License Renewal Application

Donald C. Cook Nuclear Plant

October 2003

PREFACE

The following describes the content, layout, and editorial conventions in the Donald C. Cook Nuclear Plant (CNP) License Renewal Application (hereinafter referred to as "this application" or "the application"). With the exception of the intended function definitions, abbreviations and acronyms used throughout this application are defined in the table at the end of this preface. The abbreviations used for intended functions are defined in Table 2.0-1. Commonly understood terms (such as U.S.) and terms used only in referenced document numbers (such as DPR) may not be identified in this table. Regulatory documents such as NUREG-1801, *Generic Aging Lessons Learned (GALL) Report,* U. S. Nuclear Regulatory Commission, April 2001, and 10 CFR Part 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants* (the license renewal rule), are typically referred to solely by the document number; i.e., NUREG-1801 and 10 CFR 54, respectively.

Section 1 provides administrative information, including information about the plant owner, the licensee (the Applicant), and the site. This is required by the following sections of 10 CFR 54:

- 10 CFR 54.17, "Filing of application"; and
- 10 CFR 54.19, "Contents of application – general information."

Section 2 describes and justifies the screening and scoping methods used to determine the systems and structures within the scope of license renewal and the structures and components subject to an aging management review (AMR). Results of the system and structure scoping effort are provided in Tables 2.2-1, 2.2-2, 2.2-3, and 2.2-4**.**

- 2.2-1a, 2.2-1b, and 2.2-3 list the mechanical systems, electrical systems, and structures, respectively, within the scope of license renewal.
- 2.2-2 and 2.2-4 list the systems and structures, respectively, not in the scope of license renewal.

Section 2 also provides descriptions of in-scope systems and structures and their intended functions. These descriptions refer to the license renewal drawings that identify the mechanical components that are subject to aging management review. One electrical drawing is provided to identify the offsite power boundary for license renewal. The drawings, which are provided as a separate attachment to the license renewal application, are neither incorporated by reference into this application nor considered part of the application. Tables in Section 2 identify structures and components requiring aging management review and their intended functions. In conjunction with Section 3 and Appendix B, information in Section 2 fulfills the requirements of 10 CFR 54.21(a) for an integrated plant assessment (IPA).

Section 3 describes the results of the aging management reviews and is divided into six sections that address the following:

(1) Reactor vessel, internals, and reactor coolant system;

(2) Engineered safety features;

(3) Auxiliary systems;

(4) Steam and power conversion systems;

(5) Containment, structures, and component supports; and

(6) Electrical and instrumentation and controls.

Tables in Section 3 provide a summary of information concerning the aging effects requiring management, and the applicable aging management programs (AMPs) for structures and components in the scope of license renewal. Information presented in these tables is based on the format and content of NUREG-1800, *Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants*, U. S. Nuclear Regulatory Commission, April 2001.

The Section 3 tables include comparisons with evaluations documented in NUREG-1801. In conjunction with Section 2 and Appendix B, information in Section 3 fulfills the requirements of 10 CFR 54.21(a) for an IPA. In addition to the NUREG-1801-style tables, an additional nine-column table will accompany each system, as agreed upon by the NRC Staff and the industry for those applicants submitting license renewal applications in 2003 and 2004. These nine-column tables provide additional information and cross-referencing associated with NUREG-1801 items and measures taken to manage aging effects at CNP.

Section 4 addresses the time-limited aging analyses (TLAAs), as defined by 10 CFR 54.3. It includes identification of the component or subject and an explanation of the time-dependent aspects of the calculation or analysis. Section 4 demonstrates whether—

(1) the analyses remain valid for the period of extended operation;

(2) the analyses have been projected to the end of the period of extended operation; or

(3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

A review of the CNP docket has been performed and the results of this review identified two 10 CFR 50.12 exemptions based on a TLAA as defined in 10 CFR 54.3. These exemptions are discussed in Section 4.1.2. Information in Section 4 fulfills the requirements of 10 CFR 54.21(c) for evaluation of TLAAs.

Appendix A, Updated Final Safety Analysis Report Supplement, provides a summary description of the programs and activities that will manage the effects of aging for the period of extended operation. A summary description of the evaluation of TLAAs for the period of extended operation is also included. Following issuance of the renewed license, material contained in this appendix will be incorporated into the Updated Final Safety Analysis Report (UFSAR). Information in Appendix A fulfills the requirements of 10 CFR 54.21(d) for an FSAR supplement.

Appendix B, Aging Management Programs, describes the aging management programs (AMPs) and activities that will manage the aging effects on the structures and components within the scope of the license renewal rule such that the plant systems, structures, and components will continue to perform their intended functions consistent with the current licensing basis during the period of extended operation. Appendix B contains a comparison of the CNP programs to the programs evaluated in NUREG-1801. In conjunction with Sections 2 and 3, information in Appendix B fulfills the requirements of 10 CFR 54.21(a) for an IPA.

Appendix C is not used.

Appendix D, Technical Specification Changes, concludes that no Technical Specification changes are necessary to manage the effects of aging during the period of extended operation. Information in Appendix D fulfills the requirements of 10 CFR 54.22, “Contents of application – technical specifications.”

Appendix E contains environmental information relative to license renewal. Information in Appendix E fulfills the requirements of 10 CFR 54.23, “Contents of application – environmental information,” and 10 CFR 51.53(c), “Postconstruction environmental reports – Operating license renewal stage.”

In the electronic version of this application, hyperlinks are provided in the text where related subsections, appendices, drawings, or UFSAR sections are mentioned.

ABBREVIATIONS AND ACRONYMS

Abbreviation/Acronym	Description
AC	alternating current
ACI	American Concrete Institute
AEP	American Electric Power Company
AFW	auxiliary feedwater
AISC	American Institute of Steel Construction
AMP	aging management program
AMR	aging management review
AS	auxiliary steam
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AVB	anti-vibration bar
AWWA	American Water Works Association
B&PV	Boiler and Pressure Vessel
BD	blowdown
BIT	boron injection tank
BMI	bottom-mounted instrumentation
BWR	boiling water reactor
CASS	cast austenitic stainless steel
CCW	component cooling water
CE	Combustion Engineering
CEQ	containment equalization / hydrogen skimmer
CF	chemical feed
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CNP	Donald C. Cook Nuclear Plant
CO_2	carbon dioxide
CPWCPS	containment penetration and weld channel pressurization system
CRDM	control rod drive mechanism
CST	condensate storage tank
CTRLA	control air
CTS	containment spray
CUF	cumulative usage factor
C_V USE	Charpy upper-shelf energy
CVCS	chemical and volume control system
CW	circulating water
DC	direct current

Abbreviation/Acronym	Description
DEMIN	demineralized water
DOR	Division of Operating Reactors
DRAIN	process drains – miscellaneous drain tank
ECCS	emergency core cooling system
ECT	eddy current testing
EDG	emergency diesel generator
EFPY	effective full power years
EPRI	Electric Power Research Institute
EQ	environmental qualification
ESF	engineered safety features
ESFAS	engineered safety features actuation system
ESRR	Expanded System Readiness Review
ESW	essential service water
FAC	flow-accelerated corrosion
FAP	fatigue action plan
FDB	Facility Database
FHA	Fire Hazards Analysis
FP	fire protection
FPPM	Fire Protection Program Manual
FRV	feedwater regulating valve
GALL	NUREG-1801, *Generic Aging Lessons Learned*
GDC	General Design Criterion
GL	Generic Letter
GSI	Generic Safety Issue
HELB	high-energy line break
HPSI	high pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and controls
I&M	Indiana Michigan Power Company
IASCC	irradiation-assisted stress corrosion cracking
ICE	ice condenser
IGA	intergranular attack
IGSCC	inter-granular stress corrosion cracking
ILRT	integrated leakage rate test
IN	Information Notice
INEL	Idaho National Engineering Laboratory
IPA	integrated plant assessment

