigue management program is expected to yield acceptable CUF results for the entire license renewal period.

The fatigue management program includes two locations that use stress-based fatigue (SBF) as the fatigue estimation basis, the RPV feedwater nozzles and the RPV support skirt. The CUF value for the RPV support skirt does not require any modification for potential environmentally assisted fatigue effects because this knuckle region, outside the RPV, is not exposed to reactor water. The CUF values for the RPV feedwater nozzle locations (one in each of two feedwater loops) are used for information only, because this component has an alternate aging management program as discussed in Section 4.7.2.

All of the remaining RPV, Class 1 piping, and torus locations included in the fatigue management program use a cycle-based fatigue (CBF) method. This method uses conservative design basis equations and actual plant transient counts to estimate the CUF. Equations were developed for each of the remaining limiting RPV locations and for limiting locations in each Class 1 piping system and the torus.

Table 4.3.4-2 and Table 4.3.4-3 show that the PBAPS fatigue management program conservatively estimates CUF based on design basis transient definitions, and that these estimates and the scope of the program are adequate to ensure that fatigue effects, including effects of the reactor coolant environment, will be kept below the design CUF limit of 1.0 throughout the license renewal period. The PBAPS fatigue management program also includes other locations beyond those evaluated in NUREG/CR-6260, and thereby provides more comprehensive CUF management. See Table 4.3.1-1 and Section B.4.2.

Disposition for Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping: Aging Management, 10 CFR 54.21(c)(1)(iii)

Exelon has implemented a fatigue management program. The fatigue management program tracks cumulative usage factor (CUF) for several bounding Class 1 pressure boundary and torus locations. The program is described in detail in Section 4.3 and Section B.4.2, "Fatigue Management Activities." The fatigue management program includes limiting locations in the reactor pressure vessel (RPV), Class 1 piping, and the torus. Exelon evaluated the current CUF based upon actual operating history for both PBAPS units to date to develop a baseline for this program. Exelon will continue to use the fatigue management program to monitor CUF for the Class 1 pressure boundary and torus locations throughout the license renewal period. See Table 4.3.1-1 for the list of monitored locations, and Table 4.3.4-3 and its notes, which describes how the NUREG/CR-6260 locations are monitored.

Much of the conservatism in the design basis calculation process is due to design basis transient definitions. As demonstrated in the "Analysis," above, the conservative design basis transient definitions by themselves bound any potential effects of the reactor water environment on fatigue usage factor. The fatigue monitoring program cycle-based fatigue (CBF) equations for the RPV, Class 1 piping, and the torus locations are conservatively based on such transient definitions. Therefore, the use of design basis transient severity in the fatigue monitoring program CUF equations is another conservatism that more than compensates for potential reactor water environmental effects.

The fatigue management program monitors at least those locations for which the 40-year CUF equaled or exceeded 0.4 in the original design basis analysis. This screening criterion includes sufficient margin, together with the conservative load case definitions, to account for potential reactor water environmental effects for the extended licensed operating period.

Table 4.3.4-1 Design Basis Plant Transient Comparison for the BWR-4 in EPRI Report No. TR-110356 vs. PBAPS

Transient	**BWR-4 No. of Cycles**	**PBAPS Units 2 and 3 No. of Cycles**
Boltup	123	66
Design Hydrostatic Test	130	130
Startup	117	161
Turbine Roll & Increase to Rated Power	not specified	161
Daily Reduction to 75% Power	10,000	10,000
Weekly Reduction to 50% Power	2,000	480
Rod Pattern Change (Rod Worth Test)	400	400
Loss of Feedwater Heaters, Turbine Trip with 100% Steam Bypass, Unit 1 = Turbine Trip at 25% Power	10	10
Loss of Feedwater Heaters, Partial Feedwater Heater Bypass	70	70
SCRAM, Turbine Generator Trip, Feedwater On, Isolation Valves Stay Open	40	80
SCRAM, All Other	140	107
Rated Power Normal Operation	not specified	not specified
Reduction to 0% Power	111	161
Hot Standby	111	2,600
Shutdown/Vessel Flooding	111	161
Unbolt	123	66
Refueling	not specified	not specified
Pre-Operational Blowdown	10	not included
Loss of Feedwater Pumps, Isolation Valves Close	5	10
Reactor Over Pressure with Delayed SCRAM, Feedwater Stays On, Isolation Valves Stay Open	1	1
Single Relief or Safety Valve Blowdown	8	8
Automatic Blowdown	1	1
Improper Start of Cold Recirculation Loop	1	1
Sudden Start of Pump in Cold Recirculation Loop	1	1
Improper Startup with Recirculation Pumps Off & Drain Shut Off	1	not included
Pipe Rupture and Blowdown	1	1
Natural Circulation Startup	3	not included
Loss of AC Power, Natural Circulation Restart	5	not included
Feedwater Temperature Reduction	not included	2,000
Excessive Heatups (160°F/hr)	not included	10
Excessive Cooldowns (160°F/hr)	not included	10
Code Hydrostatic Test	0	3

Table 4.3.4-2 Revised Fatigue Usage Results for BWR (Including Environmental Effects)

Case No.	Location	Projected 60 Year Usage Factor from TR-110356 (with F_{en})	Correction Factor to Account for NUREG/ CR-6583 or NUREG/ CR-5704	Revised 60-Year Usage Factor (with F_{en})(1)	Design Basis 40-Year Fatigue Usage(2)	Margin(3)
1	1 = CRD Penetration	0.034	2.0	0.068	0.875	12.9
	2 = FW Loop A Safe End	0.009	2.0	0.018	0.471	26.2
	3 = FW Loop A Nozzle Forging	0.001	1.0	0.001	< 0.1	~100
	4 = FW Loop B Safe End	0.009	2.0	0.018	0.471	26.2
	5 = FW Loop B Nozzle Forging	0.001	1.0	0.001	< 0.1	~100
2	1 = CRD Penetration	0.013	2.0	0.026	0.875	33.7
	2 = FW Loop A Safe End	0.009	2.0	0.018	0.471	26.2
	3 = FW Loop A Nozzle Forging	0.001	1.0	0.001	< 0.1	~100
	4 = FW Loop B Safe End	0.009	2.0	0.018	0.471	26.2
	5 = FW Loop B Nozzle Forging	0.001	1.0	0.001	< 0.1	~100
3	1 = CRD Penetration	0.016	2.0	0.032	0.875	27.3
	2 = FW Loop A Safe End	0.009	2.0	0.018	0.471	26.2
	3 = FW Loop A Nozzle Forging	0.001	1.0	0.001	< 0.1	~100
	4 = FW Loop B Safe End	0.009	2.0	0.018	0.471	26.2
	5 = FW Loop B Nozzle Forging	0.001	1.0	0.001	< 0.1	~100

Notes:

1. The "Revised 60-Year Usage Factor" is equal to the "Projected 60-Year Usage Factor from TR-110356" multiplied by the "Correction Factor to Account for NUREG/CR-6583 or NUREG/CR-5704."

2. As documented in the governing design basis fatigue analysis report for the plant evaluated in TR-110356. These values do not include environmental effects.

3. The "Margin" is equal to the "Design Basis Fatigue Usage" divided by the "Revised 60-Year Usage Factor."

Table 4.3.4-3 Locations Evaluated in NUREG/CR-6260 for Older Vintage General Electric Plant (BWR-4) vs. PBAPS, and Projected 60-Year CUFs

NUREG/CR-6260 Location	**NUREG/CR-6260 Material**	**Addressed by PBAPS Program?**	**PBAPS Material**	**Projected 60-Year CUF for PBAPS**[6]
Reactor Vessel (Lower Head to Shell Transition)	Low Alloy Steel	YES [1]	Low Alloy Steel	U2 = 0.85 U3 = 1.02
Feedwater Nozzle (Bore)	Low Alloy Steel	YES [2]	Carbon Steel	U2 = 0.57 U3 = 0.59
Recirculation System (RHR Return Line Tee)	Stainless Steel	YES	Stainless Steel	U2 = 0.78 U3 = 0.54
Core Spray System (Nozzle)	Low Alloy Steel	YES [3]	---	---
Core Spray System (Safe End)	Stainless Steel	YES	Stainless Steel	U2 = 0.12 U3 = 0.13
Residual Heat Removal Line (Tapered Transition)	Stainless Steel	YES [4]	Stainless Steel	U2 = 0.63 U3 = 0.52
Feedwater Line (RCIC Tee)	Carbon Steel	YES [5]	Carbon Steel	U2 = 0.05 U3 = 0.04

Notes:

1. The support skirt is monitored by the PBAPS fatigue management program. For managing fatigue effects this is an acceptable substitute for the shell region evaluated in NUREG/CR-6260, since it is more limiting for PBAPS.
2. The feedwater nozzle safe end is monitored by the PBAPS fatigue management program. For managing fatigue effects this is an acceptable substitute for the bore region evaluated in NUREG/CR-6260, since it is more limiting for PBAPS.
3. The core spray nozzle safe end is monitored by the PBAPS fatigue management program. For managing fatigue effects this is an acceptable substitute for the nozzle region evaluated in NUREG/CR-6260, since it is more limiting for PBAPS.
4. The limiting locations in the Class 1 portions of the RHR line were selected for PBAPS.
5. The limiting location in the feedwater piping was selected for PBAPS.
6. Before environmental effect factors F_{en}, if applicable. At PBAPS the equivalent location for the first entry is on the vessel exterior, for which no F_{en} applies. See Note 1.

4.4 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL EQUIPMENT

The thermal, radiation, and cyclic aging analyses of plant electrical equipment within the scope of 10 CFR 50.49 have been identified as time-limited aging analyses for PBAPS.

4.4.1 Electrical Equipment Environmental Qualification Analyses

10 CFR 50.49 requires that an environmental qualification (EQ) program be established to demonstrate that certain electrical equipment located in “harsh” plant environments (i.e., those areas of the plant that could be subject to the harsh environment effects of a loss-of-coolant accident, high energy line break, or post loss-of-coolant accident radiation) are qualified to perform their safety function in those harsh environments after the effects of in-service aging. The PBAPS EQ program complies with all applicable regulations and manages equipment thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. Environmentally qualified equipment must be refurbished, replaced or have its qualification extended prior to reaching the aging limits established in the aging evaluation.

Analysis

Aging evaluations for environmentally qualified equipment that specify the qualified life of at least 40 years are considered time-limited aging analyses (TLAAs) for license renewal. The following is a list of identified TLAAs for EQ of electrical equipment:

- GE Co. 4kV pump motors and associated cable
- EGS Grayboot connectors
- Raychem insulated splices for class 1E systems
- Bussman Co. and Gould Shawmut fuses and fuse holders
- EGS quick disconnect connectors
- Limitorque motor operated valve actuators
- Namco position switches
- ASCO solenoid valves, trip coils and pressure switches
- UCI splice tape

- Rosemount 1153 Series B transmitters
- GE Co. control station
- Agastat relays
- Static-O-Ring pressure switches
- Cutler Hammer motor control centers
- NDT International accoustical monitors
- Target Rock solenoid valves
- PYCO RTDs and thermocouples
- ITT Barton differential pressure switches
- Atkomatic solenoid valves
- Reliance fan motors and SGTS auxiliaries
- Brown Boveri load centers
- Valcor solenoid valves
- GE Co. radiation elements
- Pyle National plug connectors
- General Atomic radiation monitors
- GE electrical penetrations
- Buchanan terminal blocks
- GE terminal blocks
- Marathon terminal blocks
- Weidmueller terminal blocks
- Amp Inc. terminal lugs
- Scotch Insulating Tape
- GE SIS cable
- Brand Rex cable

- ITT Suprenant 600v control cable
- Okonite 600v power and control cable
- Rockbestos cable
- Foxboro pressure transmitters
- Patel conduit seals
- Jefferson coaxial cable
- Anaconda cable
- HPCI system equipment
- Masoneilan electropneumatic Transducer
- Westinghouse Y panels and associated transformers
- Barksdale pressure switches
- H_2 and O_2 analyzer
- Avco pilot solenoid valves
- Rosemount model no. 710-DU trip units
- Westinghouse manual transfer switch

Disposition: Aging Management, 10CFR54.21(c)(1)(iii).

The aging effects of the EQ equipment identified in this TLAA will be managed during the extended period of operation by the EQ program activities described in Section B.4.1.

4.4.2 GSI-168, Environmental Qualification Of Electrical Components

NRC guidance for addressing GSI-168 for license renewal is contained in the June 2, 1998, NRC letter to NEI [Reference 4.11]. In the letter, the NRC states: "With respect to addressing GSI-168 for license renewal, until completion of an ongoing research program and staff evaluations the potential issues associated with GSI-168 and their scope have not been defined to the point that a license renewal applicant can reasonably be expected to address them at this time. Therefore, an acceptable approach described in the Statements of Consideration is to provide a technical rationale demonstrating that the current licensing basis for environmental qualification pursuant to 10 CFR 50.49 will be maintained in the period of extended operation. Although the Statements of Consideration also indicated that an applicant should provide a brief description of one or more reasonable options that would be available to adequately manage the effects of aging, the staff does not expect an applicant to provide the options at this time."

Environmental qualification evaluations of electrical equipment are identified as time-limited aging analyses for PBAPS. The PBAPS program (Section B.4.1) evaluates the qualified lifetime of equipment in the EQ program. The existing EQ program requires that equipment qualified for 40 years be reanalyzed prior to entering the period of extended operation. The EQ program requires inclusion of any changes managed by closure of GSI-168. Consistent with the above NRC guidance, no additional information is required to address GSI-168 in a license renewal application at this time.

4.5 LOSS OF PRESTRESS IN CONCRETE CONTAINMENT TENDONS

PBAPS containments have no prestress tendons.

4.6 CONTAINMENT FATIGUE

Subsequent to the original design, elements of the PBAPS containment were re-analyzed in response to discoveries by General Electric and others of unevaluated loads due to design basis events and Safety Relief Valve (SRV) discharge. The load definitions include assumed pressure and temperature cycles resulting from SRV discharge and design basis loss of coolant accident (LOCA) events, and combinations thereof. This re-evaluation was in two parts: generic analyses applicable to each of the several classes of BWR containments, and Mark I Containment Program plant-unique analyses (PUA). The scope of the analyses included the tori (also referred to as "Pressure Suppression Chambers"), the drywell-to-torus vents, SRV discharge piping, other torus-attached piping and its penetrations, and the torus vent bellows.

In the absence of hydrodynamic loads, fatigue is not a concern in containment design except at penetrations or other stress concentration areas. Drywell shell plate was not evaluated for fatigue in the original design and the PUA did not re-evaluate the drywell, drywell penetrations, or process penetration bellows, all of which are attached to the drywell. The licensing and design basis documents do not reflect the existence of any fatigue analysis for the drywell or its penetrations. However, the drywell process bellows were originally specified for a finite number of operating cycles, and the design of these bellows is therefore a TLAA.

4.6.1 Fatigue Analyses of Containment Pressure Boundaries: Analyses of Tori, Torus Vents, and Torus Penetrations

The tori were originally evaluated for a maximum of 800 SRV events.

For the stress cycles associated with SRV and other dynamic events, the PUA calculated a maximum design life fatigue usage factor for the torus of 0.89 and "less than 1" for the drywell-to-torus vents. Current calculations show a usage factor of 0.662 for the most-limiting Unit 2 torus penetration and 0.992 for the most limiting Unit 3 penetration. All of these examples except the Unit 2 limiting penetration would exceed the code allowable CUF of 1.0 if multiplied by 1.5, the ratio of proposed licensed operating years to presently-licensed operating years.

Analysis

Validation: For most torus, vent, and torus penetration locations, the predicted 40-year CUF is less than 0.666, and could be validated for 60 years. However, a CUF of 0.666 provides no analytical or event margin. This validation will, therefore, be applied only to locations with a calculated 40-year CUF of 0.4 or less.

Aging Management**:** Locations whose 40-year CUF exceeds 0.4 are included in the fatigue management program. Since only the SRV load cases contribute to fatigue during normal operation, normal operation may continue so long as the contribution from SRV lifts has not exceeded 1.0 minus the contribution expected from the postulated worst-case LOCA event. As part of the fatigue management program, the analyses will be revised to show that this usage factor limit is not expected to be exceeded in the period of extended operation. This will be confirmed for the duration of the extended operating period by monitoring fatigue at the high-usage-factor locations in the containment tori, torus vents, and penetrations with the fatigue management program. The fatigue management program CUF modeling equations will be updated as necessary, and transient events will be tracked to ensure that the CUF remains less than 1.0. See Appendix B, Section B.4.2.

This program also permits reanalysis of high-usage-factor locations. Conservatism in original containment PUA may permit the calculated 40-year usage factor to be reduced below the value (0.4) for which fatigue monitoring would be required.

Disposition: Validation, 10 CFR 54.21(c)(1)(i), and Aging Management, (iii)

Most locations have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i), as discussed above.

However, portions of this TLAA will require management of the aging effects (10 CFR 54.21(c)(1)(iii)). Refer to Appendix B, Section B.4.2, Fatigue Management Activities.

4.6.2 Fatigue Analysis of SRV Discharge Lines and External Torus-Attached Piping

SRV discharge lines and external torus-attached piping were originally analyzed separately from the tori and torus vents. The analysis included the SRV lines, all piping and branch lines (including small-bore piping less than four inches nominal) attached to the tori, pipe supports, valves, flanges, equipment nozzles, and equipment anchors. The worst-case predicted fatigue usage factors are lower than those found in the tori and vents, and permit a simpler disposition.

PUA Addendum 1 states that 800 SRV actuations were used. PUA Addendum 1 calculated a maximum usage factor for SRV discharge lines and torus-attached piping of 0.202.

Analysis

The fatigue analysis for SRV discharge lines and external torus-attached piping is dispositioned by validation:

$$(U_{max,\,40} = 0.202) \times 60/40 = (0.303 = U_{max,\,60}) < 1.0,$$

where <1.0 is the design criterion. The maximum usage factor will not exceed the design criterion of 1.0 if multiplied by 1.5, the ratio of proposed licensed operating years (60) to presently-licensed operating years (40).

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The fatigue analysis for SRV discharge lines and external torus-attached piping has been evaluated and remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3 Expansion Joint and Bellows Fatigue Analyses - Drywell to Torus Vent Bellows

The predicted fatigue usage factors for the drywell to torus vent bellows are lower than those calculated for the torus, and permit a simpler disposition. The PUA calculated a "negligible" fatigue usage factor for the drywell-to-torus vent bellows.

Analyses

The predicted fatigue usage factors for the drywell to torus vent bellows are "negligible," and, therefore, will remain negligible compared to the <1.0 design criterion even if increased by a factor of 1.5 for the extended licensed operating period.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The predicted fatigue usage factors for the drywell to torus vent bellows have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6.4 Expansion Joint and Bellows Fatigue Analyses - Containment Process Penetration Bellows

At PBAPS, the only containment process piping expansion joints subject to significant thermal expansion and contraction are those between the drywell shell penetrations and process piping. These bellows are designed for a stated number of operating and thermal cycles. The design of containment boundary components for a stated number of cycles over the design life is a TLAA.

The PUA does not include any reanalysis of process penetration bellows.

Some PBAPS process expansion joints have been replaced with components designed to later code and specification requirements. Both the original and replacement components were designed for a number of equivalent full-temperature thermal cycles far in excess of their specifications.

Analysis

The bellows originally supplied were designed for “greater than 10,000” cycles; the replacement bellows were designed for ”greater than 50,000” cycles. The bellows were designed to the requirements of ASME Code, Section III, that specified a minimum of 200 “startup-shutdown” cycles and a minimum of 1500 “normal operating” cycles. The as-supplied design cycles of the original and replacement bellows far exceed the requirements of the original specifications if extrapolated to 60 years, and similarly far exceed a very conservative estimate of the governing thermal cycles that might be expected to occur in the process piping in 60 years.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The expansion joint and bellows fatigue analyses have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7 OTHER PLANT SPECIFIC TLAAS

4.7.1 Reactor Vessel Main Steam Nozzle Cladding Removal Corrosion Allowance

Original reactor vessel corrosion allowances were conservative values intended to encompass 40 years of operation but without reliance on a particular corrosion rate. However, a subsequent calculation to justify removal of the main steam nozzle cladding used a time-dependent corrosion rate for 40 years, and is thereby a TLAA.

Analysis

Corrosion data for unclad portions of the vessel interior were evaluated, and predict a loss of about 0.030 inches in 60 years. The main steam nozzle clad removal calculation was validated to confirm that the 1/16 inch (.065") corrosion allowance is conservative for 60 years of operation.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The reactor vessel main steam nozzle clad removal corrosion allowances have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.2 Generic Letter 81-11 Crack Growth Analysis to Demonstrate Conformance to the Intent of NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking"

Generic Letter 81-11 and NUREG–0619 were initiated because cracking was observed in BWR feedwater nozzles. The causes included thermal sleeve bypass leakage and consequent rapid thermal cycling on inner surfaces, on-off low-flow feedwater control, and the clad-base metal interface.

The concern was extended to Control Rod Drive Hydraulic System returns as well. At PBAPS, these returns were capped to eliminate the thermal cycling concern at this nozzle.

Analysis

Modifications were installed to reduce or eliminate the causes and an inspection program was invoked to detect and manage any future cracking. Improved triple thermal sleeves with dual piston ring seals were installed, the clad was removed from the nozzle bores and blend radii, and the low-flow controllers were improved. The PBAPS units now use the improved BWR Owners Group (BWROG) inspection and management methods [Ref. 4.12] in lieu of NUREG-0619 methods. The BWROG methods depend on a fracture mechanics analysis and ultrasonic inspection (UT) from the vessel and nozzle exteriors.

The fracture mechanics analysis has cyclic duty inputs and calculates their effects (Criterion 2). The expected cycle accumulation rate over the current 40-year licensed operating period is used to predict crack growth. At PBAPS the analysis predicts that growth between the assumed initial flaw size and an upper analytic limit will require about 60 years. This predicted time for a flaw to reach an upper analytic limit is not used to justify a 60-year operating life. Instead, the BWROG method determines the inspection (or "reinspection") interval as a fraction of this flaw growth time. Therefore, although the fracture mechanics analysis is based on the calculated effects on the number of cycles expected in the current 40-year licensed operating period, it is not "time-limited … by the current operating term," and thereby fails Criterion 3. It is not a TLAA.

However, GL 81-11 nozzle cracking effect must be acceptable for the period of extended operation if the fatigue design of the reactor vessel is to remain acceptable. Fatigue design of the reactor vessel clearly is a TLAA, and this effect must, therefore, be acceptable if the reactor vessel fatigue TLAA is to be acceptable.

The UFSAR description of this issue includes an evaluation of combined effects of long-term thermal cyclic fatigue (which affects the entire vessel and nozzle wall), and the rapid surface-effect thermal cycles of concern here (which affect only the inner surface of the nozzle of the vessel). This evaluation is a TLAA.

However, these fatigue effects are separable, and the revised safety determination which depends on the improved, NRC-approved BWROG inspection methods no longer depends on this combined fatigue evaluation.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(ii)

The basis for the safety determination documented in the UFSAR will be reexamined and the alternative dispositions consistent with NRC-approved BWROG improved inspection methods will be invoked. The revised methods include aging management activities necessary to manage this effect, which consist of inspections with acceptance criteria and prescribed actions if criteria are not met. These activities are included in the Reactor Pressure Vessel and Internals Inservice Inspection (ISI) Program described in Section B.2.7. In addition, periodic review of the fracture mechanics analysis, in conjunction with the fatigue management program, discussed in Section B.4.2, will ensure that the fracture mechanics evaluation remains bounding and applicable for its intended purpose.

This reexamination of the basis for the safety evaluation will be completed before the current licensed operating period expires.

4.7.3 Fracture Mechanics of ISI-Reportable Indications for Group I Piping: As-forged laminar tear in a Unit 3 Main Steam elbow near weld 1-B-3BC-LDO discovered during preservice UT

A preservice ultrasonic volumetric examination (UT) discovered an imbedded as-forged laminar tear in the Unit 3 main steam elbow material. The indication did not extend to the weld.