Abbreviation/Acronym	Description
IR	insulation resistance
ISG	Interim Staff Guidance
ISI	inservice inspection
ITG	Issues Task Group (PWR Materials Reliability Project)
ksi	1000 pounds per square inch
LBB	leak before break
LOCA	loss of coolant accident
LPSI	low pressure safety injection
LRA	license renewal application
LTOP	low temperature overpressure protection
LTW	Lake Charter Township water
MATL	material/equipment handling
MCC	motor control center
MDAFP	motor-driven auxiliary feedwater pump
MIC	microbiologically influenced corrosion
MRP	Material Reliability Program
MSLB	main steam line break
MSS	Manufacturer’s Standardization Society
MT	main turbine
MWe	megawatts-electric
MWt	megawatts-thermal
N2	reactor nitrogen
NaOH	sodium hydroxide
NDE	non-destructive examinations
NEI	Nuclear Energy Institute
NESW	nonessential service water
NF	nuclear fuel
NFPA	National Fire Protection Association
NPS	nominal pipe size
NS	nuclear sampling
NSSS	nuclear steam supply system
OBE	operational basis earthquake
ODSCC	outside diameter stress corrosion cracking
OFPW	offsite power
PA	plant air
PACHMS	post-accident containment hydrogen monitoring system

Abbreviation/Acronym	Description
PASS	post-accident sampling system
PM	Preventive Maintenance
P-T	pressure-temperature
PTS	pressurized thermal shock
PW	primary water
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
QAPD	Quality Assurance Program Description
RAAI	Renewal Applicant Action Item
RCP	reactor coolant pump
RCS	reactor coolant system
RF	refueling
RHR	residual heat removal
RMS	radiation monitoring system
RPV	reactor pressure vessel
RT_{PTS}	reference temperature (pressurized thermal shock)
RTS	reactor trip system
RVI	reactor vessel internals
RVID	reactor vessel integrity database
RVLIS	reactor vessel level instrumentation system
RWD	radioactive waste disposal
RWST	refueling water storage tank
SAT	spray additive tank
SBO	station blackout
SCC	stress corrosion cracking
SCRN	screen wash
SD	station drainage
SER	Safety Evaluation Reports
SFP	spent fuel pool
SG	steam generator
SS	stainless steel
SSC	system, structure, and component
SSCA	Safe Shutdown Capability Assessment
T/4	one fourth of the way through the vessel wall
TDAFP	turbine-driven auxiliary feedwater pump
TLAAs	time-limited aging analyses
TS	Technical Specifications

Abbreviation/Acronym	Description
TSC	technical support center
UFSAR	Updated Final Safety Analysis Report
USE	upper-shelf energy
UV	ultraviolet
VAB	auxiliary building ventilation
VCONT	containment ventilation
VCRAC	control room ventilation system
VEDG	emergency diesel generator ventilation
VES	engineered safety features ventilation
VHP	vessel head penetration
VMISC	miscellaneous ventilation
VSFP	spent fuel pool ventilation
VSWGR	switchgear ventilation
WCAP	Westinghouse Commercial Atomic Power
WOG	Westinghouse Owners Group

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1.0 ADMINISTRATIVE INFORMATION

Pursuant to Part 54 of Title 10 of the *Code of Federal Regulations* (10 CFR 54), this application seeks renewal, for an additional 20-year term, of the facility operating licenses for Donald C. Cook Nuclear Plant (CNP), Units 1 and 2. The current Unit 1 facility operating license (DPR-58) expires at midnight on October 25, 2014. The current Unit 2 facility operating license (DPR-74) expires at midnight on December 23, 2017. This application also seeks renewal of the source material, special nuclear material, and by-product material licenses that are subsumed in or combined with each of the facility operating licenses.

This application is organized in accordance with Regulatory Guide 1.188, *Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses*, April 2001, and is consistent with guidance provided by NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR 54 - License Renewal*, Nuclear Energy Institute, Revision 3, March 2001. In addition, a summary of the issues for which additional NRC Staff and industry guidance may be necessary, as addressed in NRC Interim Staff Guidance documents (ISGs), is presented in the application.

This application is intended to provide sufficient information for the NRC to complete its technical and environmental reviews pursuant to 10 CFR 54 and 10 CFR 51, *Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,* respectively.

This application is designed to allow the NRC to make the findings required by 10 CFR 54.29, “Standards for issuance of a renewed license,” in support of the issuance of renewed facility operating licenses for CNP.

1.1 GENERAL INFORMATION

The following is the general information required by 10 CFR 54.17 and 10 CFR 54.19.

1.1.1 Name of Applicant

Indiana Michigan Power Company (I&M), the current licensee and renewal applicant, is a subsidiary of American Electric Power Company (AEP).

1.1.2 Address of Applicant

Indiana Michigan Power Company
1 Riverside Plaza
Columbus, Ohio 43215

Address of Donald C. Cook Nuclear Plant

Donald C. Cook Nuclear Plant
1 Cook Place
Bridgman, Michigan 49106

Address of American Electric Power Company

American Electric Power Company
1 Riverside Plaza
Columbus, Ohio 43215

1.1.3 Description of Business of Applicant

I&M, the licensee for CNP, is a wholly-owned subsidiary of AEP, a public utility holding company. I&M is a public utility engaged in the generation, purchase, sale, transmission, and distribution of electric power to approximately 567,000 retail customers in its service territory in northern and eastern Indiana, and a portion of southwestern Michigan. As a member of the AEP Power Pool, I&M shares the revenues and the costs of the AEP Power Pool's wholesale sales to neighboring utilities and power marketers, including power trading transactions. I&M also sells wholesale power to municipalities and electric cooperatives.

AEP is one of the largest investor-owned electric public utility holding companies in the United States. AEP provides generation, transmission, and distribution service to over 4.9 million retail customers in eleven states (Arkansas, Indiana, Kentucky, Louisiana, Michigan, Ohio, Oklahoma, Tennessee, Texas, Virginia, and West Virginia) through its electric utility operating companies. AEP markets and trades electricity and natural gas in the United States and Europe.

1.1.4 Organization and Management of Applicant

I&M is a public utility incorporated under the laws of the State of Indiana. AEP is an investor-owned electric public utility holding company incorporated under the laws of the State of New York. Neither AEP nor I&M is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

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

Directors (I&M)

E. Linn Draper, Jr. Chairman of the Board	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Karl G. Boyd	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
John E. Ehler	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Henry W. Fayne	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Thomas M. Hagan	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
David L. Lahrman	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Marc E. Lewis	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215

Directors (I&M) (continued)

Susanne M. Moorman	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Robert P. Powers	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
John R. Sampson	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Thomas V. Shockley, III	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
D. B. Synowiec	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Susan Tomasky	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215

Principal Officers (I&M)

E. Linn Draper, Jr. Chief Executive Officer	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Henry W. Fayne President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Mano K. Nazar Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215

Principal Officers (I&M) (continued)

Karl G. Boyd Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Wendy G. Hargus Assistant Treasurer	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Glenn M. Files Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Thomas M. Hagan Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Michelle S. Kalnas Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Holly Keller Koeppel Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Mark C. McCullough Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Armando A. Pena Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Robert P. Powers Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Marsha P. Ryan Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215

Principal Officers (I&M) (continued)

John R. Sampson Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Thomas V. Shockley, III Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
William L. Sigmon, Jr. Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Susan Tomasky Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Richard P. Verret Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
William F. Vineyard Vice President	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Joseph M. Buonaiuto Controller and Chief Accounting Officer	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215
Timothy A. King Secretary	Indiana Michigan Power Company 1 Riverside Plaza Columbus, Ohio 43215

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

Directors (AEP)

E. Linn Draper, Jr. Chairman of the Board	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Thomas V. Shockley, III Vice Chairman of the Board	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
E. R. Brooks	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Donald M. Carlton	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
John P. DesBarres	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Robert W. Fri	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
William R. Howell	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Lester A. Hudson, Jr.	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Leonard J. Kujawa	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215

Directors (AEP) (continued)

Richard L. Sandor	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Donald G. Smith	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Linda Gillespie Stuntz	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Kathryn D. Sullivan	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215

Principal Officers (AEP)

E. Linn Draper, Jr. President and Chief Executive Officer	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Henry W. Fayne Vice President	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Susan Tomasky Vice President, Secretary, and Chief Financial Officer	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Wendy G. Hargus Assistant Treasurer	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215
Joseph M. Buonaiuto Controller and Chief Accounting Officer	American Electric Power Company 1 Riverside Plaza Columbus, Ohio 43215

1.1.5 Class and Period of License Sought

I&M requests renewal of the Class 104b facility operating license for CNP Unit 1 (facility operating license DPR-58) for a period of 20 years beyond the expiration of the current license term. License renewal would extend the facility operating license from midnight on October 25, 2014, to midnight on October 25, 2034.