Although this piping was not in general subject to an ASME III Class 1 fatigue analysis, a stress and 40-year-life fatigue analysis was performed. The analysis found that the 40-year CUF will not exceed 1.0 (the code acceptance limit) and that primary, secondary, and primary plus secondary stresses are within code. The calculated 40-year CUF is 0.012, which at worst could rise to 0.036 if the lamination extended to the weld joint. This analysis is a TLAA.

Analysis

The fatigue analysis for the as-forged laminar tear in a Unit 3 Main Steam elbow near weld 1-B-3BC-LDO discovered during preservice UT is dispositioned by validation.

Even if the laminar tear were to extend to the weld, the CUF would still not exceed 0.054, which does not exceed the code design criterion (1.0). The condition is, therefore, acceptable for a 60-year operating life.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The fatigue analysis for the as-forged laminar tear in a Unit 3 main steam elbow near weld has been evaluated and remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.8 REFERENCES FOR SECTION 4

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4.2 General Electric Topical Report APED-5460, "Design and Performance of GE-BWR Jet Pumps," September, 1968.

4.3 NUREG-0933, “A Prioritization of Generic Safety Issues”, Division of Systems Analysis and Regulatory Effectiveness, Office of Nuclear Regulatory Research, USNRC, June 2000

4.4 Memorandum, Ashok C. Thadani, Director, Office of Nuclear Regulatory Research, to William D. Travers, Executive Director for Operations, “Closeout of Generic Safety Issue 190, Fatigue Evaluation of Metal Components for 60 Year Plant Life”, USNRC, December 26, 1999

4.5 EPRI Report TR-110356, “Evaluation of Environmental Thermal Fatigue Effects on Selected Components in a Boiling Water Reactor Plant”, April 1998

4.6 Letter from Christopher Grimes (NRC) to Douglas J. Walters (NEI), Request for Additional Information on the Industry’s Evaluation of Fatigue Effects for License Renewal”, August 6, 1999

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4.10 NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components,” March 1995.

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4.15 BWRVIP-05, EPRI Report TR-105697, “BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05).” For the Boiling Water Reactor Owners Group (Proprietary), September 28, 1995, with supplementing letters of June 24 and October 29, 1996, May 16, June 4, June 13, and December 18, 1997, and January 13, 1998.

4.16 BWRVIP-74, General Electric Report TR-(Draft, to be numbered), “BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines (BWRVIP-74).” For the Boiling Water Reactor Owners Group and EPRI (Proprietary). Currently in draft (Summer, 2000).

4.17 BWRVIP-27, EPRI Report TR-107236, “BWR Vessel and Internals Project: BWR Standby Liquid Control System Core Plate ΔP Inspection and Flow Evaluation Guidelines”, April 1997.

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4.20 Ranganath, S., “Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident,” Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979.

APPENDIX A UPDATED FINAL SAFETY ANALYSIS REPORT (UFSAR) SUPPLEMENT

APPENDIX A UPDATED FINAL SAFETY ANALYSIS REPORT (UFSAR) SUPPLEMENT

Introduction

The aging management activity descriptions presented in this appendix represent commitments for managing aging of the in-scope systems, structures and components during the period of extended operation. These descriptions will be incorporated in the PBAPS, Units 2 and 3 Updated Final Safety Analysis Report (UFSAR) following issuance of the renewed operating license.

As part of the license renewal effort, it must be demonstrated that the aging effects applicable for the components and structures within the scope of license renewal are adequately managed during the period of extended operation.

In many cases, existing activities were found adequate for managing aging effects during the period of extended operation. In some cases, aging management reviews revealed that existing activities should be enhanced to adequately manage applicable aging effects. In a few cases, new activities were developed to provide added assurance that aging effects are adequately managed.

Summary descriptions of TLAAs will be incorporated in the PBAPS, Units 2 and 3 Updated Final Safety Analysis Report (UFSAR) following issuance of the renewed operating license.

Activities Credited for Managing Aging in the Renewal Term

PBAPS has numerous activities that detect and monitor aging effects. This supplement to the UFSAR only describes those activities which PBAPS is crediting for the purposes of complying with the license renewal rule.

Each aging management activity presented in this Appendix is characterized as one of the following:

- **Existing Activity:** A current activity that will continue to be implemented during the period of extended operation.

- **Enhanced Activity:** A current activity that will be modified during the extended period of operation. Enhancements will be implemented as discussed in this Appendix.

- **New Activity:** An activity that does not currently exist, which will manage aging during the extended period of operation. These activities will be implemented as shown in this Appendix.

- **Time Limited Aging Analyses Activity:** An activity that has been credited by a time-limited aging analysis described in Section 4.0

Time Limited Aging Analyses Summaries

Summary descriptions of time-limited aging analyses are provided.

A.1 EXISTING AGING MANAGEMENT ACTIVITIES

A.1.1 Flow Accelerated Corrosion Program

The PBAPS Flow Accelerated Corrosion (FAC) Program activities manage loss of material in pipes and fittings by monitoring the condition of piping susceptible to FAC induced wall thinning. The FAC Program provides for prediction of the amount of wall thinning in carbon steel pipes and fittings through analytical evaluations and periodic examinations of locations most susceptible to FAC induced loss of material. The program includes analyses to determine critical locations, baseline inspections to determine the extent of thinning at these locations, and follow-up inspections to confirm the predictions. The FAC Program provides reasonable assurance that loss of material of carbon steel pipe and fittings is detected and addressed prior to loss of intended function of the piping.

A.1.2 Reactor Coolant System Chemistry

PBAPS reactor coolant system (RCS) chemistry activities manage loss of material and cracking of components exposed to reactor coolant and steam through measures that monitor and control reactor coolant chemistry. These activities include monitoring and controlling of reactor coolant water chemistry to ensure that known detrimental contaminants are maintained within pre-established limits. Reactor coolant is monitored for indications of abnormal chemistry conditions. If such indications are found, then measurements of impurities are conducted to determine the cause, and actions are taken to address the abnormal chemistry condition. Whenever corrective actions are taken to address an abnormal chemistry condition, sampling is utilized to verify the effectiveness of these actions. The RCS chemistry activities provide reasonable assurance that intended functions of components exposed to reactor coolant and steam are not lost due to loss of material or cracking aging effects.

A.1.3 Closed Cooling Water Chemistry

The PBAPS closed cooling water (CCW) chemistry activities manage loss of material, cracking and reduction of heat transfer in components exposed to closed cooling water through measures that monitor and control cooling water chemistry. These activities include periodic monitoring and controlling of chemistry parameters and corrosion inhibitors. If parameter limits are exceeded, corrective actions are taken to restore parameters within the acceptable range. The CCW chemistry activities provide reasonable assurance that the intended functions of components in a CCW environment are not lost due to loss of material, cracking, or reduction of heat transfer aging effects.

A.1.4 Condensate Storage Tank Chemistry Activities

PBAPS condensate storage tank (CST) chemistry activities manage loss of material and cracking of components exposed to condensate storage tank water in the RCIC, HPCI, CRD, core spray and condensate storage systems. In addition, CST chemistry activities manage reduction in heat transfer in the HPCI gland seal condenser, and the RCIC and HPCI turbine lubricating oil coolers. CST water is monitored periodically to assure that purity is maintained within pre-established limits. If parameter limits are exceeded, corrective actions are taken to restore parameters within the acceptable range. CST chemistry activities provide reasonable assurance that intended functions of components exposed to CST water are not lost due to loss of material, cracking, or reduction of heat transfer aging effects.

A.1.5 Torus Water Chemistry Activities

PBAPS torus water chemistry activities manage loss of material and cracking of components exposed to torus grade water in the RHR, HPCI, RCIC, core spray and main steam systems. In addition, torus water chemistry activities manage cracking of stainless steel component supports submerged in torus grade water, and reduction of heat transfer in RHR heat exchangers. Torus grade water is monitored periodically to assure that purity is maintained within pre-established limits. Torus water chemistry activities provide reasonable assurance that intended functions of components exposed to torus grade water are not lost due to loss of material, cracking, or reduction of heat transfer aging effects.

A.1.6 Fuel Pool Chemistry Activities

PBAPS fuel pool chemistry activities manage loss of material for fuel pool gates, fuel storage racks, fuel pool liner, component supports, fuel preparation machines, refueling platform mast, and loss of material and cracking for fuel pool cooling and cleanup system components exposed to fuel pool water. Fuel pool water is monitored periodically to assure that purity is maintained within pre-established limits. Fuel pool chemistry activities provide reasonable assurance that intended functions of components contacted by fuel pool water are not lost due to loss of material or cracking aging effects.

A.1.7 High Pressure Service Water Radioactivity Monitoring Activities

PBAPS high pressure service water radioactivity monitoring activities manage loss of material and cracking in RHR heat exchangers through routine sampling and isotopic analysis of the HPSW system water contained within the RHR heat exchangers to confirm the absence of radioactive isotopes that do not occur naturally. High pressure service water radioactivity monitoring activities provide reasonable assurance that loss of material and cracking are detected and addressed prior to loss of intended function.

A.1.8 Inservice Inspection (ISI) Program

The inservice inspection (ISI) aging management program, as augmented to address the requirements of GL 88-01, consists of those portions of the PBAPS ISI program that are being utilized for managing aging in pressure retaining piping and components in the scope of license renewal. However, the reactor pressure vessel components and internals in the PBAPS ISI program are not included in the ISI aging management program. The PBAPS ISI program complies with the requirements of the 1989 edition of the ASME Section XI code and includes requirements for inspections of ASME Class 1, 2, and 3 pressure retaining components. In addition, it provides for condition monitoring of ASME Class 1,2 and 3 piping and equipment supports and integral support anchors. The ISI program provides reasonable assurance that aging effects are detected and addressed prior to loss of intended function.

A.1.9 Primary Containment Inservice Inspection Program

The primary containment ISI program consists of inspections that manage loss of material in the primary containment for Class MC pressure-retaining components, their integral attachments, and Class MC component supports; and loss of sealing for the drywell internal moisture barrier at the juncture of the containment wall and the concrete floor. The program complies with subsection IWE of the ASME Section XI Code 1992 Edition including 1992 Addenda or alternatives, as approved by the NRC. The primary containment ISI program provides reasonable assurance that aging effects are detected and addressed prior to loss of intended function.

A.1.10 Primary Containment Leakage Rate Testing Program

The primary containment leakage rate testing program is that portion of the PBAPS primary containment leakage rate testing program that is being credited for license renewal. The primary containment leakage rate testing program provides for aging management of pressure boundary degradation due to loss of material in a wetted gas environment in containment atmosphere control and dilution, RHR, and primary containment isolation systems penetrating primary containment. The primary containment leakage rate testing program also manages change in material properties and cracking of gaskets and O-rings for the primary containment pressure boundary access penetrations. The program complies with the requirements of 10CFR50 Appendix J, Option B. and provides reasonable assurance that aging effects are detected and addressed prior to loss of intended function.

A.1.11 Inservice Testing (IST) Program

The Inservice Testing (IST) aging management program is that portion of the PBAPS IST program that is being credited for license renewal. The IST aging management program manages flow blockage of system components from the ECW pump through the ESW and ECW system piping to the ECT. In addition, the program manages reduction of heat transfer of the RHR heat exchangers through flow testing of the torus water path. IST program activities are conducted in accordance with the ASME O&M Code 1990 Edition. IST program activities provide reasonable assurance that aging effects are detected and addressed prior to loss of intended function.

A.1.12 Reactor Materials Surveillance Program

The PBAPS Reactor Materials Surveillance (RMS) program manages loss of fracture toughness in the reactor pressure vessel beltline region consistent with the requirements of 10 CFR 50, Appendix H and ASTM E185. The RMS program provides for periodic withdrawal and testing of in-vessel capsules to monitor the effects of neutron embrittlement on the reactor vessel beltline materials. The results of this testing are used to determine plant operating limits. The RMS program contains sufficient dosimetry and materials to monitor irradiation embrittlement during the period of extended operation and provides reasonable assurance that aging effects are detected and addressed prior to loss of intended function.

A.1.13 Standby Liquid Control System Surveillance Activities

The standby liquid control system (SBLC) surveillance activities are credited with managing the aging effects of loss of material and cracking in components of the

SBLC that are on the suction side of the SBLC pumps. The surveillance activities monitor the SLCS solution tank liquid level in accordance with a PBAPS procedure. The SBLC components covered by this surveillance include the solution tank, piping, and valves on the suction side of the SBLC pumps. The extent and frequency of this monitoring provides reasonable assurance that loss of material and cracking are detected and addressed prior to loss of intended function.

A.1.14 Crane Inspection Activities

PBAPS crane inspection activities manage loss of material for the structural members, rails, and rail anchorage for the circulating water pump structure gantry crane, and rails and monorails for the cranes and hoists located in a sheltered environment. These annual crane inspections provide reasonable assurance that loss of material is detected and addressed prior to loss of intended function.

A.1.15 Conowingo Hydroelectric Plant (Dam) Aging Management Program

The Conowingo Hydroelectric Plant dam is subject to the FERC 5-year inspection program. This program consists of a visual inspection by a qualified independent consultant approved by FERC, and is in compliance with Title 18 of the Code of Federal Regulations, Conservation of Power and Water Resources, Part 12 (Safety of Water Power Projects and Project Works), Subpart D (Inspection by Independent Consultant). The NRC has found that mandated FERC 5-year inspection programs are acceptable for aging management.

A.1.16 Maintenance Rule Structural Monitoring Program

The maintenance rule structural monitoring program is that portion of the PBAPS structural monitoring program that is being credited for license renewal. The maintenance rule structural monitoring program complies with 10CFR50.65 and utilizes visual inspections in managing aging effects for structures and components within the scope of license renewal that are not covered by other existing inspection programs. The structures and components include emergency cooling tower and reservoir reinforced concrete walls in contact with raw water, structural steel components outside primary containment exposed to the outdoor environment, emergency cooling water outdoor piping support anchors, and penetration seals and expansion joints. Maintenance rule structural monitoring program activities provide reasonable assurance that aging effects are detected and addressed prior to loss of intended function.

A.2 ENHANCED AGING MANAGEMENT ACTIVITIES

A.2.1 Lubricating and Fuel Oil Quality Testing Activities

Lubricating and fuel oil quality testing activities manage loss of material, cracking and reduction of heat transfer in components that contain or are exposed to lubricating oil or fuel oil. Lubricating and fuel oil quality testing activities provide for sampling and testing of lubricating oil in components in emergency diesel generator (EDG), high pressure coolant injection (HPCI), high pressure service water (HPSW), core spray (CS), and reactor core isolation cooling (RCIC) systems. Lubricating and fuel oil quality testing activities also provide for sampling and testing of fuel oil in the EDG and diesel driven fire pump fuel oil systems. Lubricating and fuel oil quality testing activities include sampling and analysis of lubricating oil and fuel oil for detrimental contaminants. The diesel driven fire pump fuel oil sampling methods will be enhanced to improve water detection capabilities. Analyses of the diesel driven fire pump and EDG fuel oil samples will be enhanced to add testing for microbes in any water detected. The lubricating and fuel oil quality testing activities provide reasonable assurance that aging effects on system components will be detected and addressed prior to loss of intended function of the components. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.2 Boraflex Management Activities

The Boraflex management activities provide for aging management of the spent fuel rack neutron poison material. These activities involve monitoring the condition of Boraflex by routinely sampling fuel pool silica levels and periodically performing in-situ measurement of boron-10 areal density. Existing processes will be enhanced by including the requirement and frequency for in-situ measurement of boron-10 areal density in one or more PBAPS procedures. The Boraflex management activities monitor the condition of Boraflex to provide reasonable assurance that its degradation will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.3 Ventilation System Inspection and Testing Activities

PBAPS ventilation system inspection and testing activities manage aging of filter plenum access door seals and fan flex connections in the standby gas treatment system and the control room ventilation system. These activities also include inspections of fan flex connections for the standby gas treatment system, the control room ventilation system, the battery room and emergency switchgear ventilation system exhaust fans, and the ESW booster pump room ventilation supply fans. These activities will be enhanced by adding inspections of fan flex connections in the diesel generator building ventilation system, the pump structure ventilation system and the battery room and emergency switchgear ventilation system supply fans. PBAPS ventilation system inspection and testing activities provide reasonable assurance that change in material properties will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.4 Emergency Diesel Generator Inspection Activities

The emergency diesel generator (EDG) inspection activities provide for condition monitoring of EDG equipment within the scope of license renewal that are exposed to a gaseous, closed cooling water, lubricating oil or fuel oil environment. Loss of material in the starting air system air receivers is mitigated by daily removal of any accumulation of condensate. Loss of material and cracking in lubricating oil and fuel oil systems is mitigated by periodic inspections performed for underground storage tanks. Visual inspections for change in material properties of flexible hoses in the starting air system and the cooling water system are performed in accordance with a PBAPS procedure in connection with periodic EDG maintenance. This procedure will be enhanced to require inspections of the lubricating oil system and fuel oil system flexible hoses for a change in material properties. The aging management review also determined that the management of loss of material in the EDG exhaust silencer will be enhanced by periodic disassembly, cleaning, and inspection of an automatic drain trap to ensure its functionality in preventing condensation build up. The emergency diesel generator (EDG) inspection activities provide reasonable assurance that aging effects will be detected and addressed prior to loss of intended function of the components. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.5 Outdoor, Buried and Submerged Component Inspection Activities

The outdoor, buried, and submerged component inspection activities provide for loss of material and cracking aging management of external surfaces of components subject to outdoor, buried, and raw water external environments. (Separately, the ISI program provides for monitoring of pressure boundary integrity for outdoor and buried components through pressure tests, flow tests, and inspections.) The submerged components include HPSW, ESW, ECW, and fire protection system pumps. HPSW and ESW system manual discharge pond isolation valves, condensate storage system piping and valves, and the external surfaces of the CSTs and the piping insulation jacketing at the CST are the components exposed to the outdoor environment. The buried components include HPSW, ESW, ECW, fire protection, and EDG fuel oil system piping, fire protection system fire main isolation valves, the EDG fuel oil storage tanks, the SGTS exhaust to the main stack, and the undersides of the CSTs which are in direct contact with compacted fill. The outdoor, buried, and submerged component inspection activities are implemented in accordance with PBAPS maintenance procedures and routine test procedures. The scope of components covered by these activities will be enhanced to include periodic visual inspection of the external surfaces of the CSTs, periodic visual inspection of the ECW pump casing and casing bolts, visual inspection of buried commodities whenever they are uncovered during excavation and enhanced inspections of the refueling water storage tank (as representative of the condition of the CST). These inspection activities provide reasonable assurance that aging effects will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.6 Door Inspection Activities

The door inspection activities provide for managing the aging effects for hazard barrier doors that are exposed to the outdoor environment. The aging management review determined that the activities will be enhanced to include additional doors. In addition, the activities will be enhanced to include inspection for loss of material in hazard barrier doors in an outdoor environment. The door inspection activities also provide for managing the aging effects for gaskets associated with water-tight hazard barrier doors in both outdoor and sheltered environments. The inspection activities consist of condition monitoring of the gaskets associated with water-tight hazard barrier doors on a periodic basis. The hazard barrier doors inspection activities are condition monitoring activities that utilize inspections to provide reasonable assurance that aging effects will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.7 Reactor Pressure Vessel and Internals ISI Program

The BWR Vessels and Internals Project (BWRVIP) guidelines are implemented through the reactor pressure vessel and internals ISI program. The reactor pressure vessel and internals ISI program is that part of the PBAPS ISI program that provides for condition monitoring of the reactor vessel and internals using guidance provided by the BWRVIP and the BWR Owners Group alternate BWR feedwater nozzle inspection requirements. The PBAPS ISI program complies with requirements of an NRC approved Edition of the ASME Section XI Code, or approved alternative, and is implemented through a PBAPS specification. The PBAPS ISI program has been augmented to include various additional requirements, including those from the BWRVIP guidelines and the BWR Owners Group (BWROG) alternative to NUREG-0619 augmented inspection of feedwater nozzles for GL 81-11 thermal cycle cracking. The reactor pressure vessel and internals ISI program will be enhanced to assure that inspections are consistent with the relevant BWRVIP program criteria and NRC safety evaluation reports. The program utilizes early detection, evaluation and corrective actions that provide reasonable assurance that aging effects of reactor vessel components and internals will be detected and addressed prior to loss of intended function. Program enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.8 GL 89-13 Activities

The GL 89-13 activities provide for management of loss of material, cracking, flow blockage, and reduction of heat transfer aging effects in cooling water piping and components that are tested and inspected in accordance with the guidelines of NRC Generic Letter 89-13, “Service Water System Problems Affecting Safety Related Equipment”. The GL 89-13 activities include both condition monitoring and mitigating activities for managing aging effects in HPSW, ESW, and the ECW systems and in other systems’ components using raw water as a cooling medium. System and component testing, visual inspections, UT, and biocide treatments are conducted to ensure that aging effects are managed such that system and component intended functions are maintained. Maintenance procedures will be enhanced to require inspection for specific signs of degradation, including corrosion, excessive wear, cracks and Asiatic clams. Also additional piping locations will be added to the UT inspection program. The GL 89-13 activities provide reasonable assurance that aging effects will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.9 Fire Protection Activities

The fire protection activities provide for inspections, monitoring, and performance testing of fire protection systems and components to detect aging effects prior to loss of intended function. Degradation of fire protection systems and components due to corrosion buildup, biofouling, and silting are detected by performance testing based on NFPA 24 standards. Periodic and maintenance inspections detect corrosion, fouling, and cracking in system components due to internal and external environment aging effects and detect aging effects in fire barriers. Monitoring of system pressure detects system leakage due to both internal and external aging effects. The scope of fire protection activities will be enhanced. The activities will require additional inspection requirements for deluge valves in the power block sprinkler systems, testing of sprinklers that have been in service for 50 years, inspection of diesel driven fire pump exhaust systems, inspection of diesel driven fire pump fuel oil system flexible hoses, inspection of fire doors for loss of material, and perform a one-time test of a cast iron fire protection component for loss of material due to selective leaching.

The fire protection activities provide reasonable assurance that aging effects will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.10 HPCI and RCIC Turbine Inspection Activities

The HPCI and RCIC turbine inspection activities provide for aging management of the HPCI and RCIC turbine casings that are exposed to a wetted gas environment. The HPCI turbine inspection activities additionally provide for condition monitoring of components exposed to a lubricating oil environment. The inspection activities perform assessments of components for loss of material aging effects. The activities will be enhanced to inspect the HPCI lubricating oil system flexible hoses for a change in material properties. The HPCI and the RCIC turbine inspection activities are performed periodically in connection with turbine maintenance. The HPCI and RCIC turbine inspection activities provide reasonable assurance that aging effects will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.11 Susquehanna Substation Wooden Pole Inspection Activity

The Susquehanna substation wooden pole inspection activity manages the aging effects of loss of material and change in material properties for a wooden takeoff pole at the Susquehanna substation. This pole provides the structural support for the conductors connecting the substation to the submarine cable that is used to transmit the alternate AC power for PBAPS from the Conowingo Hydroelectric Plant in compliance with the requirements of 10 CFR 50.63 for coping with station blackout. The inspection activity will be enhanced to ensure that it is performed every ten years in accordance with corporate specification. The wooden pole inspection activity provides reasonable assurance that aging effects will be detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.2.12 Heat Exchanger Inspection Activities

The heat exchanger inspection activities provide for periodic component visual inspections and cleaning of heat exchangers and coolers that are outside the scope of NRC Generic Letter 89-13, “Service Water System Problems Affecting Safety Related Equipment”. These activities manage aging effects of loss of material, cracking, and reduction of heat transfer effects for the HPCI gland seal condenser, the HPCI turbine lube oil cooler, and the RCIC turbine lube oil cooler.

These activities will be enhanced to require periodic inspection of the HPCI gland seal condenser tube side internals. These inspections provide reasonable assurance that aging effects are detected and addressed prior to loss of intended function. Activity enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.3 NEW AGING MANAGEMENT ACTIVITIES

A.3.1 Torus Piping Inspection Activities

The PBAPS torus piping inspection activities will provide for identification of loss of material in carbon steel piping located at the water-gas interface in the torus compartment of the primary containment by monitoring the condition of a representative sample of the piping at a susceptible location. These activities will include a one-time inspection of the wall thickness of selected torus piping. The scope and frequency of subsequent examinations will be based on the results of the initial inspection sample. Torus piping inspection activities provide reasonable assurance that loss of material will be detected and addressed prior to loss of intended function. Torus piping inspection activities will be implemented prior to the end of the initial operating license term for PBAPS.

A.3.2 FSSD Cable Inspection Activity

PBAPS fire safe shutdown (FSSD) cable inspection activities will manage change in material properties of the PVC-insulated FSSD cables located in the drywell by monitoring the condition of a representative sample of the cables. FSSD cable inspection activities will identify anomalies in the PVC insulation surface that are precursor indications of loss of material properties of the PVC insulation. These activities provide reasonable assurance that loss of material properties of the PVC-insulated cables will be detected and addressed prior to loss of their intended function. The FSSD cable inspection activities will be implemented prior to the end of the initial operating license term for PBAPS.

A.4 TIME-LIMITED AGING ANALYSES ACTIVITIES

A.4.1 Environmental Qualification Activities

PBAPS environmental qualification (EQ) program ensures maintenance of qualified life for the electrical equipment important to safety within the scope of 10 CFR 50.49, “Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants.” An aging limit (qualified life) is established for equipment within the scope of the EQ program and an appropriate action such as replacement or refurbishment is taken prior to or at the end of the equipment qualified life so that the aging limit is not exceeded. The PBAPS EQ program activities establish, demonstrate and document the level of qualification, qualified configuration, maintenance, surveillance and replacement requirements necessary to apply the qualification conclusions and the equipment qualified life.

A.4.2 Fatigue Management Activities

The fatigue management program counts fatigue stress cycles and tracks fatigue usage factors. The program will be enhanced to broaden its scope and update implementation methods, and will consist of analytical methods to determine stress cycles and fatigue usage factors from operating cycles, automated counting of fatigue stress cycles, and automated calculation and tracking of fatigue cumulative usage factors (CUFs). The program will calculate and track CUFs for bounding locations in the reactor pressure vessel (RPV), RPV internals, Group I piping, and containment torus. The fatigue management program enhancements will be implemented prior to the end of the initial operating license term for PBAPS.

A.5 TIME-LIMITED AGING ANALYSES SUMMARIES

In the descriptions of this section, Groups I, II, and III are the PBAPS pressure boundary safety groups described in UFSAR Appendix A, Section A.2

A.5.1 Reactor Vessel Neutron Embrittlement

The PBAPS Units 2 and 3 reactor vessels are described in UFSAR Sections 3.3 and 4.2. Reactor vessel materials are subject to embrittlement, primarily due to exposure to neutron radiation. Reactor vessel neutron embrittlement is a TLAA.

A.5.1.1 Reactor Vessel End-of-Life Fluence, USE, • RT_{NDT}, and P-T Limit Curves, Reflood Thermal Shock Analysis

The vessel end-of-life fluence, USE, • RT_{NDT}, and P-T limit curves will be recalculated for a 60-year licensed operating life. These calculations will be completed and acceptable values will be confirmed prior to the end of the initial operating license term for PBAPS.

The analyses of reactor vessel fluence, USE, • RT_{NDT}, and the operating limit P-T curves will be projected to the end of the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(ii).

The reflood thermal shock analysis was examined and remains valid and bounding for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

A.5.1.2 Reactor Vessel Circumferential Weld Examination Relief

Relief has been granted from the requirements for inspection of RPV circumferential welds for the remainder of the current 40-year licensed operating period. The justification for relief is consistent with Boiling Water Reactor Vessel and Internals Program BWRVIP-05 guidelines. Application for an extension of this relief for the 60-year period of extended operation will be submitted prior to the end of the initial operating license term.

The procedures and training that will be used to limit the frequency of cold over-pressure events to the number specified in the SER for the RPV circumferential weld relief request extension, during the license renewal term, are the same as those approved for use in the current period.

The analyses associated with reactor vessel circumferential weld examination relief will be projected to the end of the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(ii).

A.5.1.3 Reactor Vessel Axial Weld Failure Probability

BWRVIP-05 estimated the 40-year end-of-life failure probability of a limiting reactor vessel axial weld, showed that it was orders of magnitude greater than the 40-year end-of-life circumferential weld failure probability, and used this analysis to justify relief from inspection of the circumferential welds, as noted above.

The re-evaluation of the axial weld failure probability for 60 years depends on vessel • RT_{NDT} calculations. Evaluation of plant-specific values will be completed prior to the end of the initial operating license term.

The analysis of reactor vessel limiting axial weld failure probability will be completed to confirm that the assumed limit on the axial weld failure probability remains valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21 (c)(1)(i).

<u>A.5.2 Metal Fatigue</u>

The thermal and mechanical fatigue analyses of mechanical components have been identified as TLAAs for PBAPS. Specific components have been designed considering transient cycle assumptions, as listed in vendor specifications and the PBAPS UFSAR.

A.5.2.1 Reactor Vessel Fatigue

Unit 2 and Unit 3 reactor vessel fatigue analyses depend on cycle count assumptions that assume a 40-year operating period. The effects of fatigue in the reactor vessel will be managed for the period of extended operation by the fatigue management program for cycle counting and fatigue usage factor tracking as described in Section A.4.2.

This aging management program will ensure that fatigue effects in vessel pressure boundary components will be adequately managed and will be maintained within code design limits for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

A.5.2.2 Reactor Vessel Internals Fatigue and Embrittlement

A.5.2.2.1 Reactor Vessel Internals Fatigue Analyses

Original Core Shroud, Shroud Support and Jet Pump Assembly Analysis: Fatigue in these components is from both system cycles and vibrations. Vibration effects in the core shroud, shroud supports, and jet pump assemblies were evaluated in a standard-plant analysis applicable to PBAPS. The design analysis was based on the cyclic stress criteria of ASME Section III.

Core shroud and jet pump assemblies: The evaluations were extended to 60 years with a usage factor less than the allowable of 1.0.

The fatigue analyses of the core shroud and jet pump assemblies have been evaluated and remain valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

Revised Core Shroud supports analysis: Fatigue analyses of the shroud supports were reevaluated for effects of increased recirculation pump starts with the loop outside thermal limits. The reevaluation used very conservative estimates of the expected number of these starts in 40 years, and conservative methods of estimating the fatigue usage factor. The evaluation therefore estimated an upper bound on the 40-year usage factor which is less than the code limit, but which cannot readily be validated for 60 years.

The usage factor at the critical shroud support locations will, therefore, be managed by the cycle counting and fatigue usage factor tracking used by the fatigue management program described in Section A.4.2, in accordance with the requirements of 10 CFR 54.21(c)(1)(iii). The fatigue management program will ensure that the fatigue effects in the shroud supports will be adequately managed for the period of extended operation.

Unit 3 Core Spray Pipe to Tee Box Weld Crack Repair Bracket: Repair brackets were installed in Unit 3 in 1985. The repair brackets and attachment welds to the piping were analyzed in accordance with the requirements of ASME Section III Article NB-3200.

The fatigue analysis of the Unit 3 Core Spray pipe to tee box weld crack repair bracket has been evaluated and remains valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

A.5.2.2.2 Reactor Vessel Internals Embrittlement Analyses

The reactor vessel internals embrittlement analyses affect the core shroud and top guides.

Shroud: An evaluation was performed and found that the expected 60-year fluence on the shroud is below the damage threshold.

Top Guide: An evaluation was performed and, although the expected 60-year fluence is above the damage threshold, critical locations in the top guide at PBAPS have low tensile stresses and thus are exempt from inspection under the BWRVIP-26 guidelines. That is, at these low stresses, a fracture is not a concern, and embrittlement is therefore not a threat to the intended function.

The existing analyses of the effects of embrittlement in core shrouds and top guides have been evaluated and remain valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

A.5.2.2.3 Effect of Fatigue and Embrittlement on End-of-Life Reflood Thermal Shock Analysis

Radiation embrittlement and fatigue usage may affect the ability of certain internals, particularly the core shroud support plate, to withstand an end-of-life reflood thermal shock following a recirculation line break.

The existing analyses of the effects of fatigue and embrittlement on end-of-life reflood thermal shock analyses of reactor internals have been evaluated and remain valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

A.5.2.3 Piping and Component Fatigue and Thermal Cycles

A.5.2.3.1 Fatigue Analyses of Group I Primary System Piping

All Group I piping was originally designed in accordance with USAS B31.1, 1967 Edition. The recirculation and RHR piping in Group 1 was replaced under the GL 88-01 IGSCC Correction Program. The replacement piping was analyzed to ASME Section III Class 1 rules. ASME Section III requires an explicit fatigue analysis for Class 1 components. USAS B.31.1 does not require an explicit fatigue analysis. However, a simplified fatigue analysis was developed to estimate the current usage factors from operating data for the fatigue management cycle counting and fatigue usage factor tracking program.

The effects of fatigue in Group I primary system piping will be managed for the period of extended operation by the fatigue management cycle counting and fatigue usage factor tracking program, as part of the Fatigue Management Activities, discussed in Section A.4.2. This aging management activity will ensure that fatigue effects in pressure boundary components will be adequately managed and will be maintained within code design limits for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

A.5.2.3.2 Assumed Thermal Cycle Count for Allowable Secondary Stress Range Reduction in Group II and III Piping and Components

<u>Group II and III Piping</u>: Thermal cycle count is a consideration in all the codes associated with the design of Group II and III piping (e.g., USAS or ANSI B31.1). The applicable piping codes require the use of a stress range reduction factor in the evaluation of calculated stresses due to thermal expansion. The reduction factor is based on the anticipated number of equivalent full temperature cycles over the total number of years the plant is expected to be in operation.

The number of thermal cycles assumed for design of Group II and III piping has been evaluated and the existing stress range reduction factor remains valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

A.5.2.3.3 Design of the RHR System for a Finite Number of Cycles

Group I RHR piping inside the drywell that was analyzed to ASME III Class 1 rules is discussed in Section A.5.2.3.1.

Group II RHR piping and some Group I RHR piping is designed to a USAS or ANSI B31.1 allowable secondary stress range determined by a finite number of equivalent full-temperature thermal cycles, without a detailed fatigue analysis.

The ANSI B31.1 threshold number for applying a reduction factor for RHR valves is 7,000 equivalent full-temperature cycles. The total number of cycles assumed for the original 40-year plant life is, conservatively, less than 1,000. For the period of extended operation, the number of thermal cycles for piping analyses would be proportionately increased to 1,500, which is still significantly less than the 7,000 cycle threshold. The code stress range reduction factor therefore remains at 1.0 and is not affected by extending the operating period to 60 years

The RHR valve and piping thermal cycle analyses have been evaluated and remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.5.2.4 Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping (Generic Safety Issue 190)

Generic Safety Issue (GSI) 190 was identified by the NRC because of concerns about potential effects of reactor water environments on component fatigue life during the period of extended operation. The GSI was closed in December 1999 because the NRC concluded that environmental effects have a negligible effect on core damage frequency; however, license renewal applicants need to address the effects of the coolant environment on component fatigue life.

Exelon has reviewed the potential effects of reactor coolant on component fatigue life based on EPRI generic studies and on laboratory fatigue data in simulated reactor water environments that were generated by Argonne National Laboratory. This review concluded that environmental effects on fatigue life of components are encompassed by the conservatism of design basis transient definitions. However, to ensure that all CUFs remain below the code design limit throughout the extended operation period, Exelon will monitor selected locations in the fatigue management program in accordance with 10 CFR 54.21(c)(1)(iii).

A.5.3 Environmental Qualification Of Electrical Equipment

Electrical equipment included in the PBAPS Environmental Qualification Program which has a specified qualified life of at least 40 years involves time-limited aging analyses for license renewal. The aging effects of this equipment will be managed in the Environmental Qualification Program discussed in Section A.4.1, Environmental Qualification Activities, in accordance with the requirements of 10CFR54.21(c)(1)(iii).

A.5.4 Containment Fatigue

Subsequent to the original design, elements of the PBAPS containment were re-analyzed in response to discoveries of unevaluated loads due to design basis events and Safety Relief Valve (SRV) discharge. This re-evaluation was in two parts: Generic analyses applicable to each of the several classes of BWR containments, and plant-unique analyses (PUA). The scope of the analyses included the tori, the drywell-to-torus vents (torus vents), SRV discharge piping, other torus-attached piping and its penetrations, and the torus vent bellows.

A.5.4.1 Fatigue Analyses of Containment Pressure Boundaries: Analysis of Tori, Torus Vents, and Torus Penetrations

For low usage factor locations (40-year CUF < 0.4) the PBAPS new loads analyses of tori, torus vents, and torus penetrations have been evaluated and determined to remain valid for the extended period of operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

For higher usage factor locations in the analyses of tori, torus vents, and torus penetrations (40-year CUF ≥ 0.4) the effects of fatigue will be managed for the period of extended operation by the fatigue management cycle counting and fatigue usage factor tracking program described in Section A.4.2.

The Fatigue Management Activities will ensure that fatigue effects in vessel pressure boundary components will be adequately managed and will be maintained within code design limits for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

A.5.4.2 Fatigue Analysis of SRV Discharge Lines and External Torus-Attached Piping

SRV discharge lines and external torus-attached piping were analyzed separately from the tori and torus vents. The PBAPS analysis included the SRV lines, all piping and branch lines attached to the tori, pipe supports, valves, flanges, equipment nozzles, and equipment anchors.

The fatigue analyses of SRV discharge lines and external torus-attached piping have been evaluated and remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

A.5.4.3 Expansion Joint and Bellows Fatigue Analyses - Drywell to Torus Vent Bellows

The predicted fatigue usage factors for the drywell torus vent bellows for the period of extended operation are negligible.

The PBAPS new loads fatigue analyses of the drywell-to-torus vent bellows have been evaluated and remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

A.5.4.4 Expansion Joint and Bellows Fatigue Analyses - Containment Process Penetration Bellows

The only containment process piping expansion joints subject to significant thermal expansion and contraction are those between the drywell shell penetrations and process piping. These are designed for a stated number of operating and thermal cycles.

The thermal cycle designs of PBAPS containment process penetration bellows have been evaluated and remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

A.5.5 Metal Corrosion Allowances

A.5.5.1 Reactor Vessel Corrosion Main Steam Nozzle Cladding Removal Allowance

The original vessel corrosion allowances were conservative values intended to encompass 40 years of operation but without reliance on a particular corrosion rate. The original allowances: therefore, do not depend on the 40 year design life. However, a subsequent calculation to justify removal of the main steam nozzle cladding used a time-dependent corrosion rate and is thereby a TLAA.

The reactor vessel corrosion allowances have been evaluated and remain valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

A.5.6 Inservice Flaw Growth Analyses That Demonstrate Structural Integrity For 40 Years

Two flaw dispositions were identified that include TLAAs.

A.5.6.1 Generic Letter 81-11 Crack Growth Analysis to Demonstrate Conformance to the Intent of NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking"

The PBAPS control rod drive hydraulic system return nozzles were capped. Therefore, cracking of the feedwater nozzles is the only aging effect that applies to PBAPS. Cracking of the feedwater nozzles was addressed by installing triple thermal sleeves with double-piston-ring seals, by removing the vessel clad from the nozzles, by installing improved low-flow feedwater controllers, and by adopting and maintaining an augmented inspection program to detect incipient problems currently using the NRC-approved BWR Owner's Group (BWROG) inspection and management methods.

The fracture mechanics evaluations which support the validity of the current examination methods are not TLAAs. However, the effects of the cracking phenomena must be managed to ensure the continued validity of the assumptions of fatigue analyses for the reactor vessel, which are TLAAs.

The aging effect is adequately addressed by the modifications already installed and by the inspection program already in place. No enhancements are required.

Any remaining or recurring effects of rapid-thermal-cycle damage at feedwater nozzle inner blend radii will be managed for the period of extended operation by the reactor vessel and internals inspection program described in Section A.2.7.

This aging management activity includes specific requirements for these nozzles and for this issue.

This program will ensure that any effects will be adequately detected, managed, and controlled, within the limits of the supporting fracture mechanics analyses, for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(iii).

A.5.6.2 Fracture Mechanics of As-forged Laminar Tear in a Unit 3 Main Steam Elbow

Preservice inspection discovered an as-forged laminar tear in a Unit 3 main steam elbow near weld 1-B-3BC-LDO. The original disposition included a fatigue analysis.

The fatigue analysis for the as-forged laminar tear has been evaluated and remains valid for the period of extended operation in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

A.5.7 References for Section A.5

(1) BWRVIP-05, EPRI Report TR-105697, “BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05).” For the Boiling Water Reactor Owners Group (Proprietary), September 28, 1995, with supplementing letters of June 24 and October 29, 1996, May 16, June 4, June 13, and December 18, 1997, and January 13, 1998.

(2) BWRVIP-26, EPRI Report TR-107285, “BWR Vessel and Internals Project: BWR Top Guide Inspection and Flaw Evaluation Guidelines”, December 1996.

APPENDIX B AGING MANAGEMENT ACTIVITIES

APPENDIX B AGING MANAGEMENT ACTIVITIES

Introduction

The aging management activity descriptions are provided in this Appendix for each activity credited for managing aging effects based upon the aging management review results provided in Sections 3.1 through 3.6.

In many cases, existing activities were found adequate for managing aging effects during the period of extended operation. In some cases, aging management reviews revealed that existing activities should be enhanced to adequately manage aging. In a few cases, new activities were developed to provide reasonable assurance that aging effects are adequately managed.

Each aging management activity presented in this Appendix is characterized as one of the following:

Existing Activity: A current activity that will continue to be implemented during the extended period of operation.

Enhanced Activity: A current activity that will be modified to manage aging during the extended period of operation.

New Activity: An activity that does not currently exist, which will manage aging during the extended period of operation.

Time Limited Aging Analyses Activity: An activity that has been credited by a time-limited aging analysis described in Section 4.0

B.1 Existing Aging Management Activities

B.1.1 Flow Accelerated Corrosion Program

ACTIVITY DESCRIPTION

The PBAPS flow accelerated corrosion (FAC) program activities predict, detect, and monitor wall thinning in piping and fittings due to flow accelerated corrosion. The FAC program is based on the EPRI guidelines in NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program." A PBAPS specification ensures that the FAC program will be implemented as required by NRC Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning".

The FAC program provides for prediction of the amount of wall thinning in pipes and fittings through analytical evaluations and periodic examinations of locations most susceptible to FAC induced loss of material. Specifically, the program includes analyses to determine critical locations, baseline inspections to determine the extent of thinning at these locations, and follow-up inspections to confirm the predictions. Repairs and replacements are performed as necessary.

The susceptible piping systems are divided into two categories. Category 1 consists of piping systems, or portions of systems, that are susceptible to FAC and have a completed FAC Wear Rate Analysis in EPRI's CHECWORKS computer code. Category 2 consists of piping systems, or portions of systems, that are susceptible to FAC but do not have a completed FAC Wear Rate Analysis in the CHECWORKS computer code.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The FAC program provides for prediction, inspection, and monitoring of piping and fittings for a loss of material aging effect due to flow accelerated corrosion so that timely and appropriate action may be taken to minimize the probability of experiencing a FAC-induced consequential leak or rupture.

The FAC program elements are based on the recommendations identified in NSAC-202L-R2, which requires controls to assure the structural integrity of carbon steel lines containing high-energy fluids (two phase as well as single phase). The PBAPS FAC program manages loss of material in carbon steel piping and fittings. The PBAPS feedwater system is classified as Category 1.

The main steam system and the HPCI and RCIC steam line drains are classified as Category 2.

(2) Preventive Actions: The FAC program is a condition monitoring program that identifies loss of material aging effects prior to loss of intended function. No preventive or mitigative attributes are associated with the FAC program.

(3) Parameters Monitored/Inspected: The FAC program provides for inspection and monitoring of the wall thickness of piping and fittings susceptible to FAC-induced loss of material. Piping and fitting wall thickness reduction could challenge the maintenance of the pressure boundary intended function.

(4) Detection of Aging Effects: The FAC program provides for periodic ultrasonic inspections of components susceptible to FAC to validate analytical evaluations. The extent and schedule of inspections ensure that loss of material (wall thinning) of piping and fittings is detected prior to loss of intended function of the piping.

(5) Monitoring and Trending: The FAC program provides for analytical evaluations using parameters such as pipe material, geometry, hydrodynamic conditions, temperature, pH and oxygen content to predict wall thickness reduction due to FAC. Inspections of the piping verify the evaluations. The schedule of the next inspection is based on the remaining life determined after each inspection. If degradation is detected such that the wall thickness is less than the minimum predicted thickness, additional examinations are performed in similar and adjacent areas to bound the thinning. The FAC program provides reasonable assurance that structural integrity will be maintained between inspections.

(6) Acceptance Criteria: Inspection results are used to calculate the number of refueling or operating cycles remaining before the component reaches design code minimum allowable wall thickness. If calculations indicate that an area will reach design code minimum allowable thickness before the next scheduled outage the component is repaired, replaced or reevaluated.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: Wall thinning problems in single-phase systems have occurred throughout the industry in feedwater and condensate systems, and in two-phase piping in extraction steam lines and moisture separator reheater and feedwater heater drains. The PBAPS HPCI and RCIC steam drain lines have experienced wall thinning due to FAC and this piping has been replaced. The FAC program was originally outlined in NUREG-1344 and implemented through GL 89-08. The FAC program has evolved through industry experience and is now described in NSAC-202L. Application of the FAC program has resulted in the replacement of piping identified as being subject to FAC before loss of material has challenged pressure boundary integrity. The FAC program has provided an effective means of ensuring the structural integrity of high-energy carbon steel systems. The NRC has audited industry programs based on the EPRI methodology at several plants and has determined that these activities can provide a good prediction of the onset of FAC so that timely corrective actions can be undertaken.

The PBAPS FAC program is updated to reflect the latest industry and plant experience. Modifications have been implemented at PBAPS due to discovery of pipe wall thinning or leakage. No failures, other than HPCI and RCIC steam drain lines, have occurred in any components at PBAPS within the license renewal boundary.

<u>SUMMARY</u>

The PBAPS FAC program activities predict, detect, and monitor wall thinning in piping due to flow accelerated corrosion. The FAC program is based on the EPRI guidelines in NSAC-202L-R2, “Recommendations for an Effective Flow-Accelerated Corrosion Program.” A PBAPS specification ensures that the FAC program is implemented as required by NRC Generic Letter 89-08, “Erosion/Corrosion-Induced Pipe Wall Thinning”.

Based on the use of industry guidelines, NRC requirements, and PBAPS operating experience, there is reasonable assurance that the PBAPS FAC program will continue to adequately manage the aging effects due to flow accelerated corrosion in carbon steel piping systems containing high energy fluids to maintain intended functions consistent with the current licensing basis for the period of extended operation.

<u>REFERENCES</u>

(1) EPRI NSAC-202L-R2, April, 1999, “Recommendations for an Effective Flow-Accelerated Corrosion Program”

(2) NRC Generic Letter 89-08, “Erosion/Corrosion-Induced Pipe Wall Thinning”
(3) EPRI “CHECWORKS”, “Computer Program, Database, and User’s Manual”
(4) NUREG - 1344, “Erosion/Corrosion-Induced Pipe Wall Thinning in U.S. Nuclear Power Plants”

B.1.2 Reactor Coolant System Chemistry

ACTIVITY DESCRIPTION

PBAPS reactor coolant system (RCS) chemistry activities consist of preventive measures that are used to manage loss of material and cracking in components exposed to reactor water and steam. RCS chemistry activities provide for monitoring and controlling of RCS water chemistry using PBAPS procedures and processes based on EPRI TR-103515, "BWR Water Chemistry Guidelines."

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: RCS chemistry activities manage loss of material and cracking in reactor, RPV Instrumentation, reactor recirculation, standby liquid control, feedwater, HPCI, RCIC, core spray, RHR, PCIS (RWCU), and main steam systems by monitoring and controlling detrimental contaminants.