I&M requests renewal of the Class 104b facility operating license for CNP Unit 2 (facility operating license DPR-74) for a period of 20 years beyond the expiration of the current license term. License renewal would extend the facility operating license from midnight on December 23, 2017, to midnight on December 23, 2037.

This application also includes a request for renewal of the source material, special nuclear material, and by-product material licenses that are subsumed in or combined with the current facility operating licenses.

1.1.6 Alteration Schedule

I&M does not propose to construct or alter any production or utilization facility in connection with this application.

1.1.7 Regulatory Agencies and Local News Publications

The following regulatory agencies have jurisdiction over AEP's rates and services.

Indiana Utility Regulatory Commission
Indiana Government Center South
302 West Washington Street
Suite E-306
Indianapolis, IN 46204

Michigan Public Service Commission
P. O. Box 30221
Lansing, MI 48909-7721

Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426-0002

The following news publications are in circulation near CNP and are considered appropriate to give reasonable notice of this application:

The Herald Palladium
P.O. Box 128
St. Joseph, MI 49085

Niles Daily Star
217 N. 4th Street
Niles, MI 49120

South Bend Tribune
225 W. Colfax Ave.
South Bend, IN 46626

1.1.8 Conforming Changes to Standard Indemnity Agreement

10 CFR 54.19(b) requires that license renewal applications 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 (No. B-61) for CNP states, in Article VII, that the agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment to the agreement, which is the last to expire.

Item 3 of the Attachment to the indemnity agreement, as revised by Amendment No. 7, lists CNP special nuclear material licenses SNM-1301 and SNM-1753, and operating licenses DPR-58 and DPR-74. I&M requests that conforming changes be made to Article VII of the indemnity agreement, and Item 3 of the Attachment to that agreement, specifying the extension of agreement to the expiration date of the renewed CNP facility operating licenses sought in this application.

In addition, should the license numbers be changed upon issuance of the renewal license, I&M requests that conforming changes be made to Item 3 of the Attachment to the indemnity agreement, and to other sections of the agreement as deemed appropriate.

1.1.9 Restricted Data Agreement

This application does not contain any Restricted Data, Safeguards Information, or National Security Information. I&M does not expect that any activity or review requisite to issuance of the renewed license for CNP will involve such information. However, if such information were to become involved, I&M agrees to appropriately safeguard such information and not permit any individual to have access to, or any facility to possess, such information until the individual or facility has been approved under the provisions of 10 CFR 25 or 10 CFR 95, respectively.

1.2 DESCRIPTION OF DONALD C. COOK NUCLEAR PLANT

The CNP site encompasses approximately 650 acres. The site is located along the eastern shore of Lake Michigan in Lake Charter Township, Berrien County, Michigan; about 11 miles south-southwest of Benton Harbor, Michigan. The nearest town is Bridgman, Michigan, which is approximately two miles south of the plant site.

The two-unit plant is operated by I&M. Each unit employs a pressurized water reactor (PWR) nuclear steam supply system (NSSS) furnished by Westinghouse Electric Corporation. The Unit 1 reactor is licensed for a power output of 3304 megawatts-thermal (MWt), and the Unit 2 reactor is licensed for a power output of 3468 MWt. The approximate net electrical outputs of Unit 1 and Unit 2 are 1044 megawatts-electric (MWe) and 1117 MWe, respectively. Descriptive information about Unit 1, Unit 2, and common systems and structures is provided in Section 2 of this application. Additional descriptions of CNP systems and structures can be found in the UFSAR.

2.0 Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results

This section describes the process for identification of structures and components subject to aging management review (AMR) in the CNP Integrated Plant Assessment (IPA). For those systems, structures, and components (SSCs) within the scope of license renewal, 10 CFR 54.21(a)(1) requires a license renewal applicant to identify and list the structures and components subject to aging management review. Furthermore, 10 CFR 54.21(a)(2) requires that methods used to identify and list these structures and components be described and justified. Technical information in this chapter satisfies these requirements.

The scoping and screening method is described in Section 2.1. Results of the assessment to identify systems and structures within the scope of license renewal (plant-level scoping) are in Section 2.2. Results of the identification of the structures and components subject to aging management review (screening) are in the following sections:

- Section 2.3 for mechanical systems,
- Section 2.4 for structures, and
- Section 2.5 for electrical and instrumentation and controls (I&C) systems.

Table 2.0-1 provides expanded definitions of intended functions identified in this application for structures and components. Additional system-specific intended functions are defined as necessary in the AMR results sections. Due to the length of the definitions and space limitations in some tables, abbreviations may be used.

Table 2.0-1
Intended Functions: Abbreviations and Definitions

Intended Function	Abbreviation	Definition
Conducts Electricity	CE	Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals
Control Rod Support	*	Provide support, orientation, guidance, and protection of the control rod assemblies
Core Support	*	Provide support and orientation of the reactor core (i.e., the fuel assemblies)
Filtration	FLT	Provide filtration
Fire Barrier	FB	Provide rated fire barrier to confine or retard a fire from spreading to or from adjacent areas
Flow Control	FC	Provide flow restriction or throttling (mechanical). Prevent the flow of steam and air from bypassing the ice condenser during a loss of coolant accident (LOCA) or main steam line break (MSLB) (structural)
Flow Distribution	FD	Accumulate and direct water to support the emergency core cooling system (ECCS) and containment spray system functions during the recirculation phase of an accident. For the reactor coolant system (RCS) (Table 3.1.2-2), provide a passageway for the distribution of the reactor coolant flow to the reactor core
Flood Barrier	FLB	Provide flood protection barrier (internal or external flooding event)
Flow Shield	FS	Provide spray shield or curbs for directing flow
Heat Transfer	HT	Provide for heat transfer
HELB Shield	HELB	Provide shielding against high energy line breaks (HELB)
Incore Support	*	Provide a passageway for support, guidance, and protection for the incore instrumentation
Insulation	IN	To insulate and support an electrical conductor

Table 2.0-1
Intended Functions: Abbreviations and Definitions (Continued)

Intended Function	Abbreviation	Definition
Missile Barrier	MB	Provide barrier against internally or externally generated missile
Neutron Absorption	NAB	Provide neutron absorption in spent fuel pool
Pressure Boundary	PB	Provide pressure boundary (mechanical definition). Provide pressure boundary or essentially leaktight barrier to protect public health and safety in the event of postulated design basis events (structural definition)
Pressure Control	PC	Provide pressure control (pressurizer spray components)
Pipe Whip Restraint	PW	Provide pipe whip restraint
Secondary Core Support	*	Provide secondary core support for limiting the downward displacement of the core support structure
Shielding	*	Provide gamma and neutron shielding for the reactor pressure vessel
Source of Cooling Water	SCW	Provide source of cooling water for plant shutdown
Spent Fuel Storage	SF	Provide for storage of spent fuel assemblies
Structural Support [Criterion (a)(2) equipment]	SNS	Provide structural or functional support to nonsafety-related equipment whose failure could directly prevent satisfactory accomplishment of required safety-related functions
Shelter or Protection	SP	Provide shelter or protection to safety-related equipment (including radiation shielding)
Structural Support [Criterion (a)(3) equipment]	SRE	Provide structural or functional support to components credited for regulated events

Table 2.0-1
Intended Functions: Abbreviations and Definitions (Continued)

Intended Function	Abbreviation	Definition
Structural Support [Criterion (a)(1) equipment]	SSR	Provide structural support and functional support to safety-related equipment, including self-support for Class I structures

*Functions specific to the RCS do not use abbreviations.

2.1 SCOPING AND SCREENING METHODOLOGY

2.1.1 Scoping Methodology

The License Renewal Rule (10 CFR 54) defines the scope of license renewal. 10 CFR 54.4(a) requires systems, structures, and components (SSCs) to be included in the license renewal process if they are —

(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 § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.

(2) All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of the functions identified in paragraphs (a)(1) (i), (ii), or (iii) of this section.

(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).

NEI 95-10 (Reference 2.1-16) provides industry guidance for determining which SSCs are within the scope of license renewal. The scoping process used to determine the SSCs within the scope of license renewal for CNP followed the recommendations of NEI 95-10.