(2) Preventive Actions: RCS chemistry activities include periodic monitoring and controlling of RCS water chemistry to ensure that known detrimental contaminants are maintained within pre-established limits, providing reasonable assurance that the aging effects of loss of material or cracking are managed.

(3) Parameters Monitored/Inspected: Conductivity of the reactor coolant is continuously monitored to provide indication of abnormal conditions and the presence of impurities. If conductivity becomes abnormal then measurements are conducted of impurities identified in EPRI TR-103515, such as chlorides and sulfates, to determine the cause.

(4) Detection of Aging Effects: RCS chemistry activities mitigate the onset and propagation of loss of material and cracking. No credit is taken for detection of aging effects.

(5) Monitoring and Trending: RCS water chemistry is monitored continuously to ensure purity is maintained within acceptable limits based on EPRI guidelines. Samples are taken and analyzed, and data are trended. The frequency of sampling is based on EPRI TR-103515 and varies with plant operating conditions. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions.

(6) Acceptance Criteria: Maximum levels for various contaminants, including chlorides and sulfates, are maintained below system specific limits based on EPRI TR-103515.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: As chemistry control guidelines were evolving in the industry, PBAPS experience with reactor coolant system chemistry was similar to that of the industry. Cracking attributed to IGSCC was found in stainless steel recirculation and RHR system piping and loss of material was found in the HPCI and RCIC carbon steel steam line drains. Portions of the 304 stainless steel recirculation system, RWCU, and RHR piping were replaced with more IGSCC resistant, low carbon, 316 stainless steel. The HPCI and RCIC steam drain lines were also replaced.

The RCS water chemistry is maintained based on the recommendations of EPRI TR-103515 that have been developed based on industry experience. These recommendations have been shown to be effective and are adjusted as new information becomes available. Since the pipe replacement and improvements to chemistry activities, the overall effectiveness of RCS chemistry activities is supported by the excellent operating experience of reactor coolant and main steam systems at PBAPS.

<u>SUMMARY</u>

PBAPS reactor coolant system (RCS) chemistry activities are preventive aging management activities that assure potentially detrimental concentrations of impurities are not present in the reactor coolant. These measures manage loss of material and cracking in components exposed to reactor water and steam.

Based on the use of industry guidelines and industry and PBAPS operating experience, there is reasonable assurance that PBAPS RCS chemistry activities will continue to adequately manage the aging effects of loss of material and cracking associated with components exposed to the reactor coolant and steam environments so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) EPRI TR-103515, “BWR Water Chemistry Guidelines”, 2000 Revision

B.1.3 Closed Cooling Water Chemistry

ACTIVITY DESCRIPTION

PBAPS closed cooling water (CCW) chemistry activities consist of preventive measures that are used to manage loss of material, cracking, and reduction of heat transfer in components exposed to a closed cooling water environment. CCW chemistry activities provide for monitoring and controlling of CCW chemistry using PBAPS procedures and processes based on EPRI TR-107396, "Closed Cooling Water Chemistry Guidelines."

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: CCW chemistry activities manage loss of material and cracking in systems and portions of systems within the emergency diesel generator and primary containment isolation systems subject to a closed cooling water environment by monitoring and controlling detrimental contaminants, and maintaining corrosion inhibitors to minimize corrosion. CCW chemistry activities also manage reduction of heat transfer in the EDG air coolant coolers and the EDG jacket coolant coolers.

(2) Preventive Actions: CCW chemistry activities include periodic monitoring and controlling of corrosion inhibitor concentrations within specified limits of EPRI TR-107396 to minimize corrosion and protect metal surfaces. Maintaining the system corrosion inhibitor concentration within the pre-established limits provides reasonable assurance that the aging effects of loss of material, cracking, and reduction of heat transfer are managed.

(3) Parameters Monitored/Inspected: The CCW chemistry monitoring and controlling activities minimize the aggressiveness of this environment. CCW chemistry is maintained per the recommendations of EPRI TR-107396. Nitrite, pH and methylbenzyl triazole (TTA) levels are monitored as chemistry control parameters. Chlorides, sulfates, nitrate, turbidity and metals are monitored on a regular basis as diagnostic parameters to provide indication of abnormal conditions. If parameter limits are exceeded, the chemistry control procedures require that corrective action be taken to restore parameters to within the acceptable range. Maintenance of corrosion inhibitor levels within EPRI TR-107396 guidelines mitigates loss of material, cracking, and reduction of heat transfer.

(4) Detection of Aging Effects: CCW chemistry activities mitigate the onset and propagation of loss of material, cracking, and reduction of heat transfer. No credit is taken for detection of aging effects.

(5) Monitoring and Trending: CCW chemistry is monitored to ensure corrosion inhibitors are being maintained within acceptable limits in accordance with EPRI guidelines. Samples are taken and analyzed, and data are trended. The frequency of sampling is based on EPRI TR-107396.

(6) Acceptance Criteria: Levels for concentration of nitrite and TTA are maintained within the limits specified in the EPRI TR-107396. Parameters maintained in CCW systems include pH (8.5 – 10.5), Nitrite (500 – 1100 ppm), and TTA (5 – 30 ppm).

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes.

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The industry operating experience demonstrates that the use of corrosion inhibitors in closed cooling water systems that are monitored and maintained by CCW chemistry activities is effective in mitigating loss of material, cracking, and reduction of heat transfer. No age related failures have occurred in the components within the scope of license renewal that are covered by PBAPS CCW chemistry activities.

<u>SUMMARY</u>

PBAPS CCW chemistry activities manage loss of material and cracking in components exposed to a closed cooling water environment. CCW chemistry activities provide for monitoring and controlling of CCW chemistry using PBAPS procedures and processes based on EPRI TR-107396, “Closed Cooling Water Chemistry Guidelines”.

Based on the use of industry guidelines and PBAPS operating experience, there is reasonable assurance that the PBAPS CCW chemistry activities will continue to adequately manage the aging effects of loss of material, cracking, and reduction of heat transfer in components exposed to a CCW environment so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) EPRI TR-107396, “Closed Cooling Water Chemistry Guidelines”, October 1997

B.1.4 Condensate Storage Tank Chemistry Activities

ACTIVITY DESCRIPTION

Condensate storage tank (CST) chemistry activities consist of preventive measures that are used to manage aging in components of the RCIC, HPCI, CRD, core spray and condensate storage systems exposed to condensate storage tank water. CST chemistry activities provide for monitoring and controlling of CST water chemistry using PBAPS procedures and processes based on EPRI TR-103515, “BWR Water Chemistry Guidelines”.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: CST chemistry activities manage loss of material and cracking in the RCIC, HPCI, CRD, core spray and condensate storage system components exposed to condensate storage tank water. In addition, CST chemistry activities manage reduction of heat transfer in the HPCI gland seal condenser and the RCIC and HPCI turbine lubricating oil coolers. The aging effects are managed by monitoring and controlling detrimental contaminants in CST water.

(2) Preventive Actions: CST chemistry activities include periodic monitoring and controlling of CST water, to ensure known detrimental contaminants are maintained within pre-established limits, providing reasonable assurance that the aging effects of loss of material, cracking, and reduction of heat transfer are managed.

(3) Parameters Monitored/Inspected: Conductivity is maintained based on the EPRI guidance. Impurities identified in EPRI TR-103515, such as, chlorides and sulfates are monitored and controlled.

(4) Detection of Aging Effects: CST chemistry activities mitigate the onset and propagation of loss of material, cracking, and reduction of heat transfer aging effects. No credit is taken for detection of aging effects.

(5) Monitoring and Trending: CST water is monitored weekly to assure that purity is maintained within acceptable limits based on EPRI guidelines. Samples are taken and analyzed, and data are trended. The frequency of sampling is based on EPRI TR-103515.

(6) Acceptance Criteria: Maximum levels for various contaminants are maintained below system specific limits based on EPRI TR-103515. The acceptance criteria include the following parameter limits: conductivity $\leq 1\ \mu S/cm$, chlorides ≤ 10 ppb, and sulfates ≤ 10 ppb.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The overall effectiveness of CST chemistry activities is supported by the operating experience for systems, which are influenced by CST water chemistry. There has been no loss of component intended function in systems for which CST chemistry activities have been employed. CST water chemistry is maintained based on the recommendations of EPRI TR-103515. The EPRI recommendations have been developed based on industry experience, have been shown to be effective, and are adjusted as new information becomes available.

SUMMARY

CST chemistry activities use preventive measures to manage aging effects in components of the RCIC, HPCI, CRD, core spray and condensate storage systems exposed to condensate storage tank water. CST chemistry activities monitor and control CST water chemistry parameters using PBAPS procedures and processes based on EPRI TR-103515, “BWR Water Chemistry Guidelines”.

Based on the use of industry guidelines and industry and PBAPS operating experience, there is reasonable assurance that the CST chemistry activities will continue to adequately manage the aging effects associated with systems and components exposed to condensate storage tank water so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) EPRI TR-103515, “BWR Water Chemistry Guidelines”, 2000 Revision.

B.1.5 Torus Water Chemistry Activities

ACTIVITY DESCRIPTION

Torus water chemistry activities consist of preventive measures that are used to manage aging effects in components of the RHR, HPCI, RCIC, core spray and main steam systems exposed to torus grade water. Torus water chemistry activities provide for monitoring and controlling of torus water chemistry using PBAPS procedures and processes based on EPRI TR-103515, "BWR Water Chemistry Guidelines."

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: Torus water chemistry activities manage loss of material and cracking in RHR, HPCI, RCIC, core spray and main steam system components exposed to a torus grade water environment. In addition, torus water chemistry activities manage cracking of stainless steel component supports submerged in torus grade water, and reduction of heat transfer in RHR heat exchangers. The aging effects are managed by monitoring and controlling detrimental contaminants in torus grade water.

(2) Preventive Actions: Torus water chemistry activities include periodic monitoring and controlling of torus grade water chemistry to ensure that known detrimental contaminants are maintained within pre-established limits, providing reasonable assurance that the aging effects of loss of material, cracking, and reduction of heat transfer are managed.

(3) Parameters Monitored/Inspected: Conductivity is maintained based on the EPRI guidance. Impurities identified in EPRI TR-103515, such as chlorides and sulfates, are monitored and controlled.

(4) Detection of Aging Effects: Torus water chemistry activities mitigate the onset and propagation of loss of material, cracking, and reduction of heat transfer aging effects. No credit is taken for detection of aging effects.

(5) Monitoring and Trending: Torus grade water is monitored periodically to assure that purity is maintained within acceptable limits based on EPRI guidelines. Samples are taken and analyzed, and data are trended. The frequency of sampling is based on EPRI TR-103515.

(6) Acceptance Criteria: Maximum levels for various contaminants are maintained below system specific limits as specified in EPRI TR-103515. Parameters maintained include conductivity (< 5 μmho/cm), chloride (≤ 200 ppb), sulfate (≤ 200 ppb), total organic carbon (≤ 1000 ppb) and turbidity (2-25 ntu).

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: Torus water chemistry is maintained per the recommendations of EPRI TR-103515 that have been developed based on industry experience and shown to be effective. These limits are adjusted as new information becomes available. Components containing a torus water environment within the scope of license renewal have not experienced any age related pressure boundary failure at PBAPS. There has been no age-related loss of function of a submerged stainless steel component support or RHR heat exchanger due to chemistry related degradation. Torus inspections conducted in 1997 revealed a decrease in the rate of corrosion of the torus structure in part due to improved torus water chemistry.

<u>SUMMARY</u>

Torus water chemistry activities consist of preventive measures that manage aging effects in components of the RHR, HPCI, RCIC, core spray and main steam systems exposed to torus grade water. Torus water chemistry activities monitor and control torus water chemistry using PBAPS procedures and processes based on EPRI TR-103515, "BWR Water Chemistry Guidelines".

Based on the use of industry guidelines and PBAPS operating experience, there is reasonable assurance that the torus water chemistry activities will continue to adequately manage the aging effects in components exposed to torus grade water so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

<u>REFERENCES</u>

(1) EPRI TR-103515, “BWR Water Chemistry Guidelines”, 2000 Revision

B.1.6 Fuel Pool Chemistry Activities

ACTIVITY DESCRIPTION

Fuel pool chemistry activities consist of preventive measures that are used to manage loss of material and cracking in structures and components exposed to fuel pool water. Fuel pool chemistry activities provide for monitoring and controlling of fuel pool water chemistry using PBAPS procedures based on EPRI TR-103515, "BWR Water Chemistry Guidelines".

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: Fuel pool chemistry activities manage loss of material for fuel pool gates, fuel storage racks, fuel pool liner, component supports, fuel preparation machines, refueling platform mast, and loss of material and cracking for fuel pool cooling and cleanup system components by monitoring and controlling detrimental contaminants.

(2) Preventive Actions: Fuel pool chemistry activities include periodic monitoring and controlling of fuel pool water chemistry to ensure that contaminants are maintained within pre-established limits, providing reasonable assurance that the aging effects of loss of material and cracking are managed.

(3) Parameters Monitored/Inspected: Conductivity is maintained based on the EPRI guidance. Impurities identified in EPRI TR-103515, such as chlorides and sulfates, are monitored and controlled.

(4) Detection of Aging Effects: Fuel pool chemistry activities mitigate the onset and propagation of loss of material and cracking aging effects. No credit is taken for detection of aging.

(5) Monitoring and Trending: Fuel pool water is monitored weekly to ensure purity is maintained within acceptable limits based on EPRI guidelines. Samples are taken and analyzed, and data are trended. The frequency of sampling is based on EPRI TR-103515.

(6) Acceptance Criteria: Maximum levels for various contaminants are maintained below system specific limits based on EPRI TR-103515. The acceptance criteria include the following limits: conductivity $\leq$ 2 μmho/cm, chlorides $\leq$ 100 ppb, and sulfates $\leq$ 100 ppb.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The overall effectiveness of fuel pool chemistry activities is supported by the operating experience for components and structures influenced by fuel pool water chemistry. There has been no loss of intended function for components or structures for which fuel pool chemistry activities have been employed. Fuel pool chemistry is maintained per the recommendations of EPRI TR-103515 that have been developed based on industry experience, shown to be effective and are adjusted as new information becomes available.

SUMMARY

Fuel pool chemistry activities use preventive measures to manage loss of material and cracking in structures and components exposed to fuel pool water. Fuel pool chemistry activities monitor and control fuel pool water chemistry using PBAPS procedures based on EPRI TR-103515, “BWR Water Chemistry Guidelines”.

Based on the use of industry guidelines and industry and PBAPS operating experience, there is reasonable assurance that the fuel pool chemistry activities will continue to adequately manage the aging effects associated with structures and components exposed to fuel pool water so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) EPRI TR-103515, “BWR Water Chemistry Guidelines”, 2000 Revision.

B.1.7 High Pressure Service Water Radioactivity Monitoring Activities

ACTIVITY DESCRIPTION

High pressure service water radioactivity monitoring activities consist of sampling and analysis of HPSW system water to confirm the absence of radioactive contaminants. These condition-monitoring activities manage loss of material and cracking in the RHR heat exchangers and are implemented through PBAPS procedures.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: PBAPS high pressure service water radioactivity monitoring activities provide for routine sampling and isotopic analysis of the HPSW system water contained within the RHR heat exchangers to confirm the absence of radioactive contaminants.

(2) Preventive Actions: High pressure service water radioactivity monitoring activities identify aging degradation of the RHR Heat Exchangers prior to loss of intended function. No preventive or mitigating attributes are associated with these activities.

(3) Parameters Monitored/Inspected: High pressure service water radioactivity monitoring activities monitor HPSW system water contained within the RHR heat exchangers for the presence of radioactive isotopes that do not occur naturally. Samples taken from selected system test points and the bottom head drains of the RHR heat exchangers are analyzed to confirm the functional integrity of the RHR heat exchanger pressure boundary internal components, including tubes.

(4) Detection of Aging Effects: High pressure service water radioactivity monitoring activities provide for routine sampling and analysis to detect loss of material and cracking in the RHR heat exchangers. The extent and schedule of the activities assures detection of component degradation prior to the loss of their intended functions.

(5) Monitoring and Trending: High pressure service water radioactivity monitoring activities provide for monitoring of aging degradation of the RHR heat exchangers. Weekly sampling and analysis provides for timely component degradation detection.

(6) Acceptance Criteria: The presence of identified power production isotopes is considered to be positive activity. The acceptance criterion requires that no positive activity be identified. Naturally occurring isotopes are not considered as contaminants or indications of positive activity.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

***(10) Operating Experience**:* Leakage and minor degradation have been detected in the RHR heat exchangers on the HPSW (raw water) side. The degradation has involved leakage of floating head gaskets, and degradation of internal baffle welds. Evaluations and appropriate corrective actions, including gasket modifications were implemented prior to loss of intended function.

SUMMARY

High pressure service water radioactivity monitoring activities consist of sampling and analysis of HPSW system water to confirm the absence of radioactive contaminants. These condition-monitoring activities manage loss of material and cracking in the RHR heat exchangers and are implemented through PBAPS procedures.

Based on PBAPS operating experience, there is reasonable assurance that high pressure service water radioactivity monitoring activities will continue to manage loss of material and cracking in the RHR heat exchangers so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.1.8 Inservice Inspection (ISI) Program

ACTIVITY DESCRIPTION

The inservice inspection (ISI) program, as augmented to address the requirements of GL88-01, provides for condition monitoring of pressure retaining piping and components in the scope of license renewal except for the reactor pressure vessel components and internals. This activity is part of the PBAPS ISI program which complies with the requirements of 1989 Edition of the ASME Section XI*,* "Rules for Inservice Inspection of Nuclear Power Plant Components", and is implemented through a PBAPS specification. The PBAPS ISI program includes requirements for inspections of ASME Class 1, 2, and 3 pressure retaining components. In addition, it provides for condition monitoring of ASME Class 1,2 and 3 piping and equipment supports and integral support anchors in accordance with ASME Code Case N-491-1.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The ISI program provides for condition monitoring of:

- support members for ASME Class 2 and 3 piping and equipment submerged in raw water or torus grade water,
- ASME Class 3 portions of HPSW, ECW, and ESW systems, including the CS, HPCI, RCIC, and RHR pump room cooling coils, exposed to raw water,
- ECW system piping and equipment support members located in an outdoor environment,
- ASME Class 1 components in the main steam, reactor pressure vessel instrumentation, RCIC and HPCI systems subject to a steam environment,
- ASME Class 1 components in reactor recirculation, reactor pressure vessel instrumentation, SBLC, feedwater, RHR, RCIC, core spray, HPCI, and PCIS (reactor water cleanup) systems subject to a reactor grade water environment,
- SBLC components from the suction side of the SBLC pumps to the RPV injection isolation valve subject to a borated water environment,
- components in reactor head flange leakoff piping, scram discharge piping, and the steam supply and return portions of the RCIC and HPCI systems subject to a wetted gas environment, and
- reactor pressure vessel closure studs.

(2) Preventive Actions: The ISI program consists of condition monitoring activities that detect degradation of components before loss of intended function. No preventive or mitigating attributes are associated with these activities.

(3) Parameters Monitored/Inspected: The ISI program provides for the following condition monitoring in the following environments:

Raw water and torus grade water:

- loss of material monitoring for support members for ASME Class 2 and 3 piping and equipment submerged in raw water or torus water using VT-3 visual inspections for corrosion,
- loss of material and cracking monitoring for components in HPSW, ESW, and ECW systems including the CS, HPCI, RCIC and RHR pump room cooling coils, subject to raw water through flow testing or identification of leakage during pressure tests,

Outdoor:

- loss of material monitoring for ECW system piping and equipment support members located in an outdoor ambient environment using VT-3 visual inspections for corrosion,

Steam:

- loss of material and cracking monitoring for ASME Class 1 components in the main steam, reactor pressure vessel instrumentation, HPCI and RCIC systems through monitoring for leaks during pressure testing,
- loss of material monitoring for ASME Class 1 components in the main steam and HPCI systems by visually inspecting valves for corrosion and pressure retaining wall thickness reduction, when they are disassembled for maintenance,

Reactor grade water:

- loss of material and cracking monitoring for susceptible ASME Class 1 components in the reactor recirculation, reactor pressure vessel instrumentation, SBLC, feedwater, RHR, RCIC, core spray, HPCI and PCIS (reactor water cleanup) systems through monitoring for leaks during pressure testing,
- loss of material and cracking monitoring for susceptible ASME Class 1 components in the reactor recirculation, RHR, core spray, and PCIS (reactor water cleanup) systems by visually inspecting valves or reactor recirculation pump casings for evidence of these aging effects when they are disassembled for maintenance,
- loss of material monitoring for susceptible ASME Class 1 components in the feedwater, RCIC, and HPCI systems by visually inspecting valves for evidence of this aging effect when they are disassembled for maintenance,
- cracking monitoring for susceptible ASME Class 1 components in the reactor recirculation, RHR, core spray, and PCIS (reactor water cleanup) systems through surface and volumetric examinations of pressure retaining welds and their heat affected zones in piping,

- cracking monitoring for ASME Class 1 reactor pressure vessel closure studs through surface and volumetric examinations,

- loss of fracture toughness monitoring for susceptible ASME Class 1 components in the reactor recirculation and PCIS (reactor water cleanup) systems by visually inspecting reactor water cleanup system valves and reactor recirculation pump casings for evidence of this aging effect when they are disassembled for maintenance,

Borated water:

- loss of material and cracking monitoring for SBLC components from the suction side of the SBLC pumps to the RPV injection isolation valve by monitoring for visible leakage of susceptible component pressure boundaries during pressure testing,

Wetted gas:

- loss of material and cracking monitoring for susceptible components in reactor head flange leakoff piping, scram discharge piping, and the steam supply and return portions of the RCIC and HPCI systems through pressure testing.

(4) ***Detection of Aging Effects:*** The method, extent and schedule of the ISI program examinations provide reasonable assurance of detection of cracks, loss of material and loss of fracture toughness before loss of intended function.

(*5) Monitoring and Trending:* The ISI program provides for monitoring for the presence of aging degradation per the guidance provided in the ASME Section XI schedules or Code Case N-491-1. Documentation that facilitates comparison with previous and subsequent inspection results is maintained in accordance with ASME Section XI, IWA-6000.

(6) Acceptance Criteria: Relevant conditions detected during testing are evaluated in accordance with ASME Section XI Articles IWB-3000, IWC-3000 or IWD-3000, for classes 1, 2 and 3 respectively. Conditions detected in support members are evaluated in accordance with PBAPS implementing procedure acceptance criteria that is in agreement with Code Case N-491-1.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The ISI program complies with ASME Section XI including Code Case N-491-1. It is reviewed and approved every 10 years. ASME Section XI incorporates industry practice and experience that provides reasonable assurance that it provides early detection, evaluation and corrective actions.

In response to concerns with intergranular stress corrosion cracking (IGSCC), portions of the 304 stainless steel reactor recirculation, PCIS (reactor water cleanup) and RHR piping were replaced with more IGSCC resistant type 316 stainless steel. PBAPS has implemented extensive inspection programs through the ISI program to identify IGSCC.

SUMMARY

The inservice inspection (ISI) program, as augmented to address the requirements of GL 88-01, provides for condition monitoring of pressure retaining piping and components in the scope of license renewal except for those components covered by the reactor pressure vessel and internals ISI program.

This program is part of the PBAPS ISI program, which complies with the requirements of 1989 Edition of the ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components", and is implemented through a PBAPS specification.

Based on the use of industry standards and PBAPS operating experience, there is reasonable assurance that the ISI program will adequately manage the identified aging effects for the piping and components so that intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) ASME Boiler and Pressure Vessel Code, Section XI, "Rules for In-service Inspection of Nuclear Plant Components," American Society of Mechanical Engineers, New York, NY, 1989.
(2) GL 88-01, NRC Position on IGSCC in BWR Austenitic Stainless Piping, January 25, 1988, including Supplement 1, February 4, 1992

B.1.9 Primary Containment Inservice Inspection Program

ACTIVITY DESCRIPTION

The PBAPS primary containment ISI program provides for inspections that manage loss of material in the primary containment for Class MC pressure-retaining components, their integral attachments, and Class MC component supports; and loss of sealing for the drywell internal moisture barrier at the juncture of the containment wall and the concrete floor. The program complies with subsection IWE of ASME Section XI, 1992 Edition including 1992 Addenda, in accordance with the provisions of 10 CFR 50.55a, and is implemented through a PBAPS specification. Class MC support inspection also meets the support examination criteria established by Code Case N-491-1.

EVALUATION AND TECHNICAL BASIS

(1) **Scope of Activity:** The primary containment ISI program manages loss of material in pressure boundary components and supports of the drywell, pressure suppression chamber and vent system. The components monitored in the drywell are the shell, head, control rod drive removal hatch, equipment hatch, personnel airlock, access manhole, inspection ports and penetration sleeves. The components monitored in the pressure suppression chamber are the shell, ring girders, access hatches and penetrations. The components monitored in the vent system are the vent lines, vent header with downcomers, downcomer bracing and vent system supports. The primary containment ISI program also manages loss of sealing for the moisture barrier inside the drywell at the juncture of the containment wall and the concrete floor.

(2) Preventive Actions: The primary containment ISI program utilizes inspections for detection of conditions. No preventive or mitigating attributes are associated with these activities.

(3) Parameters Monitored/Inspected: The primary containment ISI program provides for visual examination of containment surfaces and Class MC component supports for evidence of loss of material that could affect structural integrity or leak tightness of the primary containment. The moisture barrier is examined for wear, damage, erosion, tears, cracks or other defects that could affect leak tightness.

(4) ***Detection of Aging Effects:*** The method, extent and schedule of the primary containment ISI program visual examinations provide reasonable assurance that evidence of loss of material or loss of sealing is detected prior to loss of intended function.

(5) Monitoring and Trending: The primary containment ISI program provides for periodic monitoring for the presence of aging degradation per the guidance provided in ASME Section XI.

(6) Acceptance Criteria: The acceptance criteria for the drywell, pressure suppression chamber, vent system, and drywell moisture barrier are in accordance with the requirements of ASME XI, Subsection IWE. MC component supports acceptance criteria is in accordance with Code Case N-491-1.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: Indications of coating degradation and loss of material in certain wetted areas of the pressure suppression chamber structure were found at PBAPS in 1991. The interior surfaces were recoated and torus grade water chemistry was improved. Subsequent pressure suppression chamber inspections indicate that the rate of degradation has decreased significantly. No failure of containment components due to the loss of material or failure of the moisture barrier inside the drywell due to the loss of sealing has occurred at PBAPS. The development process for the ASME Code that forms the basis for the primary containment ISI program includes review and approval by industry experts thereby assuring that significant industry data has been considered.

SUMMARY

The PBAPS primary containment ISI program manages loss of material in the primary containment for Class MC pressure-retaining components, their integral attachments, and Class MC component supports; and loss of sealing for the drywell internal moisture barrier at the juncture of the containment wall and the concrete floor. The program complies with subsection IWE of ASME Section XI, 1992 Edition including 1992 Addenda, in accordance with the provisions of 10 CFR 50.55a, and is implemented through a PBAPS specification. Class MC support inspection also meets the support examination criteria established by

Code Case N-491-1.

Based on the application of industry standards and the PBAPS operating experience, there is reasonable assurance that the primary containment ISI program will continue to adequately manage the identified aging effects so that the primary containment intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

<u>REFERENCES</u>

(1) ASME Boiler and Pressure Vessel Code, Section XI, “Rules for In-service Inspection of Nuclear Plant Components,” American Society of Mechanical Engineers, New York, NY, 1992 Edition with the 1992 Addenda.

B.1.10 Primary Containment Leakage Rate Testing Program

ACTIVITY DESCRIPTION

The PBAPS Primary Containment Leakage Rate Testing Program complies with the requirements of 10CFR50 Appendix J, Option B. Containment leak rate tests are performed to assure that leakage through the primary containment and systems and components penetrating primary containment does not exceed allowable leakage rates specified in the PBAPS Technical Specifications. An integrated leak rate test (ILRT) is performed during a period of reactor shutdown at a frequency of at least once every ten years. Local leak rate tests (LLRT) are performed on isolation valves and containment pressure boundary access penetrations at frequencies that comply with the requirements of 10CFR50 Appendix J, Option B.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The primary containment leakage rate testing program is credited with managing the loss of material of pressure retaining boundaries of piping and components in a wetted gas environment for containment atmosphere control and dilution, RHR, and primary containment isolation systems. Two types of tests are implemented in the program. The ILRT is performed to measure the overall primary containment integrated leakage rate. LLRTs are performed to measure local leakage rates across each pressure containing or leakage limiting boundary for the primary containment isolation system containment penetrations. The method, extent and schedule of these tests will detect minor leakage prior to loss of intended function.

The primary containment leakage rate testing program also manages change in the material properties and cracking of gaskets and O-rings of the primary containment pressure boundary access penetration points including the drywell head, the equipment hatch, the airlock, control rod drive removal hatch, drywell head access hatch, stabilizer inspection ports and the two access hatches in the pressure suppression chamber.

(2) Preventive Actions: The primary containment leakage rate testing program does not prevent or mitigate degradation due to aging effects but provides measures for condition monitoring to detect the degradation prior to loss of intended function.

(3) Parameters Monitored/Inspected: The parameters monitored are leakage rates through penetrations, piping, valves, fittings, and other access openings.

The ILRT is a test of the pressure retaining capabilities of the containment as a whole. The LLRTs measure the pressure retaining integrity of individual containment penetrations and the local leak rate at access penetration points of containment pressure boundary. Gaskets and O-rings not meeting the allowable leakage rate are assumed to be degraded, and are visually examined, replaced and re-tested until the leakage rate is acceptable.

(4) Detection of Aging Effects: The primary containment leakage rate testing program detects containment pressure boundary piping and components loss of material by integrated containment and individual penetration pressure tests to verify the pressure retaining integrity of the containment.

The ILRT demonstrates the overall leak-tightness of the containment and systems within the containment boundaries. LLRTs demonstrate the leak-tightness of individual containment boundaries of the piping systems.

The program also detects local leaks and measures leakage across the leakage-limiting boundary of containment access penetrations whose design incorporated gaskets and O-rings. Leakage is an indication of change in material properties and cracking of the sealing materials.

The primary containment leakage rate testing program serves to detect aging degradation prior to loss of the pressure boundary function of selected portions of the primary containment.

(5) Monitoring and Trending: Since the primary containment leakage rate testing program must be repeated throughout the operating license period, the entire primary containment pressure boundary, including access penetrations whose design incorporated gaskets and O-rings, is being monitored and trended over time.

(6) Acceptance Criteria: The acceptance criteria are defined in the PBAPS Technical Specifications. These acceptance criteria meet the requirements in 10CFR50, Appendix J, Option B.

(7) Corrective Actions*:* Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process*:* The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The primary containment leakage rate testing program activities at PBAPS have been effective in maintaining the pressure integrity of the containment boundaries, including identification of leakage within the containment atmosphere control and dilution, RHR, and primary containment isolation systems pressure boundaries. Degradation due to loss of material and failure of pressure boundary function has not occurred in any of the portions of these systems subject to a wetted gas environment.

The program found no age related pressure boundary integrity failures due to local leakage for gaskets and O-rings at penetration access points including the drywell head, the equipment hatch, the airlock, control rod drive removal hatch, drywell head access hatch, stabilizer inspection ports and the two access hatches in the pressure suppression chamber. Consequently, the program has been effective in preventing unacceptable leakage through the containment pressure boundary. PBAPS continues to demonstrate it's good operating history by electing to perform Option B of 10CFR50 Appendix J test requirements.

<u>SUMMARY</u>

The primary containment leakage rate testing program activities manage loss of material for pressure retaining boundaries of piping and components in a wetted gas environment for containment atmosphere control and dilution, RHR, and primary containment isolation systems. These activities also manage change in the material properties and cracking for gaskets and O-rings of the access penetration points for the primary containment pressure boundary. Based on compliance with PBAPS Technical Specification requirements and PBAPS operating experience, there is reasonable assurance that the primary containment leakage rate testing program activities will continue to adequately manage aging effects of loss of material, and change in materials and cracking of the identified primary containment components to preclude loss of intended function and maintain the current licensing basis during the period of extended operation.

<u>REFERENCES</u>

None

B.1.11 Inservice Testing (IST) Program

ACTIVITY DESCRIPTION

The inservice testing (IST) program that is being credited for license renewal is a portion of the PBAPS IST program.

The PBAPS IST program is implemented by a PBAPS specification and provides for inservice testing of Class 1, 2, and 3 pumps and valves in compliance with the ASME O&M Code, 1990 Edition, and 10 CFR 50.55a.

The IST program manages flow blockage in the ESW and ECW components exposed to raw water. In addition, the program manages reduction of heat transfer for the torus water path through the RHR heat exchangers.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The IST program manages flow blockage of system components from the ECW pump through the ESW and ECW system piping to the ECT. In addition, the program manages reduction of heat transfer of the RHR heat exchangers by performing periodic flow testing of the torus water path.

(2) Preventive Actions: The IST program consists of condition monitoring activities that detect flow restrictions prior to loss of intended function. No preventive or mitigating attributes are associated with these activities.

(3) Parameters Monitored/Inspected: The IST program detects flow blockage in ECW and ESW components by measuring ECW pump discharge flow and ESW booster pump discharge flow. The IST detects reduction of heat transfer of the RHR heat exchangers by measuring the flow output of the RHR pump through the associated heat exchanger.

(4) *Detection of Aging Effects:* IST program activities detect flow blockage and reduction of heat transfer aging effects in carbon steel and stainless steel components. Buildup of corrosion products and general silting and fouling contribute to flow blockage and reduction of heat transfer. The test methods, extent and schedule of the IST program activities provide for detection of flow blockage in the ESW and ECW components and reduction of heat transfer in the RHR heat exchangers prior to loss of intended function.

(*5) Monitoring and Trending:* The periodic testing schedule provides for detection of flow blockage and reduction of heat transfer aging effects. Corrective maintenance work orders are initiated for observations of low or inadequate flow. Deficiencies discovered during testing are monitored in accordance with ASME O&M Code requirements.

(6) Acceptance Criteria: Conditions detected during RHR flow testing are evaluated in accordance with the test procedure by verifying acceptable flow rates through the RHR heat exchangers. ECW system flow, from the ECW pump through the ESW booster pumps to the ECT, is evaluated in accordance with the test procedure by verifying acceptable flow rates at the test point near the ECT.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The IST program complies with ASME O&M Code. The IST program is reviewed and approved every 10 years. The ASME O&M Code incorporates industry practice and experience.

System modifications have been made to repair and replace piping and components due to leakage and degrading performance. In addition, the presence of corrosion, silting and clams has been discovered and evaluated through plant work order inspections. RHR heat exchanger leaks, degradation of baffle plate welds, and tube plugging events have been noted. Corrective actions were implemented prior to loss of function.

SUMMARY

The PBAPS IST program is implemented by a PBAPS specification and provides for inservice testing of Class 1, 2, and 3 pumps and valves in compliance with the ASME O&M Code, 1990 Edition, and 10 CFR 50.55a. The IST program manages the aging effects of flow blockage in the ESW and ECW components exposed to raw water and reduction of heat transfer for the torus water path through the RHR heat exchangers.

Based on the application of industry standards and the PBAPS operating experience, there is reasonable assurance that the IST program will continue to provide a method for early detection of flow blockage and reduction of heat transfer so that intended functions of the components will be maintained consistent with the current licensing basis through the period of extended operation

<u>REFERENCES</u>

(1) ASME Code for Operation and Maintenance of Nuclear Power Plants, American Society of Mechanical Engineers, New York, NY, 1990.

B.1.12 Reactor Materials Surveillance Program

ACTIVITY DESCRIPTION

PBAPS maintains a Reactor Materials Surveillance (RMS) program consistent with the requirements of 10 CFR 50, Appendix H and ASTM E185 to manage loss of fracture toughness in the RPV beltline material. This program contains sufficient dosimetry and materials to monitor irradiation embrittlement during the period of extended operation. This program will be incorporated into the industry Integrated Surveillance Program (ISP), as described in BWRVIP-78.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The RMS program includes periodic withdrawal and testing of in-vessel capsules to monitor the effects of neutron embrittlement on the reactor vessel beltline materials. The results of this testing are used to determine plant operating limits.

(2) Preventive Actions: The RMS program is a condition monitoring activity. There are no preventive or mitigating attributes associated with these activities.

(3) Parameters Monitored/Inspected: Charpy V-Notch 30 ft.-lb. transition temperature, upper shelf energy, and neutron fluence are monitored, consistent with the requirements of ASTM E185.

(4) Detection of Aging Effects: The RMS Program monitors the effects of neutron embrittlement by evaluating the loss of fracture toughness.

(5) Monitoring and Trending: Monitoring is provided by the RMS Program, as well as industry experience contained in Regulatory Guide 1.99. The program provides for compilation of information concerning loss of fracture toughness of RPV components.

(6) Acceptance Criteria: The acceptance criteria are based upon the requirements of ASTM E185 and Regulatory Guide 1.99, Revision 2.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions, and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: PBAPS Units 2 and 3 have tested surveillance capsules containing plate and weld material, and the results are consistent with Regulatory Guide 1.99, Revision 2 predictions.

SUMMARY

The PBAPS reactor materials surveillance (RMS) program manages loss of fracture toughness in the RPV beltline material. The program is consistent with the requirements of 10 CFR 50, Appendix H and ASTM E185 and will be incorporated into the industry Integrated Surveillance Program (ISP), as described in BWRVIP-78.

Based on the application of industry standards and the PBAPS operating experience, there is reasonable assurance that the RMS program will continue to adequately manage fracture toughness in the RPV beltline material so that intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) EPRI Report TR-114228, “BWR Vessel and Internals Project, BWR Integrated Surveillance Program Plan (BWRVIP-78)”, EPRI, Palo Alto, CA, December 1999

(2) Regulatory Guide 1.99, Revision 2, ”Radiation Embrittlement of Reactor Vessel Materials”, NRC, May 1988

B.1.13 Standby Liquid Control System Surveillance Activities

ACTIVITY DESCRIPTION

The standby liquid control (SBLC) system surveillance activities provide for managing the aging effects of loss of material and cracking in components of the SBLC system that are on the suction side of the SBLC pumps. The surveillance activities monitor the SBLC solution tank liquid level on a daily basis in accordance with a PBAPS procedure. The SBLC components covered by this surveillance include the solution tank, piping, and valves on the suction side of the SBLC pumps. The extent and frequency of this monitoring verifies the component intended functions.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The SBLC system surveillance activities manage the loss of material and cracking aging effects for the SBLC solution tank, piping, and valves, which are on the suction side of the SBLC pumps.

(2) Preventive Actions: The SBLC system surveillance activities provide a method to detect leakage due to loss of material or cracking prior to loss of intended function of the components. There are no preventive or mitigating attributes associated with these activities.

(3) Parameters Monitored/Inspected: The SBLC system surveillance activities verify the liquid level in the solution tank.

(4) Detection of Aging Effects: The daily surveillance of solution tank level will detect minor leakage in the SBLC components prior to excessive degradation from loss of material or cracking and prior to loss of intended component functions.

(5) Monitoring and Trending: The daily monitoring of solution tank liquid level is required by PBAPS Technical Specifications and provides for timely detection of loss of material or cracking in SBLC components that are on the suction side of the SBLC pumps.

(6) Acceptance Criteria: The SBLC system surveillance activities verify the required solution tank level is greater than 46% as specified in the PBAPS Technical Specifications to maintain intended system function.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: A review of both PBAPS and industry experience uncovered no age related loss of material or cracking in the SBLC components covered by this surveillance activity.

SUMMARY

The standby liquid control (SBLC) system surveillance activities manage loss of material and cracking for components of the SBLC system that are on the suction side of the SBLC pumps. PBAPS operating experience, and the use of daily surveillance of the SBLC solution tank liquid level to ensure it meets PBAPS Technical Specifications, provide reasonable assurance that the SBLC system surveillance activities will continue to adequately manage the effects of aging associated with components on the suction side of the SBLC pumps that are exposed to a borated water environment so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.1.14 Crane Inspection Activities

ACTIVITY DESCRIPTION

PBAPS crane inspection activities consist of inspections that are relied upon to manage loss of material for passive components of cranes and hoists. Crane inspection activities comply with the requirements of ASME B30.2, B30.11, B30.16 and B30.17 and are implemented through a PBAPS procedure.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: Crane inspection activities consist of inspections of the structural members, rails, and rail anchorage for the circulating water pump structure gantry crane located in an outdoor environment, and rails and monorails for the cranes and hoists located in a sheltered environment.

(2) Preventive Actions: Crane inspection activities include inspections to identify component aging effects prior to loss of intended function. No preventive or mitigating attributes are associated with these activities.

(3) Parameters Monitored/Inspected: Crane inspection activities verify structural integrity of crane and hoist elements required to maintain intended functions and comply with ASME B30.2, B30.11, B30.16 and B30.17. The activities include visual inspections for conditions such as corroded structural members, misalignment, flaking, sidewear of rails, loose tie down bolts, and excessive wear or deformation of monorail lower flange.

(4) Detection of Aging Effects: Crane inspection activities provide for inspections to identify deficiencies in components and degradation due to loss of material.

(5) Monitoring and Trending: Crane inspection activities monitor inspection results from previously identified findings and for newly developing conditions. The annual inspections provide for prediction of the onset of degradation and for timely implementation of corrective actions to prevent loss of intended function.

(6) Acceptance Criteria: Crane inspection activities provide for engineering evaluation of inspection results to assess the ability of the crane or hoist to perform its intended function. The acceptance criterion is no unacceptable visual indication of loss of material due to corrosion or wear.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: No incidents of failure of passive crane and hoist components due to aging have occurred at PBAPS. Loss of material in crane rails and monorails has been detected and managed by the crane inspection activities providing reasonable assurance that the intended functions of crane and hoist passive components will be maintained during the period of extended operation.

SUMMARY

PBAPS crane inspection activities manage loss of material for passive components of cranes and hoists. Crane inspection activities comply with the requirements of ASME B30.2, B30.11, B30.16 and B30.17 and are implemented through a PBAPS procedure.

Based on the application of industry standards, the extent and schedule of the inspections, and the PBAPS operating experience, there is reasonable assurance that the crane inspection activities will adequately manage the aging effects so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) ASME Safety Standard B30.2, “Overhead and Gantry Cranes.”
(2) ASME Safety Standard B30.11, “Monorails and Underhung Cranes”
(3) ASME Safety Standard B30.16, “Overhead Hoists (Underhung)”
(4) ASME Safety Standard B30.17, “Overhead and Gantry Cranes (Top Running Bridge, Single Girder With Top or Running Trolley Hoist)”

B.1.15 Conowingo Hydroelectric Plant (Dam) Aging Management Program

ACTIVITY DESCRIPTION

The Conowingo Hydroelectric Plant dam is subject to the FERC 5-year inspection program. This program consists of a visual inspection by a qualified independent consultant approved by FERC, and is in compliance with Title 18 of the Code of Federal Regulations, Conservation of Power and Water Resources, Part 12 (Safety of Water Power Projects and Project Works), Subpart D (Inspection by Independent Consultant). The NRC has found that mandated FERC 5-year inspection programs are acceptable for aging management.

REFERENCES

(1) NRC Letter, May 5, 1999, Christopher I. Grimes (NRC) to Douglas J. Walters (NEI), License Renewal Issue No. 98-0100, “Crediting FERC-Required Inspection and Maintenance Programs for Dam Aging Management”

B.1.16 Maintenance Rule Structural Monitoring Program

ACTIVITY DESCRIPTION

The maintenance rule structural monitoring program is that portion of the PBAPS maintenance rule structural monitoring program that is being credited for license renewal.

The maintenance rule structural monitoring program provides for condition monitoring of structures and components within the scope of license renewal that are not covered by other existing inspection programs. The program complies with the 10CFR50.65 and is implemented through a PBAPS procedure.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The maintenance rule structural monitoring program provides for condition monitoring of**:**

- Emergency cooling tower and reservoir reinforced concrete walls in contact with raw water;
- Structural steel components outside primary containment exposed to the outdoor environment, including siding and exterior blowout panels;
- Emergency cooling water outdoor piping support anchors; and
- Penetration seals and expansion joint seals.

(2) Preventive Actions: The maintenance rule structural monitoring program is a condition monitoring program that utilizes inspections to identify aging effects prior to loss of intended function. No preventive or mitigating attributes are associated with this program.

(3) Parameters Monitored/Inspected*:* The maintenance rule structural monitoring program specifies visual inspection of:

- Emergency cooling tower and reservoir reinforced concrete walls in contact with raw water for evidence of a change in material properties due to leaching of calcium hydroxide;
- Structural steel components for loss of material;
- Emergency cooling water outdoor piping support anchors for corrosion; and
- Penetration seals and expansion joint seals for gaps, voids, tears and general degradation associated with cracking, delamination and separation, and change in material properties.

(4) Detection of Aging Effects*:* The method, extent and frequency of maintenance rule structural monitoring program inspections provide reasonable assurance of detection of change in material properties, loss of material, and cracking, delamination and separation aging effects prior to a loss of intended function.

***(5) Monitoring and Trending**:* Structures and components are inspected at least once every four years, with provisions to perform trending and root cause analysis and increase the frequency of inspections in the event problems are identified.

***(6) Acceptance Criteria**:* Maintenance rule structural monitoring program inspection results are documented and evaluated by qualified personnel. Evaluations are based on ensuring that the intended functions of the structure or component are maintained. The acceptance criteria are consistent with the recommended criteria in NUMARC 93-01, Revision 2.

- Acceptance criteria for the emergency cooling tower and reservoir walls are based on an evaluation of the walls' condition when compared to the condition from previous inspections in order to verify that no changes have occurred that may affect their ability to perform their intended functions.

- Acceptance criteria for structural steel are directed at finding corrosion that may affect its ability to perform its intended functions.

- Acceptance criteria for visual inspection of the emergency cooling water outdoor piping support anchors require that structures be free of corrosion that could lead to possible failure.

- Acceptance criteria for the inspections performed on penetration seals and expansion joint seals are provided on PBAPS drawings and in the inspection procedure for these seals. These documents are directed at finding any changes in the condition of these components that may affect their ability to perform their intended functions.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

***(8) Confirmation Process**:* The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls*:* All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience*:* Aging effects have been detected and evaluated by the program before loss of intended function, providing reasonable assurance that the intended function of structures and components will be maintained during the period of extended plant operation. Specific PBAPS experiences include:

- Effective management of change in material properties due to contact of the emergency cooling tower and reservoir reinforced concrete walls with raw water by the detection and monitoring of leaching of calcium hydroxide. These walls have not experienced a loss of intended function.

- No loss of function of the emergency cooling water outdoor piping support anchors resulting from aging of the anchors. A review of industry experience shows that salt water corrosion and boric acid corrosion are the most common causes of loss of material for anchors. The anchors at PBAPS are not subjected to an environment containing either salt water or boric acid.

- Degraded conditions were found for some penetration and expansion joint seals. Most of the degradation was not attributed to aging effects. Corrective actions for all degraded conditions were taken prior to loss of any intended function.

SUMMARY

The maintenance rule structural monitoring program provides for condition monitoring of structures and components within the scope of license renewal that are not covered by other existing inspection programs. The program complies with the 10CFR50.65 and uses acceptance criteria that are consistent with the recommended criteria in NUMARC 93-01, Revision 2.