Consistent with NEI 95-10, the scoping process used for the CNP license renewal project began with a list of plant systems and structures, determined the functions they perform, and then determined which functions met any of the three criteria of 10 CFR 54.4(a). Functions that meet any of the criteria are intended functions for license renewal, and the systems and structures that perform these functions are included within the scope of license renewal.

A list of systems and structures commonly used in CNP design and licensing documentation was created as the starting point for the scoping process. This list was developed using CNP current licensing basis (CLB) documentation and other information sources. The CLB for CNP is consistent with the definition provided in 10 CFR 54.3. The key information sources that form the CLB include the UFSAR, Technical Specifications, and the docketed licensing correspondence. The systems and structures list was developed from these CLB documents and other information sources, including the following:

- Facility Database (FDB) — The FDB contains records of component/equipment items for which the safety-related status and procurement grades been determined and verified. In addition to identifying the component name, unique number, and safety classification, FDB records also include information pertaining to plant maintenance and operation.
- Civil/structural plant layout drawings.

Functions for structures and mechanical systems were identified based on reviews of CLB documentation and other information sources, including the following:

- Maintenance Rule Program Database — The Maintenance Rule Program database describes the systems and system functions to demonstrate that the SSCs scoped into the Maintenance Rule are monitored in accordance with 10 CFR 50.65. The database also includes the maintenance rule scoping documents. The maintenance rule systems and functions were used as part of the starting point in the scoping effort.

- Expanded System Readiness Review (ESRR) Reports — The ESRR program assessed the conformance of the plant design, testing, maintenance, operation, and configuration with the licensing and design basis requirements. The ESRR reports were used as a resource for system descriptions and identification of SSC functions.

Because of the similarities in scoping criteria between the Maintenance Rule and the License Renewal Rule, the Maintenance Rule scoping documents were a key input for the identification of system and structure functions. The ESRR reports also provided useful functional information. The intent of the document review was to identify all major system functions to provide reasonable assurance that all license renewal intended functions were identified.

For scoping, system evaluation boundaries were established to include components that supported system intended functions.

A more detailed description of the evaluation process for mechanical systems and structures using the criteria of 10 CFR 54.4 is contained in the following sections:

- Section 2.1.1.1 describes the evaluation of the safety-related criterion in 10 CFR 54.4(a)(1).
- Section 2.1.1.2 describes the evaluation of the nonsafety-related SSCs affecting safety-related SSCs criterion, 10 CFR 54.4(a)(2).
- Section 2.1.1.3 describes the evaluation of the regulated events criterion, 10 CFR 54.4(a)(3).

A bounding scoping approach was used for electrical equipment and systems. Electrical and I&C systems as well as electrical and I&C components in mechanical systems were within the scope of license renewal. See Section 2.5 for additional information on electrical and I&C scoping and screening.

The results of the scoping evaluations for plant systems and structures are presented in Section 2.2.

2.1.1.1 Application of Safety-Related Scoping Criteria

10 CFR 54.4(a)(1) provides the criteria for identifying the safety-related systems, structures, and components that are within the scope of the License Renewal Rule. System and structure functions were reviewed to determine whether the function of the safety-related system or structure is relied upon during and following a design basis event to ensure —

- the integrity of the reactor coolant pressure boundary,
- the capability to shut down the reactor and maintain it in a safe shutdown condition, or
- the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in 10 CFR 50.67(b)(2) or 10 CFR 100.11. (The safety-related criterion of 10 CFR 54.4(a)(1)(iii) also includes reference to the dose guidelines of 10 CFR 50.34(a)(1); however, these guidelines are applicable to facilities seeking a construction permit and therefore are not applicable to CNP.)

If one or more of the three criteria were met, then the function was determined to be a safety intended function per 10 CFR 54.4(a)(1) and the corresponding system or structure was determined to be within the scope of license renewal.

Following the guidance in NEI 95-10 Section 3.1.1, because of plant-unique considerations or preferences, I&M elected to treat as safety related some components that do not perform any of the functions of 10 CFR 54.4(a)(1). For example, some components in the blowdown system, for HELB considerations, are classified in the facility database as safety related but do not perform a safety function. Therefore, a component may not meet 10 CFR 54.4(a)(1) but may be treated as safety related for plant-specific reasons.

2.1.1.2 Application of Criterion for Nonsafety-Related SSCs Whose Failure Could Prevent the Accomplishment of Safety Functions

This review identified nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of a safety function. The impacts of nonsafety-related SSC failures were considered as either functional or spatial. In a functional failure, the failure of a nonsafety-related SSC to perform its normal function impacts a safety function. In a spatial failure, the loss of structural or mechanical integrity of a nonsafety-related SSC in physical proximity to a safety-related component impacts a safety function of the safety-related component.

2.1.1.2.1 Functional Failures of Nonsafety-Related SSCs

At CNP, with few exceptions, SSCs required to perform a function in support of other safety-related components are classified as safety-related and included within the scope of license renewal per Section 2.1.1.1. For the few exceptions where nonsafety-related equipment is required to remain functional in support of a safety function, the supporting systems are included in scope.

2.1.1.2.2 Spatial Failures of Nonsafety-Related SSCs

Components meeting the scoping criterion of 10 CFR 54.4(a)(2) due to proximity to safety-related SSCs fit into one of the following categories:

- Nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems); or

- Nonsafety-related SSCs that are not directly connected to safety-related SSCs but have the potential for spatial interaction.

Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs

For piping systems, the nonsafety-related piping and supports up to and including the first equivalent anchor beyond the safety/nonsafety interface are within the scope of license renewal and subject to aging management review. In addition, nonsafety-related portions of safety-related systems downstream of the first anchor are subject to aging management review if they have the potential for spatial interaction with safety-related SSCs.

Nonsafety-Related SSCs Not Directly Connected to Safety-Related SSCs with the Potential for Spatial Interaction

Protective features (whip restraints, spray shields, supports, barriers, etc.) are installed to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs. Such protective features credited in the plant design are within the scope of license renewal per 10 CFR 54.4(a)(2). Where those features provide adequate protection, the nonsafety-related SSC itself is excluded from the scope of license renewal. These protective features are typically associated with a structure and are addressed in the structural AMR.

The following sections address the different modes of spatial interaction with nonsafety-related SSCs that were considered. Interactions can occur in the following forms:

- Physical impact such as in a seismic event
- Pipe whip, jet impingement, or harsh environment resulting from a piping rupture
- Damage due to leakage, spray, or flooding

Physical Impact

This category concerns the potential spatial interaction of nonsafety-related SSCs falling on or otherwise physically impacting safety-related SSCs such that safety functions may not be accomplished.

All nonsafety-related supports with a potential for spatial interaction with safety-related SSCs are within the scope of license renewal per 10 CFR 54.4(a)(2). These supports are addressed as a commodity within the civil/structural section.

Based on earthquake experience data (Reference 2.1-22) that includes aged pipe, the following conclusions, which apply for new and aged pipe, can be drawn:

- No experience data exists of welded steel pipe segments falling due to a strong motion earthquake.
- Falling of piping segments is extremely rare and only occurs when there is a pipe support failure.

As long as the effects of aging on the supports for these piping systems are managed, falling of piping sections is not considered credible, and the piping section itself is not in scope for 10 CFR 54.4(a)(2) due to the physical impact hazard. The effects of spray and leakage were also considered, as discussed below.

Missiles can be generated from internal or external events, such as failure of rotating equipment. Inherent nonsafety-related features that protect safety-related equipment from missiles are within the scope of license renewal per 10 CFR 54.4(a)(2).

Overhead-handling systems from which a load drop could result in damage to any system that could prevent the accomplishment of a safety-related function are within the scope of license renewal per 10 CFR 54.4(a)(2).

Pipe Whip, Jet Impingement, or Harsh Environments

Pipe whip, jet impingement, and harsh environment effects on safety-related equipment are addressed in site-specific analyses of high- and medium-energy line breaks. Spatial interactions of pipe whip, jet impingement, and harsh environment are credible only for high-energy systems. The effects of spray and leakage were also considered, as discussed below.

If a high-energy line break (HELB) analysis assumes that a nonsafety-related piping system does not fail, or assumes failure only at specific locations, then that piping system is within the scope of license renewal per 10 CFR 54.4(a)(2) and is subject to aging management review in order to provide reasonable assurance that those assumptions remain valid throughout the period of extended operation.