Based on the PBAPS operating experience and the use of acceptance criteria consistent with industry recommendations, there is reasonable assurance that the maintenance rule structural monitoring program will continue to adequately manage the identified aging effects on the structures and components so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) NUMARC 93-01, Revision 2 “Monitoring the Effect of Maintenance at Nuclear Power Plants”

B.2 ENHANCED AGING MANAGEMENT ACTIVITIES

B.2.1 Lubricating and Fuel Oil Quality Testing Activities

ACTIVITY DESCRIPTION

Lubricating and fuel oil quality testing activities manage loss of material, cracking, and reduction of heat transfer in components that contain or are exposed to lubricating oil or fuel oil. Lubricating and fuel oil quality testing activities are implemented through PBAPS procedures and include sampling and analysis of lubricating oil and fuel oil for detrimental contaminants. The presence of water or particulates may also be indicative of inleakage and corrosion product buildup. The aging management review determined that diesel driven fire pump fuel oil sampling methods will be enhanced to improve water detection capabilities. Analyses of the diesel driven fire pump and EDG fuel oil samples will be enhanced to add testing for microbes in any water detected.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: Lubricating and fuel oil quality testing activities provide for sampling and testing of lubricating oil in components in emergency diesel generator (EDG), high pressure coolant injection (HPCI), high pressure service water (HPSW), core spray (CS), and reactor core isolation cooling (RCIC) systems. Lubricating and fuel oil quality testing activities also provide for sampling and testing of fuel oil in the EDG and diesel driven fire pump fuel oil systems.

(2) Preventive Actions: The lubricating and fuel oil quality testing activities are aging management activities that are preventive in that reasonable assurance is provided that potentially detrimental concentrations of contaminants such as water and particulate are not present in the oil.

(3) Parameters Monitored/Inspected: Lubricating oil sample analyses are performed periodically in accordance with an approved PBAPS procedure. Samples are analyzed for attributes such as viscosity, moisture content, and pH.

Samples of new fuel oil deliveries are analyzed for water and sediment. Emergency diesel generator and diesel driven fire pump fuel oil storage tank samples are also periodically analyzed for the presence of water and particulate content of the fuel. Enhancements to the diesel driven fire pump fuel oil sampling techniques will be made to improve the methods for detection of water in the fuel. Sampling activities for water that may be detected in the EDG and diesel driven fire pump fuel oil systems will be enhanced to include an analysis for microbes.

(4) Detection of Aging Effects: Testing of lubricating oil for water and contaminants provides a means for detecting loss of material and cracking in the HPCI and RCIC, and EDG systems, and monitors for water inleakage in the HPCI and RCIC turbine lube oil coolers, HPSW and CS pump motor oil coolers, and the EDG lube oil cooler. Testing of fuel oil for the presence of corrosion particles or water provides a means for detecting loss of material for fuel oil storage tanks and underground fuel oil piping.

(5) Monitoring and Trending: Lubricating oil and fuel oil analyses are regularly scheduled and the results are evaluated to aid in the identification of potential adverse conditions.

(6) Acceptance Criteria: The lubricating and fuel oil quality testing activities are performed in accordance with approved PBAPS procedures which contain quantitative and qualitative acceptance criteria. Lubricating oil analysis acceptance criteria are based on deviations from the physical requirements identified in the oil type listing. The acceptability of lubricating oil test results is based upon comparison with new oil values, published data, or previous oil analysis results. Oil is acceptable if viscosity changes by no more than +15% to -10%, percent water is less than or equal to 0.10, and pH is within the required values for the type of oil being analyzed.

EDG fuel oil analysis acceptance criteria are contained in the PBAPS Technical Specifications and are based on the requirements of ASTM D2276-78 and ASTM D975-81. A fuel oil testing procedure based on ASTM D975-81 requires that new fuel oil contain no visible water or sediment. PBAPS Technical Specifications require periodic sampling of the EDG fuel oil for particulates and the presence of water. Tests for particulates use the methods specified in ASTM D2276-78 to provide assurance that the particulate limit of 10 mg/L is not exceeded. Plant procedures limit EDG fuel oil storage tank water accumulation to 100 ml/L for samples taken from the bottom of the tank, and EDG fuel oil day tank water accumulation to none present at the conclusion of the surveillance test. Diesel driven fire pump fuel oil analysis acceptance criteria are based on the requirements of ASTM D975-74, which requires that the fuel contain a maximum of 0.05%, by volume, of water and sediment. Fuel oil analysis for both the EDG and diesel driven fire pump fuel samples will be enhanced to analyze any water discovered in the storage or day tanks for the presence of microbes.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The overall effectiveness of the lubricating and fuel oil quality testing activities is supported by the operating experience PBAPS has had with lubricating oil and fuel oil systems. Minor contamination events such as sediment in the diesel driven fire pump fuel oil day tank (one event), water in the diesel driven fire pump fuel oil storage tank (two events), and water in the EDG fuel oil storage tanks (two events in 1988) have been detected and corrected in a timely manner. Since moving the diesel driven fire pump fuel oil storage tank indoors, there have been no incidents of water detected in the tank. There have been no age related component failures resulting in a loss of function of systems in lubricating oil or fuel oil environments.

<u>SUMMARY</u>

The lubricating and fuel oil quality testing activities are preventive aging management activities that assure potentially detrimental concentrations of water and particulate are not present in the oil. These activities also provide for detection of loss of material and cracking in certain components containing lubricating or fuel oil. Based on the use of industry standards and PBAPS operating experience there is reasonable assurance that the lubricating and fuel oil quality testing activities will continue to adequately manage the effects of aging associated with components exposed to lubricating oil and fuel oil environments so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

<u>REFERENCES</u>

(1) ASTM Standard D2276-1978, "Test Methods for Particulate Contaminant in Aviation Turbine Fuels"
(2) ASTM Standard D975-1974, "Specification for Diesel Fuel Oils"
(3) ASTM Standard D975-1981, "Specification for Diesel Fuel Oils"

B.2.2 Boraflex Management Activities

ACTIVITY DESCRIPTION

The Boraflex management activities provide for aging management of the spent fuel rack neutron poison material. These activities involve monitoring the condition of Boraflex by routinely sampling fuel pool silica levels and periodically performing in-situ measurement of boron-10 areal density. Existing processes will be enhanced by including the requirement and frequency for in-situ measurement of boron-10 areal density in PBAPS procedures.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activities: PBAPS Boraflex management activities manage the effects of spent fuel rack Boraflex material degradation to ensure that the intended function is maintained. These activities are based on EPRI guidelines and include routine monitoring and trending of silica in the spent fuel pool and periodically performing in-situ measurement of boron-10 areal density.

(2) Preventive Actions: The Boraflex management activities monitor the condition of Boraflex to ensure that its degradation is detected before a loss of intended function. No preventive or mitigating attributes are associated with these activities.

(3) Parameters Monitored/Inspected: Silica in fuel pool water is monitored for indication of leaching of boron from the matrix and degradation of the matrix itself. Measurement of the boron-10 areal density of in-service spent fuel storage rack panels is used to monitor neutron attenuation capability.

(4) Detection of Aging Effects: Boraflex degradation from change in material properties will result in increased levels of silica in fuel pool water or loss of boron-10 areal density. These parameters are monitored in accordance with EPRI guidelines at a frequency that assures identification of unacceptable aging effects before loss of intended function.

(5) Monitoring and Trending: Monitoring of change in material properties is accomplished through periodic measurement of boron-10 areal density of in-service spent fuel storage rack panels and sampling of silica levels in fuel pool water. This data is used to trend and predict performance of Boraflex.

(6) Acceptance Criteria: Analysis has shown that Boraflex will perform its intended function if degradation is maintained at less than a 10% uniform loss and at less than 10-cm. randomly distributed gaps. These parameter limits ensure that current licensing basis fuel pool reactivity limit ($k_{eff} \leq 0.95$ or 5% margin) is not exceeded. Spent fuel pool silica data is trended and compared in an industry-wide EPRI database. A sustained increasing trend in spent fuel pool silica concentration, inconsistent with previous seasonal/refueling changes, requires an engineering evaluation to determine the need for corrective action.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: NRC Information Notices IN 87-43, IN 93-70, and IN 95-38 address several cases of significant degradation of Boraflex in spent fuel pools. In response to these findings, the US NRC issued Generic Letter 96-04. The industry formed a Boraflex Working Group with EPRI and developed a strategy for tracking Boraflex performance in spent fuel racks, detecting the onset of material degradation, and mitigating its effects.

The Peach Bottom spent fuel racks and Boraflex have been in service since 1986. In-situ testing of representative Boraflex panels was conducted in 1996 for Unit 2 and 2001 for Unit 3. Test results identified Boraflex degradation; however, the degradations are less severe than experienced in the industry. Continued testing will identify unacceptable degradation prior to loss of intended function.

<ins>SUMMARY</ins>

The Boraflex management activities provide for aging management of the spent fuel rack neutron poison material. These activities involve monitoring the condition of Boraflex by routinely sampling fuel pool silica levels and periodically performing in-situ measurement of boron-10 areal density.

Based on the use of industry guidelines and PBAPS and industry operating experience, there is reasonable assurance that the Boraflex management activities will continue to adequately manage the effects of aging of spent fuel rack Boraflex so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) NRC Generic Letter 96-04, “Boraflex Degradation in Spent Fuel Pool Storage Racks”, June 26, 1996

(2) EPRI TR-103300, “Guidelines for Boraflex Use in Spent Fuel Storage Racks”

(3) EPRI TR-101986, “Boraflex Test Results and Evaluation”

(4) EPRI NP-6159, December 1998, “An Assessment of Boraflex Performance in Spent Nuclear Fuel Racks”

(5) NRC Information Notice (IN) 87-43, “Gaps in Neutron-Absorbing Material in High Density Spent Fuel Storage Racks”, September 8, 1987.

(6) NRC Information Notice (IN) 93-70, “Degradation of Boraflex Neutron Absorber Coupons”, September 10, 1993.

(7) NRC Information Notice (IN) 95-38, “Degradation of Boraflex Neutron Absorber in Spent Fuel Storage Racks”, September 8, 1995.

B.2.3 Ventilation System Inspection and Testing Activities

ACTIVITY DESCRIPTION

PBAPS ventilation system inspection and testing activities consist of inspections and tests that are relied upon to manage change in material properties in ventilation system components. The ventilation system inspection and testing activities are implemented through periodic surveillance tests and preventive maintenance work orders that provide for assurance of functionality of the ventilation systems by confirmation of integrity of selected components. The aging management review determined that scope of the components covered by these activities will be enhanced to provide added assurance of aging management.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: PBAPS ventilation system inspection and testing activities include surveillance tests that provide for inspection and leakage testing of the filter plenum access door seals in the standby gas treatment system and the control room ventilation system. These activities also include inspections of fan flex connections for the standby gas treatment system, the control room ventilation system, the battery room and emergency switchgear ventilation system exhaust fans, and the ESW booster pump room ventilation supply fans.

Ventilation system inspection and testing activities will be enhanced to include inspections of fan flex connections in the diesel generator building ventilation system, the pump structure ventilation system, and the battery room and emergency switchgear ventilation system supply fans.

(2) Preventive Actions: Ventilation system inspection and testing activities include the inspections and testing necessary to identify component aging degradation effects prior to loss of intended function. No preventive or mitigative attributes are associated with these activities.

(3) Parameters Monitored/Inspected: Ventilation system inspection and testing activities monitor and inspect for the presence of aging degradation by visual inspection and leakage testing. Pressure boundary integrity of fan flex connections and filter plenum access door seals is confirmed through inspections for evidence of changes in resilience, strength and elasticity. Testing of the filter plenum access door seals confirms their leak-tightness.

(4) Detection of Aging Effects: Ventilation system inspection and testing activities provide for periodic component inspections and leakage testing to detect change in material properties. The extent and schedule of the inspections and testing assures detection of component degradation prior to the loss of their intended functions.

(5) Monitoring and Trending: Ventilation system inspection and testing activities provide for monitoring and trending of aging degradation. Ventilation system components are periodically inspected which provides for timely component degradation detection. The inspection interval is dependent on the component and the system in which it resides. Components in the standby gas treatment system and the control room ventilation system are inspected and tested annually.

(6) Acceptance Criteria: Ventilation system inspection and testing activities acceptance criteria are defined in the specific inspection and testing procedures and confirm ventilation system operability by demonstrating that there is no significant pressure boundary leakage. Acceptance criterion for the filter plenum access door seals is lack of visual indication of smoke escaping through the seals during the smoke test.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: No physical degradation of metallic ventilation system components has been identified at PBAPS or by the industry in general. At PBAPS, the fan flex connection and filter plenum access door seal inspections have detected damaged components that were subsequently replaced in accordance with the inspection procedures. Torn and cracked fan flex connections for various ventilation fans have been detected during performance of inspection procedures. In these cases new flex connections were installed. In addition, access door seal leakage has been detected during performance of the seal leakage testing. New seals were installed as a result of the surveillance test process. In all cases the corrective actions, including component replacement, were taken prior to loss of intended function.

SUMMARY

The ventilation system inspection and testing activities assure that change in material properties is managed for fan flex connections and filter plenum access door seals. Based on the periodic inspection and testing and PBAPS operating experience, there is reasonable assurance that the ventilation system inspection and testing activities will continue to adequately manage the identified aging effects of the components so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.2.4 Emergency Diesel Generator Inspection Activities

ACTIVITY DESCRIPTION

The emergency diesel generator (EDG) inspection activities provide for condition monitoring of EDG equipment within the scope of licensing renewal that are exposed to a gaseous, closed cooling water, lubricating oil or fuel oil environment. Loss of material in the starting air system air receivers is mitigated by daily removal of any accumulation of condensate. Loss of material and cracking in lubricating oil and fuel oil systems is mitigated by periodic inspections. Visual inspections for change in material properties of flexible hoses in the starting air system and the cooling water system are performed in accordance with a PBAPS procedure in connection with periodic EDG maintenance. This procedure will be enhanced to require inspections of the lubricating oil and fuel oil system flexible hoses for a change in material properties. The aging management review also determined that the management of loss of material in the EDG exhaust silencer will be enhanced by periodic disassembly, cleaning, and inspection of an automatic drain trap to ensure its functionality in preventing condensation build up.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The EDG inspection activities manage the aging effects of loss of material, cracking, and change in material properties by:

- mitigating actions which ensure periodic removal of moisture from the starting air system air receivers.
- periodic inspections of the EDG lubricating oil and fuel oil systems for loss of material and cracking.
- periodic inspections of flexible hoses in the starting air and cooling water systems for a change in material properties.

The scope of the EDG inspection activities will be enhanced to:

- perform periodic inspections of EDG lubricating oil and fuel oil system flexible hoses for a change in material properties.
- periodically disassemble, clean, and inspect the EDG exhaust silencer drain trap to ensure its functionality to prevent condensation buildup and the resulting loss of material of the exhaust silencer.

(2) Preventive Actions: The EDG inspection activities provide mitigation methods to manage loss of material in the starting air system air receivers and the EDG exhaust silencer by ensuring periodic removal of moisture. The remaining EDG inspection activities provide inspection methods to identify aging effects, and as such, there are no preventive or mitigative attributes associated with them.

(3) Parameters Monitored/Inspected: The existing EDG inspection activities provide for:

- blowing down the EDG starting air system air receivers until no more moisture is present in the drain line.
- performance of visual inspections of the lubricating oil and fuel oil systems for loss of material and cracking, and performance of periodic UT inspections of the EDG fuel oil storage tanks for loss of material.
- performance of visual inspections of the starting air and cooling water system flexible hoses for a change in material properties.

EDG inspection activities will be enhanced to include:

- performance of visual inspections of the lubricating oil and fuel oil system flexible hoses for a change in material properties.
- periodic disassembly, cleaning, and inspection of the EDG exhaust silencer drain trap to ensure it is operating properly.

(4) Detection of Aging Effects: The starting air system air receiver inspections and the periodic exhaust silencer automatic drain trap preventive maintenance activities mitigate potential aging effects. Visual inspections of the EDG fuel oil day tanks and EDG lubricating and fuel oil system components, and visual and UT inspections of the EDG fuel oil storage tanks are performed to assess loss of material and cracking aging effects. Visual inspection of flexible hoses provides for detection of change in material properties by observation of swelling or cracking. PBAPS procedures for EDG maintenance contain requirements for visual examinations of starting air and cooling water system flexible hoses. This procedure will be enhanced to include inspections of lubricating and fuel oil system flexible hoses.

(5) Monitoring and Trending: Existing EDG inspection activities provide the following monitoring and trending activities:

- daily starting air system receiver inspections mitigate aging and require no monitoring or trending.
- EDG lubricating and fuel oil system examinations for loss of material and cracking range from every two years for engine mounted components to a 10-year inspection of the EDG fuel oil storage tank and day tank interiors.
- starting air and cooling water system flexible hose examinations for a change in material properties are conducted every two years.

Enhancements to EDG inspection activities will provide the following monitoring and trending activities:

- examinations of the EDG lubricating and fuel oil system flexible hoses for a change in material properties will be conducted every two years.

- the periodic preventive maintenance of the EDG exhaust silencer automatic drain trap will mitigate aging and requires no monitoring or trending.

(6) Acceptance Criteria: The EDG starting air system air receiver inspection contains the requirement to blow down the air receiver until there is no moisture in its drain line. Examinations for loss of material, visible cracking, and change in material properties aging effects are conducted in accordance with approved PBAPS procedures. Degraded components are repaired or replaced as required. The EDG exhaust silencer automatic drain trap preventive maintenance will ensure the trap is left in good working order.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The overall effectiveness of the EDG inspection activities is supported by the operating experience PBAPS has had with the starting air, engine exhaust, cooling water, lubricating oil, and fuel oil systems. Minor leakage events in the starting air, engine exhaust, cooling water, lubricating oil, and fuel oil systems have been detected and corrected in a timely manner. Due to numerous small leaks, portions of the EDG exhaust piping have been replaced. Water and sediment have been observed during the fuel oil storage tank inspections. During the 1995 - 1996 fuel oil storage tank inspections, the lowest tank shell UT reading was 0.375", which is equal to the original specified thickness for the shell. No age related failures have been observed in EDG system flexible hoses. There have been no starting air, engine exhaust, cooling water, lubricating or fuel oil system age related component failures resulting in a loss of function of the EDG.

<u>SUMMARY</u>

The emergency diesel generator (EDG) inspection activities provide for condition monitoring of EDG equipment within the scope of license renewal that are exposed to a gaseous, closed cooling water, lubricating or fuel oil environment.

Loss of material in the EDG starting air receivers is mitigated by periodic removal of any moisture present. Loss of material in the EDG exhaust silencer is mitigated by maintaining the exhaust silencer drain trap in good working order. Loss of material and cracking in the lubricating and fuel oil systems is detected by periodic inspections. A change in material properties in starting air, cooling water, lubricating and fuel oil system flexible hoses is detected by periodic inspections.

Based on PBAPS operating experience, there is reasonable assurance that the EDG inspection activities will continue to adequately manage the loss of material, cracking, and change in material properties aging effects in EDG equipment within the scope of license renewal so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.2.5 Outdoor, Buried, and Submerged Component Inspection Activities

ACTIVITY DESCRIPTION

The outdoor, buried, and submerged component inspection activities provide for management of loss of material and cracking of external surfaces of components subject to outdoor, buried, and raw water external environments. Separately, the ISI program provides for monitoring of pressure boundary integrity for outdoor and buried components through pressure tests, flow tests, and inspections. The outdoor, buried, and submerged component inspection activities are implemented in accordance with PBAPS maintenance procedures and routine test procedures that provide instructions for inspections. Component inspections include inspections of external surfaces for the presence of pitting, corrosion and other abnormalities. The visual inspections provide reasonable assurance that aging effects are being managed such that system and component intended functions are maintained. The aging management review determined that the scope of components covered by these activities will be enhanced to provide added assurance of aging management.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The outdoor, buried, and submerged component inspection activities provide for detection of degradation due to loss of material or cracking of external surfaces for outdoor, buried, and submerged components.

The submerged components include HPSW, ESW, ECW, and fire protection system pumps. Components exposed to the outdoor environment include HPSW and ESW system manual discharge pond isolation valves, condensate storage system piping and valves, the external surfaces of the CSTs, and the piping insulation jacketing at the CST. The buried components include HPSW, ESW, ECW, fire protection, and EDG fuel oil system piping; fire protection system fire main isolation valves; EDG fuel oil storage tanks; the SGTS exhaust to the main stack; and the underside of the CSTs.

The scope of these activities will be enhanced to include periodic visual inspection of the external surfaces of the CSTs, periodic visual inspection of the ECW pump casing and casing bolts, and visual inspection of buried commodities whenever they are uncovered during excavation. Inspection of the refueling water storage tank (RWST) will be performed as a representative inspection to determine the condition of the underside of the CSTs. The CSTs and RWST are of same material, construction and internal environment; thus the condition of the RWST is representative of the condition of the CSTs.

(2) Preventive Actions: The outdoor, buried, and submerged component inspection activities provide inspection methods to identify aging effects on external surfaces prior to loss of intended function. There are no preventive or mitigating attributes associated with these activities.

(3) Parameters Monitored/Inspected: The outdoor, buried, and submerged component inspection activities provide for inspection of external component surfaces of submerged pumps and outdoor valves for evidence of corrosion and cracking; inspection of buried commodities for the presence of coating degradation, if coated, or base metal corrosion and cracking, if uncoated; inspection of the external surfaces of the CSTs and inspection of outdoor condensate system piping insulation to verify that the jacketing is free of damage; volumetric inspection of the bottom of the RWST for corrosion as a representative inspection for the underside of the CST.

(4) Detection of Aging Effects: Outdoor, buried, and submerged components are visually inspected to identify loss of material and cracking aging effects. These inspections in combination with other condition monitoring methods in the PBAPS aging management activities provide for detection of aging effects prior to loss of intended function.

Outdoor valves are inspected during performance of component maintenance. These inspections provide for detection of external loss of material aging effects.

Outdoor insulation jacketing is periodically inspected as part of heat trace testing. The extent and schedule of the outdoor insulation inspections assure detection of loss of material before any jacketing leaks develop.

The excavating procedure will be enhanced to direct visual inspection of buried commodities whenever they are uncovered during excavation. The inspection of the external coating or the base metal, if uncoated, will detect any external degradation due to aging.

The above ground tank inspection procedure will be enhanced to include periodic visual inspection of the above ground external surfaces of the CSTs.

Inspections during component maintenance of submerged pumps and additional periodic inspections of the ECW pump will detect external casing degradation prior to loss of its pressure boundary function.

The inspection of the RWST will be enhanced to periodically perform volumetric inspection of the bottom of the RWST for loss of material as a representative inspection to determine the condition of the underside of the CSTs.

(5) Monitoring and Trending: Inspections of submerged pumps and outdoor valves are conducted as part of the maintenance process. In addition, the ECW pump will be periodically inspected as part of preventive maintenance. Buried commodities will be visually inspected whenever they are uncovered during excavation activities. The inspections of the RWST will be used to determine the condition of the underside of the CST. Degradation identified during the inspections is evaluated in accordance with procedure requirements.

Annual inspections of the outdoor piping insulation jacketing and the above ground exterior surfaces of the CSTs provide detection of corrosion degradation or damage to the jacketing or to the tanks.

(6) Acceptance Criteria: Identified loss of material or cracking will be evaluated to provide reasonable assurance that system and component functions are maintained. Indications of component degradation detected during the inspection processes will be evaluated by engineering and the appropriate corrective actions will be initiated. Degradation of the refueling water storage tank noted during its examination will result in the CSTs being evaluated for degradation.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions, and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: Significant external surface degradation of outdoor, buried, or submerged components has not been identified to date at PBAPS except for the ECW pump. The performance lives of the HPSW, ESW and fire protection pumps are limited by wear of the pump internals. Inspections of the casings during maintenance have not detected significant corrosion degradation and the pumps are re-coated following re-assembly. The ECW pump is operated less frequently. Therefore, its performance life is dependent on external surface degradation. Enhanced periodic inspections of the pump casing and casing bolts will detect future pump casing corrosion degradation.

<u>SUMMARY</u>

The outdoor, buried, and submerged component inspection activities provide for determination of degradation due to loss of material or cracking of external surfaces for outdoor, buried, and submerged components. The outdoor, buried, and submerged component inspection activities are implemented in accordance with PBAPS maintenance procedures and routine test procedures that provide instructions for visual inspections. The scope of these activities will be enhanced to include periodic visual inspection of the external surfaces of the CSTs, periodic visual inspection of the ECW pump casing and casing bolts, visual inspection of buried commodities whenever they are uncovered during excavation, and enhanced inspections of the refueling water storage tank. The refueling water storage tank is not in the scope of license renewal. However, inspections of the refueling water tank as enhanced will be used for determining the condition of the underside of the CSTs.

Based on PBAPS operating experience and the enhanced inspections, there is reasonable assurance that the outdoor, buried, and submerged component inspection activities will manage loss of material and cracking for the identified external surfaces of components subject to outdoor, buried and raw water external environments so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

<u>REFERENCES</u>

None

B.2.6 Door Inspection Activities

ACTIVITY DESCRIPTION

The door inspection activities provide for managing the aging effects for hazard barrier doors that are exposed to the outdoor environment. The aging management review determined that the activities will be enhanced to include additional doors. In addition, the activities will be enhanced to include inspection for loss of material in hazard barrier doors in an outdoor environment.

The door inspection activities provide for managing the aging effects for gaskets associated with water-tight hazard barrier doors in both outdoor and sheltered environments. The inspection activities consist of condition monitoring of the gaskets associated with water-tight hazard barrier doors on a periodic basis in accordance with PBAPS procedures.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The door inspection activities provide for inspections and evaluations of hazard barrier doors exposed to the outdoor environment and of gaskets for water-tight hazard barrier doors exposed to the outdoor and sheltered environments. The PBAPS procedures governing the inspections will be enhanced to identify additional doors and to include more inspection parameters linked to loss of material in hazard barrier doors in an outdoor environment.

(2) Preventive Actions: The hazard barrier doors inspection activities are condition monitoring activities that utilize inspections to identify aging effects prior to loss of intended function. There are no preventive or mitigating attributes associated with this activity.

(3) Parameters Monitored/Inspected: Hazard barrier doors exposed to the outdoor environment are and will be inspected for evidence of loss of material due to corrosion. Gaskets associated with water-tight hazard barrier doors in an outdoor environment are inspected to detect change in material properties. Gaskets for water-tight hazard barrier doors in a sheltered environment are inspected for evidence of change in material properties and cracking.

(4) Detection of Aging Effects: Inspections for loss of material of water-tight hazard barrier doors and inspections of associated gaskets for change in material properties, and cracking are performed and results are documented. Inspections for loss of material of other hazard barrier doors exposed to the outside environment will be performed and the results documented.

(5) Monitoring and Trending: The door inspection activities periodically monitor water-tight hazard barrier doors for loss of material due to corrosion and their gaskets for change in material properties and cracking. In addition, door inspection activities will periodically monitor other hazard barrier doors for loss of material due to corrosion.

(6) Acceptance Criteria: Acceptance criteria for hazard barrier doors and gaskets associated with water-tight hazard barrier doors are provided in PBAPS procedures. If an indication or evidence of a degraded condition is found, the information is forwarded to engineering for evaluation to determine if an unacceptable visual indication of loss of material, cracking or change in material properties exists.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions, and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: A review of the operating experience for hazard barrier doors and gaskets associated with water-tight hazard barrier doors found no degraded conditions due to loss of material, change in material properties, or cracking that resulted in loss of intended function.

Corrosion on hazard barrier doors was found in a few instances, mainly on those doors with one face exposed to an outdoor environment. This condition was typically due to drainage problems that allowed the water to run toward the door rather than away from it. Corrective actions were taken to eliminate the drainage problem and door degradation prior to loss of intended function.

There were a few instances of watertight door gasket replacements. The cause, in most cases, was manmade. Plant documentation cited a few instances of debris within the gasket folds preventing door closure. Debris was removed and gaskets inspected with no detrimental effects observed.

SUMMARY

The door inspection activities provide for managing the aging effects for hazard barrier doors that are exposed to the outdoor environment and for managing the aging effects for gaskets associated with water-tight hazard barrier doors in both outdoor and sheltered environments.

Based on the PBAPS operating experience there is reasonable assurance that the door inspection activities will continue to adequately manage the aging effects on hazard barrier doors in an outdoor environment and on gaskets associated with water-tight hazard barrier doors in outdoor and in sheltered environments so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.2.7 Reactor Pressure Vessel and Internals ISI Program

ACTIVITY DESCRIPTION

The BWR Vessels and Internals Project (BWRVIP) guidelines are implemented through the reactor pressure vessel and internals ISI program. The reactor pressure vessel and internals ISI program is that part of the PBAPS ISI program that provides for condition monitoring of the reactor vessel and internals using guidance provided by the BWRVIP and the BWR Owners Group alternate BWR feedwater nozzle inspection requirements.

The PBAPS ISI program complies with requirements of 1989 Edition of the ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components", and is implemented through a PBAPS specification. The PBAPS ISI program has been augmented to include various additional requirements, including those from the BWRVIP guidelines and the BWR Owners Group (BWROG) alternative to NUREG-0619 augmented inspection of feedwater nozzles for GL 81-11 thermal cycle cracking.

The BWRVIP program is an industry developed effort based on over 20 years of service and inspection experience and is focused on detecting evidence of component degradation well in advance of significant degradation. The BWRVIP inspection and evaluation reports for reactor pressure vessel and internals components were submitted to the NRC for review and approval. These inspection and evaluations reports address both the current and license renewal periods.

The BWRVIP program was reviewed for its applicability to PBAPS design, construction, and operating experience. The review determined that reactor pressure vessel and internals components, including the materials of construction, are addressed by the BWRVIP inspection and evaluation reports. PBAPS operating parameters, including temperature, pressure, and water chemistry, are consistent with those used for the development of the inspection and evaluation reports. The reactor vessel and internals components that require aging management review are covered by the BWRVIP inspection and evaluation reports. The BWRVIP inspection and evaluation reports cover the design of PBAPS reactor pressure vessel and internals components. Therefore, it was concluded that the BWRVIP inspection and evaluation reports bound PBAPS design and operation.

The reactor pressure vessel and internals ISI program employs the BWRVIP program criteria documented in the final NRC safety evaluation reports except where specific exception has been identified to the NRC.

The aging management review determined that the reactor pressure vessel and internals ISI program will be enhanced to assure that the inspections are consistent with BWRVIP program criteria and the NRC safety evaluation reports.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The BWRVIP documents as implemented by the reactor pressure vessel and internals ISI program provide for examinations of reactor pressure vessel components and internals, for managing the aging effects of cracking and loss of material.

(2) Preventive Actions: The BWRVIP program and the reactor pressure vessel and internals ISI program consists of condition monitoring activities that utilize early detection, evaluation and corrective actions that address degradation of reactor pressure vessel components and internals before loss of intended function. No preventive or mitigating attributes are associated with these activities.

(3) Parameters Monitored/Inspected: The BWRVIP guidelines documents reviewed the function of each reactor pressure vessel and internals components. For those that could impact safety, the BWRVIP guidelines considered the mechanisms that might cause degradation of reactor pressure vessel and internals components and developed an inspection program that would enable degradation to be detected and evaluated before the components intended function is adversely affected. Details regarding inspection and evaluation are contained within the reactor pressure vessel and internals component-specific BWRVIP inspection and evaluation guidelines document. Additionally, the program provides for visual inspections of the top head for loss of material.

(4) Detection of Aging Effects: Reactor pressure vessel components and internals are inspected using ultrasonic, visual, and surface examinations as appropriate. The methods and the frequency of examination will be consistent with the applicable BWRVIP inspection and evaluation documents, and the BWROG “Alternate BWR Feedwater Nozzle Inspection Requirements”, as incorporated in the ISI program specification.

(5) Monitoring and Trending: The reactor pressure vessel ISI program provides for monitoring for the presence of aging degradation per the guidance provided in the ASME Section XI schedules, the BWRVIP inspection and evaluation documents, and BWROG “Alternate BWR Feedwater Nozzle Inspection Requirements”. The frequency of examination, as specified within these documents, varies for each component. The frequency is based on the component’s design, flaw tolerance, susceptibility to degradation, and the method of examination used. Documentation that facilitates comparison with previous and subsequent inspection results is maintained.

(6) Acceptance Criteria: BWRVIP inspection and evaluation documents provide the basis for reactor vessel and internals inspection requirements, acceptance criteria, and corrective actions. Any degradation in reactor pressure vessel components is evaluated in accordance with Section XI required inspections. In addition, the BWROG "Alternate BWR Feedwater Nozzle Inspection Requirements" provide additional bases for acceptance criteria contained in the ISI program specification. BWRVIP inspection and evaluation documents applicable to PBAPS reactor pressure vessel and internals components are as follows:

Reactor Pressure Vessel And Internals BWRVIP Document Applicability

Reactor Pressure Vessel Components	**Reference**
Reactor pressure vessel components	BWRVIP-74
Vessel shells	BWRVIP-05
Shroud support attachments	BWRVIP-38
Nozzle safe ends	BWRVIP-75
Core support plate	BWRVIP-25
Core ΔP / SLC nozzle	BWRVIP-27
Core spray attachments	BWRVIP-48
Jet pump riser brace attachments	BWRVIP-48
Other attachments	BWRVIP-48
CRDH stub tubes	BWRVIP-47
ICM Housing penetrations	BWRVIP-47
Instrument penetrations	BWRVIP-49
Reactor Internals Components	
Shroud support	BWRVIP-38
Shroud	BWRVIP-76
Core support plate	BWRVIP-25
Core ΔP / SLC line	BWRVIP-27
Access hole covers	(Note 1)
Top guide	BWRVIP-26
Core spray lines	BWRVIP-18
Core spray spargers	BWRVIP-18
Jet pump assembly	BWRVIP-41
CRDH stub tubes	BWRVIP-47
CRDH guide tubes	BWRVIP-47
In-core housing guide tubes, LPRM & WRNMS dry tubes	BWRVIP-47

Note 1. GE SIL 462 for Unit 2 only.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

***(10) Operating Experience*:** A review of operating experience at PBAPS was conducted on degradations in water systems. The degradations mirrored that of the industry, in that most were attributed to cracking. The PBAPS reactor pressure vessel and internals ISI program provides for early detection, evaluation and corrective actions that are based on industry practice and experience, and are considered adequate to address degradation of reactor pressure vessel components and internals prior to loss of intended function.

<u>SUMMARY</u>

The reactor pressure vessel and internals ISI program activities manage cracking and loss of material for the reactor vessel and internals using guidance provided by the BWRVIP and the BWR Owners Group alternate BWR feedwater nozzle inspection requirements. These activities are implemented through the PBAPS ISI program specification. They utilize early detection, evaluation and corrective actions that address degradation of reactor pressure vessel components and internals.

Based on the use of industry guidelines and PBAPS operating experience, there is reasonable assurance that the PBAPS reactor pressure vessel and internals ISI program will continue to adequately manage the identified aging effects for the reactor vessel and internals to maintain the intended functions consistent with the current licensing basis for the period of extended operation.

<u>REFERENCES</u>

(1) GE NE-523-A71-0594, BWROG "Alternate BWR Feedwater Nozzle Inspection Requirements," Rev. 1, May 2000.

(2) NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," U.S. Nuclear Regulatory Commission, November 1980.

(3) NRC Generic Letter, GL 81-11, “BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking (NUREG-0619),” U.S. Nuclear Regulatory Commission, 02/29/1981.
(4) ASME Boiler and Pressure Vessel Code, Section XI, “Rules for In-service Inspection of Nuclear Plant Components,” American Society of Mechanical Engineers, New York, NY, 1989.
(5) “BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05),” EPRI, Palo Alto, CA, September 1995 (EPRI Report TR-105697).
(6) “BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate Delta-P Inspection and Flaw Evaluation Guidelines (BWRVIP-27),” EPRI, Palo Alto, CA, April 1997, (EPRI Report TR-107286).
(7) “BWR Vessel and Internals Project, Shroud Support Inspection and Flaw Evaluation Guidelines (BWRVIP-38),” EPRI, Palo Alto, CA, September 1997, (EPRI Report TR-108823).
(8) “BWR Vessel and Internals Project, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines (BWRVIP-47),” EPRI, Palo Alto, CA, December 1997, (EPRI Report TR-108727).
(9) “BWR Vessel and Internals Project, Vessel ID Attachment Weld Inspection and Evaluation Guidelines (BWRVIP-48),” EPRI, Palo Alto CA, February 1998, (EPRI Report TR-108724).
(10) “BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines (BWRVIP-49),” EPRI, Palo Alto, CA, March 1998 (EPRI Report TR-108695).
(12) “BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Evaluation Guidelines (BWRVIP-74),” EPRI, Palo Alto, CA, September 1999, (EPRI Report TR-113596).
(13) “BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules (BWRVIP-75),” EPRI, San Jose, CA, October 1999, (EPRI Report TR-113932).
(14) “BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines (BWRVIP-18),” EPRI Report TR-106740, July 1996.
(15) “BWR Core Plate Inspection and Flaw Evaluation Guideline (BWRVIP-25),” EPRI Report TR-107284, December 1996.
(16) “BWR Top Guide Inspection and Flaw Evaluation Guidelines (BWRVIP-26), ” EPRI Report TR-107285, December 1996.
(17) “BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines (BWRVIP-41), ” EPRI Report TR-108728, October 1997.
(18) “BWR Core Shrouds Inspection and Flaw Evaluation Guidelines (BWRVIP-76), ” EPRI Report TR-114232, November 1999.
(19) General Electric Service Information Letter, SIL 462.

B.2.8 Generic Letter 89-13 Activities

ACTIVITY DESCRIPTION

The GL 89-13 activities provide for management of loss of material, cracking, flow blockage, and reduction of heat transfer aging effects in cooling water piping and components that are tested and inspected in accordance with the guidelines of NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety Related Equipment". The GL 89-13 activities include both condition monitoring and mitigating activities for managing aging effects in HPSW, ESW, and the ECW systems and in other systems' components using raw water as a cooling medium. System and component testing, visual inspections, UT, and biocide treatments are conducted to ensure that aging effects are managed such that system and component intended functions are maintained. The aging management review determined that several component maintenance procedures will be enhanced to require inspection for specific signs of degradation including corrosion, excessive wear, cracks and Asiatic clams. Also, additional piping locations will be added to the UT inspection program.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The GL 89-13 activities provide for managing loss of material, cracking, flow blockage, and reduction of heat transfer in components exposed to raw cooling water at PBAPS. These components include piping, piping specialties, pump casings, and valve bodies in HPSW, ESW, and ECW systems. RHR heat exchangers, HPSW and CS pump motor oil coolers, CS, HPCI, RCIC and RHR pump room cooling coils, and EDG jacket, air, and lube oil coolers are also included.

(2) Preventive Actions: The GL 89-13 activities provide for condition and performance monitoring of systems and components and utilize periodic biocide treatments and flushing of infrequently used systems to mitigate flow blockage aging effects due to biofouling.

(3) Parameters Monitored/Inspected: The GL 89-13 activities inspect and test to detect aging degradation in the HPSW, ESW, and ECW systems components and heat exchangers and coolers using raw water as the cooling medium. Procedures and work orders direct the inspection of components, including visual inspection for corrosion and cracking, and UT of system piping to detect wall thinning. System component performance testing for acceptable flowrates, pressures, and heat transfer and visual inspections for system and component fouling and silting are used to identify flow blockage and reduction of heat transfer aging effects.

Several component maintenance procedures will be enhanced to require inspection for specific signs of degradation including corrosion, excessive wear, cracks and Asiatic clams. Also, additional piping locations will be inspected for loss of material.

(4) Detection of Aging Effects: GL 89-13 activities provide for detection of aging effects prior to loss of intended functions. Loss of material and cracking is detected through component visual inspections. Loss of material in piping is detected through UT. System and component flow blockage and reduction of heat transfer are detected using a combination of system and component performance testing and component visual inspections during disassembly.

(5) Monitoring and Trending: System performance tests, piping UT, and periodic component visual inspections of pump motor oil cooling water loops and of pump process check valves provide for timely detection of loss of material, cracking and flow blockage. Other system components, which are primarily pumps and valves, are visually inspected for loss of material, cracking, and flow blockage during component maintenance. Heat exchanger performance and flow testing varies from once every six weeks to once every 48 months. Inspections and non-destructive testing of heat exchangers are used to determine the extent of biofouling, condition of surface coating, magnitude of localized pitting, and evidence of MIC.

(6) Acceptance Criteria: Engineering evaluations of identified aging degradation, including loss of material, cracking, and flow blockage aging effects, are used to confirm the component's ability to perform its intended function. Semi-annual biocide injections into the ESW and HPSW systems are performed per chemistry guidelines regarding concentration and treatment durations. Cooling water component visual inspections evaluate the presence of corrosion, pitting, erosion, MIC or other abnormalities. Heat exchanger testing measures the cooling flow rates and determines the heat removal rates and compares them with system requirements specified in plant procedures.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The PBAPS GL 89-13 activities implement the inspection and testing recommendations of NRC Generic Letter 89-13. Prior to issuance of GL 89-13, corrosion induced leakage and reduced system performance due to flow blockage had occurred. System modifications were required to replace and repair piping leaks and clean fouled heat exchangers, primarily in the ESW system. The ESW system operating configuration had relied on the use of normally closed process valves to various coolers, which would open to provide the required flow to meet plant operating conditions. These stagnant legs corroded and required replacement. Since the replacement, the system operational configuration was revised to maintain flow through the coolers to reduce corrosion and flow blockage. Also, GL 89-13 testing and inspections have been implemented.

GL 89-13 inspection activities have detected and evaluated the presence of corrosion, silting and clams. The system and component corrective actions were implemented prior to loss of system function. Existing GL 89-13 activities adequately manage the aging effects of loss of material, cracking, flow blockage, and reduction of heat transfer in components exposed to raw cooling water at PBAPS.

<u>SUMMARY</u>

The GL 89-13 activities manage loss of material, cracking, flow blockage, and reduction of heat transfer aging effects in cooling water piping and components that are tested and inspected in accordance with the guidelines of NRC Generic Letter 89-13, “Service Water System Problems Affecting Safety Related Equipment”. The GL 89-13 activities include both condition monitoring and mitigating activities for managing aging effects in HPSW, ESW, and the ECW systems and in other systems’ components using raw water as a cooling medium. System and component testing, visual inspections, UT, and biocide treatments are conducted to ensure that aging effects are managed such that system and component intended functions are maintained.

Based on PBAPS operating experience, there is reasonable assurance that the GL 89-13 activities will adequately manage loss of material, cracking, flow blockage, and reduction of heat transfer aging effects in cooling water piping and components, that are tested and inspected in accordance with the guidelines of NRC Generic Letter 89-13, to maintain their intended functions, consistent with the current licensing basis, through the period of extended operation.

REFERENCES

(1) NRC Generic Letter 89-13, Service Water System Problems Affecting Safety-Related Equipment

(2) NRC Generic Letter 89-13, Supplement 1, Service Water System Problems Affecting Safety-Related Equipment

B.2.9 Fire Protection Activities

ACTIVITY DESCRIPTION

The fire protection activities provide for inspections, monitoring, and performance testing of fire protection systems and components to detect aging effects prior to loss of intended function. Degradation of fire protection systems and components due to corrosion buildup, biofouling, and silting are detected by performance testing based on NFPA 24 standards. Periodic and maintenance inspections detect corrosion, fouling, and cracking in system components due to internal and external environment aging effects and detect aging effects in fire barriers. Monitoring of system pressure detects system leakage due to both internal and external aging effects. The aging management review determined that the scope of components covered by these activities will be enhanced to provide added assurance of aging management. In addition, a one-time test will be conducted to detect loss of material due to selective leaching.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: Existing fire protection activities provide for inspections, system monitoring, and/or system performance tests of:

- fire protection system pumps, piping, sprinklers, and valves,
- diesel driven fire pump fuel oil system pumps, valves, piping and tubing,
- buried fire main piping and valves,
- outdoor fire hydrants, hose connections and hose station block valves, and
- fire barrier penetrations seals, fire barrier doors, and fire wraps exposed to sheltered and outdoor environments.

The scope of fire protection activities will be enhanced to:

- require additional inspection requirements for deluge valves in the power block sprinkler systems,
- perform functional tests of sprinkler heads that have been in service for 50 years,
- inspect diesel driven fire pump exhaust systems,
- inspect diesel driven fire pump fuel oil system flexible hoses,
- inspect fire doors for loss of material and,
- perform a one-time test of a cast iron fire protection component.

(2) Preventive Actions: The fire protection activities provide system monitoring, performance testing, and inspections to identify aging effects prior to loss of intended function. There are no preventive or mitigating attributes associated with these activities.

(3) Parameters Monitored/Inspected: The existing fire protection activities provide for:

- visual inspections of the fire protection system piping, sprinklers, and valves to detect loss of material, cracking, and flow blockage,
- visual inspection of fire pumps for loss of material and flow blockage during corrective maintenance activities,
- visual inspections of the diesel driven fire pump fuel oil system pumps, valves, piping and tubing to detect loss of material and cracking,
- monitoring of fire protection system pressure to detect leakage of buried fire main piping and valves,
- flow tests to detect fire protection system blockage and component degradation in buried fire main piping and valves, outdoor fire hydrants, hose connections, and hose station block valves, and
- visual inspections of fire barrier penetrations seals, fire barrier doors, and fire wraps to detect changes in material properties, cracking, delamination, separation, and loss of material.

Fire protection activities will be enhanced to include:

- power block deluge valve visual inspection requirements to include examinations for loss of material, cracking. and flow blockage,
- functional testing for flow blockage of sprinkler heads that have been in service for 50 years,
- visual inspections to detect loss of material of the diesel driven fire pump exhaust system,
- visual inspections to detect a change in material properties of the diesel driven fire pump fuel oil system flexible hoses,
- visual inspections of fire doors for loss of material,
- testing of a cast iron fire protection component to detect loss of material due to selective leaching.

(4) Detection of Aging Effects: The existing fire protection activities provide for:

- periodic visual inspections of the fire protection system piping, sprinklers, and valves that will detect loss of material, cracking, and flow blockage prior to loss of intended function,
- visual inspection of fire pumps for loss of material and flow blockage during corrective maintenance activities,
- periodic visual inspections of the diesel driven fire pump fuel oil system pumps, valves, piping and tubing that will detect loss of material and cracking prior to loss of intended function,
- continuous monitoring of fire protection system pressure that will detect pressure boundary leakage of buried fire main piping and valves prior to loss of intended function,
- periodic flow tests that will detect fire protection system blockage and

component degradation in buried fire main piping and valves, outdoor fire hydrants, hose connections, and hose station block valves prior to loss of intended function and,
- periodic visual inspections of fire barriers that will detect loss of material in fire doors, and changes in material properties, cracking, delamination, separation and loss of material in fire barrier penetrations and fire wraps prior to loss of intended functions.

Fire protection activities will be enhanced to include:
- periodic visual inspection of power block deluge valves to detect loss of material, cracking and flow blockage prior to loss of intended function,
- functional testing of sprinkler heads that have been in service for 50 years to detect flow blockage,
- periodic visual inspections of the diesel driven fire pump exhaust system to detect loss of material prior to loss of intended function,
- visual inspections of the diesel driven fire pump fuel oil system flexible hoses to detect a change in material properties prior to loss of intended function, and
- added specificity for detection of loss of material in requirements for visual inspection of fire doors, and
- a one-time test of cast iron fire protection component to detect loss of material due to selective leaching.

(5) Monitoring and Trending: Existing fire protection activities provide for the following monitoring and trending activities:
- sprinkler systems are functionally tested for flow blockage on a periodic basis,
- fire main flow testing, and hydrant flushes and inspections, are performed on a periodic basis,
- the diesel driven fire pump fuel oil system is visually examined for loss of material and cracking on a periodic basis,
- fire main pressure is continuously monitored for leakage,
- specified sample quantities of fire barrier penetration seals are inspected every 24 months with the entire population being inspected every 16 years for change in material properties, cracking, delamination, and separation, and
- fire wraps on structural steel and on electrical raceways are periodically visually inspected for change in material properties and loss of material.