Leakage, Spray, or Flooding

Moderate- and low-energy systems have the potential for spatial interactions of spray and leakage. Nonsafety-related systems and nonsafety-related portions of safety-related systems with the potential for spray or leakage that could prevent safety-related SSCs from performing their required safety function are within the scope of license renewal per 10 CFR 54.4(a)(2).

Air and gas (nonliquid) systems are not a hazard to other plant equipment. Components that do not contain liquids cannot adversely affect safety-related SSCs due to leakage or spray. Operating experience indicates that nonsafety-related systems containing only air or gas have experienced no failures due to aging that could impact the ability of safety-related equipment to perform required safety functions. There are no credible aging effects for these systems when the environment is a dry gas. Therefore, these systems are not within the scope of license renewal per 10 CFR 54.4(a)(2).

Nonsafety-related systems and nonsafety-related portions of safety-related systems containing steam or liquid that are near safety-related equipment are considered within the scope of license renewal per 10 CFR 54.4(a)(2). In light of 10 CFR 54.4(a)(2), the concern for these systems is the impact of a pressure boundary failure on safety-related systems. These failures could result in the nonsafety-related piping spraying or leaking on safety-related equipment. As stated in NEI 95-10, Section 3.1.2, consideration of hypothetical failures that could result from system interdependencies that are not part of the current licensing basis and that have not been previously experienced is not required (Reference 2.1-25).

Long-term exposure to conditions resulting from a failed nonsafety-related SSC (such as leakage or spray) is not considered credible. Leakage or spray from liquid-filled low-energy systems would be detected during routine operator rounds or system walkdowns before it could impact the performance of safety-related equipment. Leakage from these low-energy systems has typically resulted from localized pitting that is not indicative of the overall condition of the piping. Follow-up actions would direct leakage away from equipment, thereby preventing its failure. Evaluations of the condition of the piping would be performed.

Nonsafety-related walls, curbs, dikes, doors, etc., that provide flood barriers to safety-related SSCs are within the scope of license renewal per 10 CFR 54.4(a)(2). These are evaluated in the civil/structural AMR for that area.

2.1.1.3 Application of Criterion for Regulated Events

The scope of license renewal includes SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for any of the following regulated events:

- Fire protection (FP) (10 CFR 50.48),
- Environmental qualification (EQ) (10 CFR 50.49),
- Pressurized thermal shock (PTS) (10 CFR 50.61),
- Anticipated transient without scram (ATWS) (10 CFR 50.62), and
- Station blackout (SBO) (10 CFR 50.63).

This section discusses the approach used to identify the systems and structures within the scope of license renewal based on this criterion. Systems and structures that perform intended functions in support of these regulated events are identified in the descriptions in Sections 2.3, 2.4, and 2.5.

2.1.1.3.1 Fire Protection (10 CFR 50.48)

SSCs are included within the scope of license renewal for fire protection based on several different functional requirements defined in 10 CFR 50.48 and 10 CFR 50, Appendix R. SSCs credited with fire prevention, detection, and mitigation in areas containing equipment important to safe operation of the plant are within the scope of license renewal. To establish this scope of equipment, a detailed review of the CNP current licensing basis for fire protection (including References 2.1-18, 2.1-19, and 2.1-20) was performed. Based on the review of the CNP current licensing basis for fire protection, the intended functions performed in support of 10 CFR 50.48 requirements were determined.

2.1.1.3.2 Environmental Qualification (10 CFR 50.49)

10 CFR 50.49 defines electric equipment important to safety that is required to be environmentally qualified to mitigate certain accidents that would result in harsh environmental conditions in the plant. 10 CFR 50.49 codifies requirements for the environmental qualification of electrical equipment that had been presented in other regulatory documents, such as IE Bulletin 79-01B (Reference 2.1-15). The CNP Environmental Qualification of Electric Components Program, which satisfies these requirements, evolved over several years based on correspondence between I&M and the NRC.

As described in Section 2.1.1, a bounding scoping approach is used for electrical equipment. Because a bounding approach is used, all electrical systems and electrical equipment in mechanical systems are within the scope of license renewal. Consequently, all environmentallly qualified equipment is within the scope of license renewal per 10 CFR 54.4(a)(3).

2.1.1.3.3 Pressurized Thermal Shock (10 CFR 50.61)

10 CFR 50.61 requires that licensees evaluate the reactor vessel beltline materials against specific criteria to ensure protection from brittle fracture. 10 CFR 50.61 specifies the calculational method to determine an analytical value, RT_{PTS}, which is compared to PTS screening criteria specified in 10 CFR 50.61.

For both units at CNP, the limiting reference temperatures after 60 years of operation are well below the screening criteria. (See Section 4.2.2 for further discussion.) The only system relied upon to meet the PTS regulation is the RCS, which contains the reactor vessel. No structures are relied upon to meet 10 CFR 50.61.

2.1.1.3.4 Anticipated Transients without Scram (10 CFR 50.62)

An ATWS event is an anticipated operational occurrence (for CNP, the ATWS event is a loss of normal feedwater or a loss of load transient) that is accompanied by a failure of the reactor trip system (RTS) to shut down the reactor. 10 CFR 50.62 requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the probability of failure to shut down the reactor following anticipated transients and to mitigate the consequences of an ATWS event.

Based on a review of the CNP current licensing basis for ATWS, the intended functions supporting the 10 CFR 50.62 requirements were determined. Since the scope of equipment required by 10 CFR 50.62 is from sensor output to the final actuation device, the plant systems that support compliance with the ATWS rule are primarily electrical and I&C systems. The intended function for the one mechanical system (main turbine) that supports 10 CFR 50.62 requirements is discussed in the system description in Section 2.3.4.5.

2.1.1.3.5 Station Blackout (10 CFR 50.63)

10 CFR 50.63 requires that each light-water-cooled nuclear power plant be able to withstand and recover from an SBO. An SBO is the loss of offsite and onsite AC electric power to the essential and nonessential switchgear buses in a nuclear power plant. It does not include the loss of AC power fed from inverters powered by station batteries. The objective of this requirement is to assure that nuclear power plants are capable of withstanding an SBO and maintaining adequate reactor core cooling and containment integrity for a required duration.

At CNP, the equipment relied upon to support 10 CFR 50.63 is that required to ensure the reactor core is cooled and containment integrity is maintained for four hours (coping duration) before offsite or onsite AC power is restored. The NRC has also required that SSCs relied upon to restore the offsite AC power (including the onsite portion of the offsite power sources) and onsite AC power be included within the license renewal scope.

Based on the review of the CNP current licensing basis for SBO, the equipment performing intended functions required for compliance with 10 CFR 50.63 was determined.

2.1.2 Screening Methodology

Screening is the process for determining which structures and components require aging management review. The requirement for screening is found in 10 CFR 54.21(a), which states:

(1) For those systems, structures, and components within the scope of this part, as delineated in § 54.4, identify and list those structures and components subject to an aging management review. Structures and components subject to an aging management review shall encompass those structures and components—

(i) That perform an intended function, as described in § 54.4, without moving parts or without a change in configuration or properties. These structures and components include, but are not limited to, the reactor vessel, the reactor coolant system pressure boundary, steam generators, the pressurizer, piping, pump casings, valve bodies, the core shroud, component supports, pressure retaining boundaries, heat exchangers, ventilation ducts, the containment, the containment liner, electrical and mechanical penetrations, equipment hatches, seismic Category I structures, electrical cables and connections, cable trays, and electrical cabinets, excluding, but not limited to, pumps (except casing), valves (except body), motors, diesel generators, air compressors, snubbers, the control rod drive, ventilation dampers, pressure transmitters, pressure indicators, water level indicators, switchgears, cooling fans, transistors, batteries, breakers, relays, switches, power inverters, circuit boards, battery chargers, and power supplies; and

(ii) That are not subject to replacement based on a qualified life or specified time period.

(2) Describe and justify the methods used in paragraph (a)(1) of this section.

(3) For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

For a structure or component that is within the scope of license renewal, the screening process determined:

- Whether it performs a component intended function without moving parts and without a change in configuration or properties (i.e., it is passive); and
- Whether it is not subject to replacement based on a qualified life or specified time period (i.e., it is long-lived).

10 CFR 54.21(a)(2) requires that the IPA include a description and justification of the methods used to determine the "passive, long-lived" structural elements and components.