Enhancements to fire protection activities will provide for the following monitoring and trending activities:
- sprinkler system deluge control valves will be visually inspected for loss of material, cracking, and flow blockage following sprinkler system testing,
- a representative sample of sprinkler heads that have been in service for 50 years will be functionally tested for flow blockage and verification of proper

operation,
- the diesel driven fire pump exhaust system will be visually inspected for loss of material on a periodic basis,
- diesel driven fire pump fuel oil system flexible hoses will be visually examined for a change in material properties on a periodic basis,
- fire barrier doors will be visually inspected for loss of material on a periodic basis, and
- if the one-time test yields unfavorable results, the scope will be expanded to other components, based upon engineering evaluations.

Fire protection testing and inspections are performed in accordance with controlled PBAPS procedures. Any degradation identified during testing and component inspections is evaluated in accordance with procedural requirements. When applicable, trending of findings is performed to determine potential long term impact.

(6) Acceptance Criteria: Tests and inspections for flow blockage, loss of material, cracking, change in material properties, and cracking, delamination, and separation aging effects are conducted in accordance with approved PBAPS procedures. These procedures contain specific acceptance criteria to confirm the systems ability to maintain required system pressures and flow rates and specific acceptance criteria for components and fire barriers to confirm their functionality. The diesel driven fire pump engine manufacturer's representative is present during engine inspections and provides standards to ensure that inspections are properly performed and that the material condition of the exhaust and fuel oil system components is acceptable.

Acceptance criteria for fire barrier doors require that there be no visual indication of corrosion. Acceptance criteria for fire barrier penetrations seals and fire wraps require that they exhibit no change in material properties, cracking, delamination, separation and loss of material.

Acceptance criteria will be based upon component material specifications.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: Buried cast iron components have typically demonstrated reliable performance in commercial and industrial applications for long operational periods. At PBAPS, repairs and replacements of several hydrants, fire pumps, and indoor piping have been required due to internal corrosion and wear. The presence of corrosion, silting, and clams have been noted during plant work order inspections. Modifications and work orders have repaired and replaced degraded fire barrier penetrations and fire barrier doors. Corrective actions were implemented prior to loss of system or barrier functions. The diesel driven fire pump fuel oil system has experienced minor leakage events that were detected and corrected in a timely manner. There have been no age related component failures resulting in a loss of function for the components covered by this aging management activity.

SUMMARY

The fire protection activities provide for inspections, monitoring, and performance testing of fire protection systems and components to detect aging effects prior to loss of intended function. Degradation of fire protection systems and components due to corrosion buildup, biofouling, and silting are detected by performance testing based on NFPA 24 standards. Periodic and maintenance inspections detect corrosion, fouling, and cracking in system components due to internal and external environment aging effects, and detect aging effects in fire barriers. Monitoring of system pressure detects system leakage due to both internal and external aging effects.

Based on industry and PBAPS experience, there is reasonable assurance that the fire protection activities as enhanced will adequately manage the internal and external environment aging effects on the fire protection system components and barriers so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) NFPA 24, “Standard for Outside Protection”, 1970

B.2.10 HPCI and RCIC Turbine Inspection Activities

ACTIVITY DESCRIPTION

The HPCI and RCIC turbine inspection activities provide for aging management of the HPCI and RCIC turbine casings that are exposed to a wetted gas environment. The HPCI turbine inspection activities additionally provide for condition monitoring of components exposed to a lubricating oil environment. The inspection activities perform assessments of components for loss of material aging effects. A PBAPS procedure will be enhanced to inspect the HPCI lubricating oil system flexible hoses for a change in material properties. The HPCI and the RCIC turbine inspection activities are performed periodically in connection with turbine maintenance in accordance with plant procedures.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The HPCI and RCIC turbine inspection activities focus on managing loss of material and change in material properties aging effects by the performance of periodic inspections of the turbine casings and HPCI lubricating oil system tank internals and flexible hoses.

(2) Preventive Actions: The HPCI and RCIC turbine inspection activities provide inspection methods to identify aging effects. There are no preventive or mitigating attributes associated with these activities.

(3) Parameters Monitored/Inspected: The HPCI and RCIC turbine inspection activities consist of visual inspections of the turbine casings and the HPCI lubricating oil tank internals for evidence of loss of material. These activities will also be enhanced to inspect the HPCI lubricating oil system flexible hoses for a change in material properties.

(4) Detection of Aging Effects: Visual inspections for evidence of loss of material are conducted in accordance with an existing PBAPS procedure. This procedure will be enhanced to perform a visual inspection of HPCI lubricating oil system flexible hoses for a change in material properties. Loss of material and change in material properties aging effects are identified and corrected prior to a loss of intended function.

(5) Monitoring and Trending: Visual examinations are conducted on a periodic basis. The examinations monitor the turbine casings, HPCI lubricating oil storage tank, and HPCI lubricating oil system flexible hoses for evidence of aging degradation.

(6) Acceptance Criteria: Examinations for pitting of turbine casings are conducted in accordance with approved PBAPS procedures. Engineering evaluations of identified turbine casing pitting are performed and appropriate corrective actions determined. Flexible hoses will be examined in accordance with approved PBAPS procedures and replaced when abnormal conditions are identified. The results of the examinations are documented.

HPCI lubricating oil tank internals are inspected for corrosion and scaling. Engineering evaluations of identified loss of material are performed and appropriate corrective actions determined.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: A review of the operating experience for PBAPS found that there have been no aging related turbine casing failures resulting in a loss of intended function of the HPCI or RCIC turbines. Minor HPCI lubricating oil system leakage events have been detected and corrected in a timely manner. There have been no HPCI lubricating oil age related component failures resulting in a loss of function.

<u>SUMMARY</u>

The HPCI and RCIC turbine inspection activities consist of visual inspections of the turbine casings and the HPCI lubricating oil tank internals for evidence of loss of material, and will be enhanced to inspect the HPCI lubricating oil system flexible hoses for a change in material properties. Based on PBAPS operating experience, there is reasonable assurance that the HPCI and RCIC turbine inspection activities will adequately manage the identified aging effects for the components so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

<u>REFERENCES</u>

None

B.2.11 Susquehanna Substation Wooden Pole Inspection Activity

ACTIVITY DESCRIPTION

The Susquehanna Substation wooden pole inspection activity manages the aging effects of loss of material and change in material properties for a wooden pole at the Susquehanna Substation. This pole provides the structural support for the conductors tying the substation to the submarine cable which is used to transmit the alternate AC power for PBAPS from the Conowingo Hydroelectric Plant in compliance with the requirements of 10 CFR 50.63 for coping with station blackout. The existing process will be enhanced to ensure the inspection activity will be performed every ten years in accordance with a PBAPS procedure.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The Susquehanna Substation wooden pole inspection activity applies to the wooden pole adjacent to the Susquehanna Substation.

(2) Preventive Actions: The Susquehanna Substation wooden pole inspection activity is a condition monitoring activity. There are no preventive or mitigating attributes associated with these activities.

(3) Parameters Monitored/Inspected: The wooden pole is inspected for loss of material due to ant, insect, and moisture damage, and for change in material properties due to moisture damage.

(4) Detection of Aging Effects: Inspection on a ten-year interval by a qualified inspector will assure that aging effects are detected prior to loss of intended function.

(5) Monitoring and Trending: Condition monitoring for loss of material and change in material properties are provided in the corporate specification for inspection of wooden poles.

(6) Acceptance Criteria: The acceptance criteria for the inspection are provided in the corporate specification for inspection of wooden poles.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: Corporate experience shows that inspections of wooden poles once every ten years is adequate to detect aging degradation prior to loss of intended function.

SUMMARY

The Susquehanna Substation wooden pole inspection activity inspects the pole that provides the structural support for the conductors tying the substation to the submarine cable.

Based on corporate experience, there is reasonable assurance that the Susquehanna Substation wooden pole inspection activity will manage loss of material and change in material properties of the pole so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.2.12 Heat Exchanger Inspection Activities

ACTIVITY DESCRIPTION

The heat exchanger inspection activities provide for periodic component visual inspections and component cleaning of heat exchangers and coolers that are outside the scope of NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety Related Equipment". These activities include condition monitoring actions for managing loss of material, cracking, and reduction of heat transfer effects for heat exchangers and coolers in reactor grade water environment.

The aging management review has determined that the aging management of loss of material and cracking of the HPCI gland seal condenser will be enhanced by periodic inspection of the HPCI gland seal condenser tube side internals.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The heat exchanger inspection activities provide for aging management for the HPCI gland seal condenser, the HPCI turbine lube oil cooler, and the RCIC turbine lube oil cooler through the cleaning and inspection of the heat exchangers on the water side. The scope of the activities will be enhanced to include periodic inspection of the HPCI gland seal condenser tube side internals.

(2) Preventive Actions: The heat exchanger inspection activities detect loss of material, cracking, and reduction of heat transfer aging effects prior to loss of intended function. There are no preventive or mitigating attributes associated with these activities.

(3) Parameters Monitored/Inspected: The heat exchanger visual inspections are performed in accordance with PBAPS procedures to identify degradation associated with loss of material, cracking, and reduction of heat transfer aging effects.

(4) Detection of Aging Effects: Loss of material and cracking degradation are detected through component surface visual inspections of the HPCI and RCIC turbine lube oil coolers on the water side. The existing maintenance procedures for the HPCI gland seal condenser will be enhanced to include periodic inspection of the condenser tube side internals to provide assurance of aging management for loss of material and cracking of the HPCI Gland Seal Condenser.

During disassembly, visual inspection for fouling would identify conditions, which could result in the reduction of heat transfer.

(5) Monitoring and Trending: The periodic component visual inspections and cleaning are conducted as part of HPCI and RCIC turbine inspections, and provide for timely detection of loss of material, cracking, and reduction of heat transfer prior to loss of intended function.

(6) Acceptance Criteria: Engineering evaluations of identified aging degradation including loss of material, cracking, flow blockage, and loss of heat transfer aging effects are used to confirm the ability of the component to perform its intended functions.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:
- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions, and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The heat exchanger inspection activities implement inspection and cleaning of heat exchangers. The PBAPS operating experience review identified no losses of pressure boundary integrity or heat transfer capability for these components as a result of aging degradation.

<u>SUMMARY</u>

The heat exchanger inspection activities provide for periodic component visual inspections and component cleaning of heat exchangers and coolers that are outside the scope of NRC Generic Letter 89-13, “Service Water System Problems Affecting Safety Related Equipment”. These activities include condition monitoring actions for managing loss of material, cracking, and reduction of heat transfer for heat exchangers and coolers in reactor grade water environment.

Based on PBAPS operating experience, there is reasonable assurance that the heat exchanger inspection activities will continue to manage loss of material, cracking, and reduction of heat transfer for heat exchangers and coolers in reactor grade water environment so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.3 NEW AGING MANAGEMENT ACTIVITIES

B.3.1 Torus Piping Inspection Activities

ACTIVITY DESCRIPTION

Torus piping inspection activities will consist of a one-time inspection of selected piping to verify the integrity of carbon steel piping located at the water-gas interface in the torus compartment of the primary containment. The aging management review determined that it would be prudent to conduct these activities to assure there is no unacceptable loss of material. The activities will be based upon the guidance provided in ASME Section V, 1989 Edition and will be implemented through a PBAPS procedure. The results of this inspection will bound the piping that runs above the water and is subjected to a humid but less corrosive environment of air/nitrogen.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The torus piping inspection activities will examine a susceptible location on a representative sample of carbon steel piping exposed to the water-gas interface environment in the torus to assure there is no unacceptable loss of material. The Torus Piping Inspection Activity will provide confirmation that the Main Steam SRV, HPCI Turbine, and RCIC Turbine piping discharging to the Torus is in acceptable condition. The results of this inspection will bound the Torus connected piping for the gas environments. The gas environment piping that runs above the waterline to the turbines, condensers, and SRVs is subjected to a humid but less corrosive environment of air/nitrogen.

(2) Preventive Actions: The torus piping inspection activities will be condition monitoring activities that identify loss of material aging effects. No preventive or mitigating attributes will be associated with the torus piping inspection activities.

(3) Parameters Monitored/Inspected: The torus piping inspection activities will provide for a one time inspection of wall thickness to assure there is no unacceptable loss of material that could potentially challenge the maintenance of the pressure boundary intended function of torus piping. In order to determine the condition of the carbon steel piping, located near the waterline, an ultrasonic (UT) test to measure the wall thickness at a sample location will be performed. The results of this inspection will bound the Torus connected piping for the gas environments.

(4) Detection of Aging Effects: The torus piping inspection activities will be undertaken to provide reasonable assurance that there is no loss of material at the water-gas interface that would result in loss of intended function of the carbon steel piping in the torus.

(5) Monitoring and Trending: Results of the torus piping inspection activities will be evaluated. The scope and frequency of subsequent examinations will be based on the results of the initial inspection sample.

(6) Acceptance Criteria: The torus piping inspection activities acceptance criteria will be used to ensure that there is no unacceptable loss of material of the carbon steel piping in the torus. Apparent unacceptable indications of corrosion will be evaluated by further engineering analysis and if warranted, additional inspections performed. The inspection acceptance criteria will provide assurance that the minimum wall thickness requirements for the torus piping continue to be met during the period of extended operation.

(7) Corrective Actions: Identified deviations will be evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: There has been no loss of intended function of PBAPS torus piping due to age related loss of material. The torus piping inspection activities are new, and therefore, there is no operating history associated with these activities. A review of industry experience shows no failures of torus piping at the water-gas interface.

SUMMARY

Torus piping inspection activities will consist of a one-time inspection of selected piping to verify the integrity of carbon steel piping located at the water-gas interface in the torus. The activities will be based upon the guidance provided in ASME Section V, 1989 Edition and will be implemented through a PBAPS procedure.

Based on PBAPS and industry experience and the use of industry guidance for conducting the inspection, there is reasonable assurance that the torus piping inspection activities will manage loss of material for carbon steel piping located at the water-gas interface in the torus so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) ASME Boiler and Pressure Vessel Code, 1989 Edition, Section V, “Nondestructive Examination”, Subsection A, “Nondestructive Methods of Examination”, Article 5, “Ultrasonic Examination Methods for Materials and Fabrication”

(2) ASME Boiler and Pressure Vessel Code, 1989 Edition, Section V, “Nondestructive Examination”, Subsection B, “Documents Adopted by Section V”, Article 23, “Ultrasonic Standards”

B.3.2 FSSD Cable Inspection Activity

ACTIVITY DESCRIPTION ACTIVITIES

FSSD cable inspection activities will consist of inspections of the PVC insulated fire safe shutdown (FSSD) cables located in the drywell. These cables are all MSRV discharge line thermocouple wires. This inspection will manage a change in material properties of the PVC insulation.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The FSSD cable inspection activities will include evaluation of PVC insulated fire safe shutdown (FSSD) cables that are within the scope of license renewal and are installed in the drywell.

(2) Preventive Actions: FSSD Cable inspection activities will be conducted for condition monitoring purposes. No preventive or mitigating attributes will be associated with FSSD cable inspection activities.

(3) Parameters Monitored/Inspected: The PVC insulation will be visually inspected for surface anomalies such as embrittlement, discoloration, or cracking.

(4) Detection of Aging Effects: FSSD cable inspection activities will identify anomalies in the PVC insulation surface that are precursor indications of a loss of material properties for PVC insulated cables.

(5) Monitoring and Trending: Sample size of the inspection will be identified in the inspection activity. The PVC insulated FSSD cables will be inspected once every 10 years.

(6) Acceptance Criteria: Acceptance will require that no unacceptable visual indications of insulation surface anomalies exist that would suggest that the insulation has degraded, as determined by engineering evaluation. An unacceptable indication will be defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the intended function.

(7) Corrective Actions: Identified deviations will be evaluated within the PBAPS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

(8) Confirmation Process: The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: No age-related PVC insulated FSSD cable failures have occurred at PBAPS.

SUMMARY

FSSD cable inspection activities will consist of inspections of the PVC insulated fire safe shutdown (FSSD) cables located in the drywell.

Based on industry experience with cable aging and inspections, there is reasonable assurance that FSSD cable inspection activities will manage a change in material properties of the PVC insulation so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

B.4 TIME-LIMITED AGING ANALYSES ACTIVITIES

B.4.1 Environmental Qualification Activities

ACTIVITY DESCRIPTION

The PBAPS environmental qualification (EQ) program maintains the qualified life of the electrical equipment important to safety within the scope of 10 CFR 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants." An aging limit (qualified life) is established for equipment within the scope of the PBAPS EQ program and an appropriate action such as replacement or refurbishment is taken prior to or at the end of the equipment qualified life so that the aging limit is not exceeded. Environmental qualification binders (EQBs) are maintained to demonstrate and document the qualified life of the equipment.

The PBAPS EQ program activities establish, demonstrate and document the level of qualification, qualified configuration, maintenance, surveillance and replacement requirements necessary to meet the requirements of 10 CFR 50.49.

The PBAPS EQ program includes maintenance of supporting documentation, such as input information, references, calculations, analyses, EQ related correspondence, qualification test reports and certifications.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The PBAPS EQ program includes certain electrical components that are important to safety and could be exposed to harsh environment accident conditions, as defined in 10 CFR 50.49.

(2) Preventive Actions*:* 10 CFR 50.49 does not require actions that prevent aging effects. The PBAPS EQ program actions that could be viewed as preventive actions include (a) establishing the component service condition tolerance and aging limits (for example, qualified life or condition limit), (b) refurbishment, replacement, or requalification of installed equipment prior to reaching these aging limits, and (c) where applicable, requiring specific installation, inspection, monitoring, or periodic maintenance actions to maintain equipment aging effects within the qualification.

(3) Parameters Monitored/Inspected: EQ component aging limits are not typically based on condition or performance monitoring. However, per Regulatory Guide 1.89 Rev. 1, such monitoring programs are an acceptable basis to modify aging limits. Monitoring or inspection of certain environmental, condition or equipment parameters may be used to ensure that the equipment is within its qualification or as a means to modify the qualification.

(4) Detection of Aging Effects: 10 CFR 50.49 does not require the detection of aging effects for in-service components. Monitoring of aging effects may be used as a means to modify component aging limits.

(5) Monitoring and Trending: 10 CFR 50.49 does not require monitoring and trending of component condition or performance parameters of in-service components to manage the effects of aging. EQ program actions that could be viewed as monitoring include monitoring how long qualified components have been installed. Monitoring or inspection of certain environmental, condition or component parameters may be used to ensure that a component is within its qualification or as a means to modify the qualification.

(6) Acceptance Criteria: 10 CFR 50.49 acceptance criteria is that an in-service EQ component is maintained within its qualification including (a) its established aging limits and (b) continued qualification for the projected accident conditions. 10 CFR 50.49 requires refurbishment, replacement, or requalification prior to exceeding the aging limits of each installed device. When monitoring is used to modify a component aging limit, plant-specific acceptance criteria are established based on applicable 10 CFR 50.49(f) qualification methods.

(7 & 8) Corrective Actions & Confirmation Process: If an EQ component is found to be outside its qualification, corrective actions are implemented in accordance with the PBAPS corrective action process. When unexpected adverse conditions are identified during operational or maintenance activities that affect the environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions. When emerging industry aging issues are identified that affect the qualification of an EQ component, the affected component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions. Confirmatory actions, as needed, are implemented as part of the PBAPS corrective action process.

(9) Administrative Controls: The PBAPS EQ program is subject to administrative controls, which require formal reviews and approvals. The PBAPS EQ program will continue to comply with 10 CFR 50.49 throughout the renewal period including development and maintenance of qualification documentation demonstrating a component will perform required functions during harsh accident conditions. The PBAPS EQ program documents identify the applicable environmental conditions for the component locations. The PBAPS EQ program qualification files are maintained in an auditable form for the duration of the installed life of the component. The PBAPS EQ program documentation is controlled under the quality assurance program.

(10) Operating Experience: The PBAPS EQ program includes consideration of operating experience to modify qualification bases and conclusions, including aging limits. Compliance with 10 CFR 50.49 provides evidence that the component will perform its intended functions during accident conditions after experiencing the detrimental effects of in-service aging.

SUMMARY

Under 10 CFR 54.21c(1)(iii), EQ programs, which implement the requirements of 10 CFR 50.49 are viewed as aging management programs for license renewal. The PBAPS EQ program complies with all applicable regulations and manages component thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods, and provides reasonable assurance that the components within the scope of license renewal will maintain their intended function consistent with the current licensing basis for the period of extended operation.

REFERENCES

(1) Code of Federal Regulations, Title 10, Part 50, Section 49, Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

(2) NRC Regulatory Guide 1.89, Rev. 1, Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants, June 1984

B.4.2 Fatigue Management Activities

ACTIVITY DESCRIPTION

The fatigue management program counts fatigue stress cycles and tracks fatigue usage factors. The program will be enhanced to broaden its scope and update implementation methods, and will consist of analytical methods to determine stress cycles and fatigue usage factors from operating cycles, automated counting of fatigue stress cycles, and automated calculation and tracking of fatigue cumulative usage factors (CUFs). The program will calculate and track CUF for bounding locations in the reactor pressure vessel (RPV), RPV internals, Group I piping, and containment torus, in order to manage fatigue in these components and structures. The program will rely upon the FatiguePro cycle counting and fatigue usage factor tracking program. FatiguePro is an EPRI-licensed computerized data acquisition, recording and tracking program that is being customized for PBAPS use.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Activity: The fatigue management program will consist of automated cycle counting and fatigue CUF tracking activities that will monitor critical components of the RPV and Group I piping reactor coolant pressure boundary, reactor internals, and torus structure.

Bounding locations for monitoring these components will be determined by an evaluation of the ASME Section III fatigue analyses of the reactor vessels, analyses of the vessel internals, ASME Section III Class 1 piping fatigue analyses, and the Mark I Containment Plant Unique Analyses. Simplified fatigue analyses will be performed to establish usage factors for USAS B31.1 Group I piping.

(2) Preventive Actions: The fatigue management program will monitor component and structure conditions. It includes no preventive or mitigating activities.

(3) Parameters Monitored or Inspected: The fatigue management program will monitor plant transients that contribute to the fatigue usage for each of the monitored reactor coolant pressure boundary, reactor internals, and torus structure components included in the program scope.

(4) Detection of Aging Effects: The fatigue management program will continuously monitor plant operational events, will calculate usage factors for all monitored locations, and will compare the accumulated data to allowable values; and will thereby identify the need for any corrective actions.

This process and the associated trending will allow appropriate corrective or mitigating actions to be taken, thereby maintaining structural safety factors originally considered in the plant design basis, and thereby preventing loss of the intended function.

(5) Monitoring and Trending: The fatigue management program will monitor and trend fatigue CUF and will allow corrective measures to be implemented in time to ensure that structural margins required by codes used in the original plant design are maintained throughout the operating life of the plant. The recording and assessment frequency reasonably ensures that normal operating transients which might occur during operation will not compromise these limits. The activities also will include provisions to identify deviations from expected fatigue CUF so that appropriate corrective or mitigating actions can be taken.

(6) Acceptance Criteria: The acceptance criterion consists of maintaining the CUF below the appropriate design code limit. This acceptance criterion will ensure that original structural margins considered in the plant design are maintained throughout the period of extended operation, and will thereby prevent loss of the intended function.

(7) Corrective Actions: Identified deviations are evaluated within the PBAPS corrective action process which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

***(8) Confirmation Process*:** The PBAPS corrective action process includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls: All credited aging management activities are subject to administrative controls, which require formal reviews and approvals.

(10) Operating Experience: The fatigue monitoring program was developed by EPRI, for the industry, in response to NRC concerns that early-life operating cycles at some units had caused fatigue usage factors to accumulate faster than anticipated in the design analyses. This fatigue monitoring program was therefore designed to ensure that the code limit will not be exceeded in the remainder of the licensed life. The fatigue management program will include operating experience provisions to ensure that corrective actions and experience are incorporated into future corrections and improvements.

SUMMARY

The fatigue management activities will adequately manage fatigue of reactor pressure vessel (RPV), RPV internals, Group I piping, and containment torus components consistent with the current licensing basis for the period of extended operation.

REFERENCES

None

APPENDIX C COMMODITY GROUPS (Optional)

Appendix C - Not Used

APPENDIX D TECHNICAL SPECIFICATION CHANGES (Later, if required)