Within the group of systems and structures that are within the scope of license renewal, the passive, long-lived structures or components that perform intended functions require aging management review. Structures or components that are either active or subject to replacement based on a qualified life or specified time period do not require an aging management review.

Although the requirements for the IPA are the same for all systems and structures, in practice the screening process differed for mechanical components, structures, and electrical and I&C components. Each screening process met the requirements of 10 CFR 54.21(a). The three separate screening processes are described below.

2.1.2.1 Screening of Mechanical Components

For each mechanical system within the scope of license renewal, the screening process identified those components that are subject to aging management review. Section 2.3 presents the results for mechanical systems.

2.1.2.1.1 Determining Evaluation Boundaries

The identification of components subject to aging management review began with the determination of the system evaluation boundary. The system evaluation boundary includes those portions of the system that are necessary to ensure that the intended functions of the system will be performed. Components needed to support each of the system-level intended functions identified in the scoping process are included within the system evaluation boundary.

Determination of the system evaluation boundary required an understanding of system operations in support of intended functions. This process was based on the following:

- CNP current licensing basis
- Plant-specific experience
- Appropriate industry-wide operating experience
- Design documents (calculations, drawings, etc.)

2.1.2.1.2 Identifying Components Subject to Aging Management Review

Within the system evaluation boundary, long-lived passive components that perform or support an intended function without moving parts or a change in configuration or properties are subject to aging management review.

In making the determination that a component is passive (i.e., its intended function is performed without moving parts or a change in configuration or properties), it is not necessary to consider the component parts. However, in the case of valves, pumps, fans, and dampers, the valve bodies, pump casings, and housings for fans and dampers perform an intended function by maintaining the pressure boundary and are therefore subject to an aging management review. If the component is not subject to replacement based on a qualified life or specified time period, then it is considered long-lived. Components that are subject to replacement are addressed in replacement programs, which are based on vendor recommendations, plant experience, or any means that establishes a specific service life, qualified life or replacement frequency under a controlled program. Components that are addressed in a replacement program are not included in the aging management review.

Licensing renewal drawings were created by marking mechanical flow diagrams to indicate only those components within the system evaluation boundaries that require an aging management review. Components that are within the scope of license renewal based solely on the criterion of 10 CFR 54.4(a)(2) are not generally indicated on the drawings but are described in Section 2.3 and listed in Table 3.3.2-11.

2.1.2.2 Screening of Structural Members and Components

For each structure within the scope of license renewal, the structural components and commodities (as defined in Section 2.1.2.2.1) were evaluated to determine those subject to aging management review. The screening process for structural components and commodities involved a review of design documents (UFSAR, drawings, etc.) to identify specific structural components and commodities that constitute the structure. Structural components or commodities subject to aging management review are those that:

- Perform an intended function without moving parts or a change in configuration or properties (i.e., are passive); and
- Are not subject to replacement based on qualified life or specified time period (i.e., are long-lived).

Since structures are inherently passive, and with few exceptions are long-lived, the screening of structural components and commodities (as defined in Section 2.1.2.2.1) was based primarily on whether they perform an intended function.

2.1.2.2.1 Structural Component and Commodity Groups

Structural components and commodities often have no unique identifiers such as those given to mechanical components. Therefore, grouping structural components and commodities based on materials of construction provides a practical means of categorizing them for aging management reviews. Structural components and commodities were categorized by the following groups based on materials of construction:

- Steel
- Threaded fasteners
- Concrete
- Fire barriers
- Elastomers
- Earthen structures
- Teflon

2.1.2.2.2 Determining Evaluation Boundaries

Structural components and commodities that are attached to a structure or reside within a structure are generally categorized as either component supports (mechanical or electrical) or other structural members.

Component Supports – Mechanical Components

Evaluation boundaries for mechanical component supports were established in accordance with rules governing inspection of component supports (i.e., ASME Section XI, Subsection IWF). Component support examination boundaries for integral and nonintegral (i.e., mechanically attached) supports are defined in Article IWF-3100, Figure IWF-1300-1. In general, the support boundary extends to the surface of the building structure, but does not include the building structure. Furthermore, the support boundary extends to include nonintegral attachments to piping and equipment but excludes integral attachments to the same.

Component Supports – Electrical Components

Supports for electrical components include cable trays and conduit supports, electrical panels, racks, cabinets and other enclosures. The evaluation boundary for these items includes all supporting elements, including mechanical or integral attachments to the building structure.

Other Structural Members

Evaluation boundaries for other structural members whose function is to carry dynamic loads caused by postulated design basis events are consistent with the method for establishing boundaries for supports specified above. That is, the boundary includes the structural component and the associated attachment to the building structure. The portion of the attachment embedded in the building structure is considered part of the structure.

2.1.2.2.3 Intended Function

Structural components and commodities were evaluated to determine intended functions as they relate to the license renewal process. Unlike mechanical equipment for which both system level and component level intended functions are defined, the intended functions for structures are typically based on a simple set of functions that apply both to the structure and to its components and commodities. NEI 95-10 (Reference 2.1-16) provides guidelines for determining the intended functions of structures, structural components and commodities for purposes of license renewal. These intended functions are included in Table 2.0-1 of this application.

2.1.2.3 Screening of Electrical and Instrumentation and Control Components

2.1.2.3.1 Determining Evaluation Boundaries

As described in Section 2.1.1, a bounding scoping approach is used for electrical equipment. Electrical equipment in mechanical systems is within the scope of license renewal.

The pressure boundary function associated with some electrical and I&C components identified in NEI 95-10 Appendix B, "Typical Structure, Component and Commodity Groupings and Active/Passive Determinations for the Integrated Plant Assessment," (e.g., flow elements, vibration probes) was considered in the mechanical AMRs, as applicable. Electrical components are supported by structural commodities (e.g., cable trays, conduit, and cable trenches), which are included in the structural AMRs.

2.1.2.3.2 Passive Screening

Regulatory Guide 1.188 (Reference 2.1-14) endorses NEI 95-10 (Reference 2.1-16) by stating, "The NRC staff has reviewed this document [NEI 95-10] and found that it provides guidance acceptable to the staff."

NEI 95-10, Appendix B, identifies electrical commodities considered to be passive. The CNP electrical commodity groups were identified and cross-referenced to the appropriate NEI 95-10 commodity, which identified the passive commodity groups.

Two passive electrical and I&C commodity groups were identified that meet the 10 CFR 54.21(a)(1)(i) criterion (i.e., components that perform an intended function without moving parts or without a change in configuration):

1) Cables and connections, bus, electrical portions of electrical and I&C penetration assemblies; and

2) High-voltage insulators.

Other electrical and I&C commodity groups are active and do not require aging management review.

Table 2.1.1 divides the aforementioned two commodity groups into seven separate commodity groupings. Because Table 2.1-1 and NEI 95-10 commodity groupings do not exactly match, the examples provided within Appendix B to NEI 95-10 have been included in Table 2.1-1 for clarity in comparisons with NEI 95-10.

Table 2.1.1
Standard List of Passive Electrical Commodities

Passive Electrical Commodities	Intended Function
Insulated cables and connections (e.g., power cables, control cables, instrument cables, communication cables, electrical splices, terminal blocks, fuse blocks)	To provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals.
Electrical portions of electrical and I&C penetration assemblies (e.g., electrical penetration assembly cables and connections)	
Phase bus (e.g., isolated-phase bus, segregated and nonsegregated phase bus)	
Transmission conductors	
Switchyard bus	
High-voltage insulators (e.g., porcelain switchyard insulators, transmission line insulators)	To insulate and support an electrical conductor.
Uninsulated ground conductors (e.g., grounding rods, buried ground cables, cathodic protection)	To provide electrical connections to specified sections of an electrical circuit.

2.1.2.3.3 Long-Lived Screening

Electrical components included in the EQ Program per 10 CFR 50.49 are replaced based on a qualified life; therefore, they do not meet the “long-lived” criterion of 10 CFR 54.21(a)(1)(ii) and are not subject to aging management review. Some insulated cables and connections and all electrical penetration assemblies are included in the EQ Program and are not subject to aging management review.

No other electrical components were screened out per the long-lived criterion. The result is that the aging management reviews involve only non-EQ electrical and I&C components. EQ evaluations are time-limited aging analyses (TLAAs) and are addressed in Section 4.4.

2.1.2.4 Identification of Short-Lived Components and Consumables

2.1.2.4.1 Packing, Gaskets, Component Seals, and O-Rings

Packing, gaskets, component mechanical seals, and O-rings are typically used to provide a leak-proof seal when components are mechanically joined together. These items are commonly found in components such as valves, pumps, heat exchangers, ventilation units/ducts, and piping segments. These types of consumables are considered subcomponents of the identified components and, therefore, are not subject to their own condition or performance monitoring where it could be demonstrated that one of the following conditions exist:

- The sealing materials are short-lived because they are replaced on a fixed frequency or have a qualified life established (e.g., for EQ purposes), or
- The sealing materials are not relied on in the CLB to maintain either:
  - Leakage below established limits, or
  - System pressure sufficiently high to deliver specified flow rates.

2.1.2.4.2 Structural Sealants

Sealants required to maintain positive or negative pressure for a space or used to provide flood and fire barriers are addressed in Section 2.1.2.2.

2.1.2.4.3 Oil, Grease, and Filters

Oil, grease, and filters (both system and component filters) have been treated as consumables because either:

- A program for periodic replacement exists, or
- A monitoring program (e.g., predictive analysis activities, condition monitoring) exists that replaces these consumables, based on established performance criteria, when their condition begins to degrade but before there is a loss of intended function.

2.1.2.4.4 Fire Extinguishers, Fire Hoses, and Air Packs

Components such as fire hoses, fire extinguishers, self-contained breathing apparatus (SCBA), and SCBA cylinders are considered to be consumables and are routinely tested or inspected.

The Fire Protection Program complies with the following applicable safety standards that specify performance and condition monitoring programs for these specific components.

- Fire extinguishers — NFPA-10, *Installation of Portable Fire Extinguishers* (Reference 2.1-23)
- Fire hoses — NFPA-1962, *Standards for the Inspection, Care, and Use of Fire Hose, Couplings and Nozzles* (Reference 2.1-24)
- SCBA —
  - 29 CFR Part 1910, "Occupational Safety and Health Standards" (Reference 2.1-9),
  - 42 CFR Part 84, "Approval Of Respiratory Protective Devices" (Reference 2.1-10),
  - NUREG-41, "Manual of Respiratory Protection Against Radioactive Materials" (Reference 2.1-11), and
  - ANSI-Z88.2, *Practices for Respiratory Protection* (Reference 2.1-21).

Fire extinguishers and fire hoses are inspected and hydrostatically tested periodically and must be replaced if they do not pass the test or inspection. SCBA and SCBA cylinders are inspected and periodically tested and must be replaced if they do not pass the test or inspection. The Fire Protection Program determines the replacement criterion of these components that are routinely checked by tests or inspections to assure operability. Therefore, while these consumables are in the scope of license renewal, they are not subject to aging management review.

2.1.3 Interim Staff Guidance Discussion

As discussed in References 2.1-30 and 2.1-31, the NRC has encouraged applicants for license renewal to address proposed Interim Staff Guidance documents (ISGs) in license renewal applications. The following list of ISGs is from NRC ISG meeting summary dated February 21, 2003 (Reference 2.1-31).

The NRC Staff has identified the following issues for which additional NRC Staff and industry guidance clarification may be necessary:

ISG-1	GALL Report Presenting One Acceptable Way to Manage Aging Effects for License Renewal
ISG-2	Scoping of Equipment Relied On to Meet the Requirements of the Station Blackout (SBO) Rule for License Renewal
ISG-3	Aging Management Program of Concrete
ISG-4	Aging Management of Fire Protection System for License Renewal
ISG-5	Identification and Treatment of Electrical Fuse Holders for License Renewal
ISG-6	Identification and Treatment of Housing for Active Components for License Renewal
ISG-7	Scoping Guidance for Fire Protection Equipment for License Renewal
ISG-8	Updating the Improved License Renewal Guidance Documents – ISG Process (This non-technical issue has been deleted from the ISG list.)
ISG-9	Identification and Treatment of Structures, Systems and Components Which Meet 10 CFR 54.4(a)(2)
ISG-10	Standardized Format for License Renewal Applications
ISG-11	Aging Management of Environmental Fatigue for Carbon/Low-Alloy Steel
ISG-12	Operating Experience with Cracking of Class 1 Small-Bore Piping
ISG-13	Management of Loss of Preload on Reactor Vessel Internals Bolting Using the Loose Parts Monitoring System
ISG-14	Operating Experience with Cracking in Bolting
ISG-15	Revision to Generic Aging Lessons Learned Aging Management Program (AMP) XI.E2
ISG-16	Time-Limited Aging Analyses Supporting Information for License Renewal Applications
ISG-17	Bus Ducts (Iso-phase and Non-segregated) for Electrical Bus Bar
ISG-18	Revision to GALL AMP XI.E3 for Inaccessible Cable (Medium Voltage)

ISG-12, ISG-13, ISG-14, ISG-17 and ISG-18 have been identified by the NRC Staff, but no guidance has been provided. Therefore, these issues will not be addressed in this application. The following is a discussion of each of the remaining active ISGs.

ISG-1 GALL Report Presenting One Acceptable Way to Manage Aging Effects for License Renewal

NUREG-1801 is used as a reference in Section 3.

ISG-2 Scoping of Equipment Relied On to Meet the Requirements of the Station Blackout (SBO) Rule for License Renewal

Scoping related to station blackout is discussed in Section 2.1.1.3.5. Scoping is in accordance with the ISG.

ISG-3 Aging Management Program of Concrete

Concrete subject to aging management review has been included in an aging management program in accordance with the ISG. This includes concrete for which no aging effects requiring management were identified. See Section 3.5.

ISG-4 Aging Management of Fire Protection System for License Renewal

This ISG dealt with three aspects of the fire protection (FP) system aging management program.

1. Wall Thinning of FP Piping due to Internal Corrosion

As stated in the ISG, disassembling portions of the FP piping as described in NUREG-1801, Chapter XI.M27 may not be the most effective means to detect this aging effect. The use of a non-intrusive means of evaluating wall thickness is recommended. The Fire Water System Program described in Appendix B of this application will address the means of evaluating wall thickness.

2. Testing of Sprinkler Heads

The Fire Water System Program will incorporate NFPA-25 sprinkler head testing guidance.

3. Valve Lineup Inspections of Halon/Carbon Dioxide Fire Suppression Systems

The ISG states that valve lineup inspections, charging pressure inspections, and automatic mode of operation verifications for the halon/carbon dioxide system are operational activities pertaining to system or component configurations or properties that may change, and are not related to aging management. Therefore, the staff position is to eliminate the halon/carbon dioxide system inspections for charging pressure, valve lineups, and automatic mode of operation. Accordingly, these inspections are not credited in the Fire Protection Program

ISG-5 Identification and Treatment of Electrical Fuse Holders for License Renewal

Fuse holders (including fuse clips and fuse blocks) are considered passive electrical components. Fuse holders (including fuse clips and fuse blocks) are included in the aging management review in the same manner as terminal blocks and other types of electrical connections as described in Section 2.1.2.3. Consistent with ISG-5, fuse holders that are part of a larger assembly inside the enclosure of an active component, such as switchgear, power supplies, power inverters, battery chargers, and circuit boards, are considered piece parts of the larger assembly. Since piece parts and sub-components in such an enclosure are inspected regularly and maintained as part of the normal maintenance and surveillance activities, they are considered not subject to aging management review.

Fuse holders are considered electrical connections (similar to terminal blocks) and are subject to aging management per NUREG-1801, Chapter XI.E1 (see Section 3.6, Table 3.6.1, Item 3.6.1-2). ISG-5 addresses fuse holders that are not part of a larger assembly, but support safety-related and nonsafety-related functions in which a failure of a fuse precludes a safety function from being accomplished. Fuse holders meeting these requirements will be evaluated before the beginning of the period of extended operation for possible aging effects requiring management. The fuse holders will either be replaced, modified to remove the aging effects, or a program will be implemented to manage the aging effects. The aging management program (if needed) for fuse holders will consider the aging stressors for the metallic clips.

ISG-6 Identification and Treatment of Housing for Active Components for License Renewal

The process used to identify passive components subject to aging management review is discussed in Section 2.1.2.1. Consistent with the interim staff guidance, this review identified active component housings (e.g., pump casings, valve bodies, and housings for fans and dampers) which are subject to aging management review.

ISG-7 Scoping Guidance for Fire Protection Equipment for License Renewal

Scoping for fire protection systems, structures and components was determined by a review of the current licensing basis for CNP. The scoping and screening results are discussed in Section 2.3.3.7 (References 2.1-18, 2.1-19, and 2.1-20).

ISG-9 Identification and Treatment of Structures, Systems and Components Which Meet 10 CFR 54(a)(2)

10 CFR 54.4(a)(2) states that SSCs within the scope of license renewal shall include nonsafety-related SSCs whose failure could prevent the satisfactory accomplishment of any of the functions identified for safety-related SSCs.

The process that was used to identify the in-scope nonsafety-related SSCs under 10 CFR 54.4(a)(2) is discussed in Section 2.1.1.2 of this application.

ISG-10 Standardized Format for License Renewal Applications

The NEI standard license renewal application format was considered during the preparation of this application.

ISG-11 Aging Management of Environmental Fatigue for Carbon/Low-Alloy Steel

Aging management of environmental fatigue for carbon/low-alloy steel items is discussed in Section 4.3.3.

ISG-15 Revision to Generic Aging Lessons Learned Aging Management Program (AMP) XI.E2

Appendix B of this application describes the Non-EQ Instrumentation Circuits Test Review Program, which will be comparable to the program described in NUREG-1801, Chapter XI.E2, Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

ISG-16 Time-Limited Aging Analyses Supporting Information for License Renewal Applications

ISG-16 addresses the level of detail of supporting information to be provided in a license renewal application in the discussion of time-limited aging analysis evaluations. Section 4 documents the evaluation of time-limited aging analyses. ISG-16 was considered in developing Section 4; however, since ISG-16 is a draft, all provisions of the ISG were not necessarily incorporated.

ISG-12, ISG-13, ISG-14, ISG-17 and ISG-18 have been identified by the NRC but no guidance has been provided. Therefore these issues are not addressed in this section.

2.1.4 Generic Safety Issues

In accordance with the guidance in NEI 95-10 (Reference 2.1-16) and Appendix A.3 (Branch Technical Position RLSB-2) of NUREG-1800 (Reference 2.1-12), review of NRC Generic Safety Issues (GSIs) as part of the license renewal process is required to satisfy a finding per 10 CFR 54.29. GSIs that involve issues related to license renewal aging management reviews or time-limited aging analyses are to be addressed in the license renewal application. Based on NUREG-0933 (Reference 2.1-13), I&M has identified the following GSIs to be addressed.

GSI-168, Environmental Qualification of Electrical Equipment

This GSI is related to aging concerns for equipment that is subject to the EQ requirements of 10 CFR 50.49. EQ evaluations of electrical equipment are identified as a TLAA for CNP. Accordingly, this GSI is addressed in Section 4.4.

GSI-190, Fatigue Evaluation of Metal Components for 60-Year Plant Life

This GSI addresses fatigue life of metal components and was closed by the NRC (Reference 2.1-28). In the closure letter the NRC concluded that licensees should address the effects of reactor coolant environment on component fatigue life as aging management programs (AMPs) are formulated in support of license renewal. Accordingly, the issue of environmental effects on component fatigue life is addressed in Section 4.3.3.

GSI-191, Assessment of Debris Accumulation on PWR Sump Performance

This GSI addresses the potential impact on ECCS performance caused by blockage of containment sump screens by debris, especially failed coatings. However, degradation of coatings inside containment is a current licensing basis issue and was addressed in I&M's response to NRC Generic Letter 98-04 (Reference 2.1-29). I&M does not credit coatings to assure that intended functions of coated structures or components are maintained. Therefore, this is not a license renewal concern; neither is the issue related to the 40-year term of the current operating license. Thus, the issue identified by GSI-191 is not a TLAA.

Based on the above, GSIs involving either aging effects for structures or components subject to aging management review or time-limited aging analyses are already being evaluated for license renewal.

2.1.5 Conclusion

The methods described in Sections 2.1.1 and 2.1.2 were used to identify the SSCs that are within the scope of license renewal and to identify those structures and components requiring aging management review. The methods are consistent with, and satisfy the requirements of, 10 CFR 54.4 and 10 CFR 54.21(a)(1).

2.1.6 References for Section 2.1

2.1-1 10 CFR 50.48, "Fire protection."

2.1-2 10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants."

2.1-3 10 CFR 50.61, "Fracture toughness requirements for protection against pressurized thermal shock events."

2.1-4 10 CFR 50.62, "Requirements for reduction of risk from anticipated transients without scram (ATWS) events for light-water-cooled nuclear power plants."

2.1-5 10 CFR 50.63, "Loss of all alternating current power."

2.1-6 10 CFR Part 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979."

2.1-7 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

2.1-8 10 CFR 100.11, "Determination of exclusion area, low population zone, and population center distance."

2.1-9 29 CFR Part 1910, "Occupational Safety and Health Standards."

2.1-10 42 CFR Part 84, "Approval of Respiratory Protective Devices."

2.1-11 NUREG-41, *Manual of Respiratory Protection Against Radioactive Materials*

2.1-12 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,* U. S. Nuclear Regulatory Commission, July 2001.

2.1-13 NUREG-0933, Supplement 25, *A Prioritization of Generic Safety Issues*, U. S. Nuclear Regulatory Commission, June 2001.

2.1-14 Regulatory Guide 1.188, *Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses*, U. S. Nuclear Regulatory Commission, July 2001.

2.1-15 IE Bulletin 79-10B, "Environmental Qualification of Class IE Equipment," U. S. Nuclear Regulatory Commission, January 14, 1980.

2.1-16 NEI 95-10, *Industry Guideline on Implementing the Requirements of 10 CFR Part 54, The License Renewal Rule*, Nuclear Energy Institute, Revision 3, April 2001.

2.1-17 Donald C. Cook Nuclear Plant Updated Final Safety Analysis Report, Revision 18.

2.1-18 Donald C. Cook Nuclear Plant Fire Hazard Analysis Report, Revision 10.

2.1-19 Donald C. Cook Nuclear Plant Safe Shutdown Capability Assessment, Revision 7.

2.1-20 Donald C. Cook Nuclear Plant Fire Protection Program Manual, Revision 5.

2.1-21 ANSI-Z88.2, *Practices for Respiratory Protection*

2.1-22 NUREG/CR-6239, *Survey of Strong Motion Earthquake Effects on Thermal Power Plants in California with Emphasis on Piping Systems*, U. S. Nuclear Regulatory Commission, November 1995.

2.1-23 NFPA-10, *Installation of Portable Fire Extinguishers*

2.1-24 NFPA-1962, *Standards for the Inspection, Care, and Use of Fire Hose, Couplings and Nozzles*

2.1-25 Letter from C. I. Grimes, NRC, to A. Nelson, NEI, and D. Lockbaum, Union of Concerned Scientists (UCS), "License Renewal Issue: Scoping of Seismic II/I Piping Systems," dated December 3, 2001.

2.1-26 Letter from C. I. Grimes, NRC, to A. Nelson, NEI, and D. Lochbaum, UCS, "License Renewal Issue: Guidance on the Identification and Treatment of Structures, Systems, and Components which Meet 10 CFR 54.4(a)(2)," dated March 15, 2002.

2.1-27 Letter from P. T. Kuo, NRC, to A. Nelson, NEI, and D. Lochbaum, UCS, "Proposed Staff Guidance on the Scoping of Fire Protection Equipment for License Renewal," dated November 13, 2002.

2.1-28 NRC memorandum from A. C. Thadani, Director, Office of Nuclear Regulatory Research, to W. D. Travers, Executive Director of Operations, "Closeout of Generic Safety Issue 190, 'Fatigue Evaluation of Metal Components for 60-Year Plant Life,'" dated December 26, 1999.

2.1-29 Letter from M. W. Rencheck, I&M, to NRC Document Control Desk, "Generic Letter 98-04: Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," dated May 21, 1999.

2.1-30 Letter from A. Nelson, Nuclear Energy Institute, to P. T. Kuo, NRC, "U.S. Nuclear Industry's Proposed Standard License Renewal Application Format Package," dated January 24, 2003.

2.1-31 Letter from P.J. Kang, NRC, to Nuclear Energy Institute, "Summary of Meeting with the Nuclear Energy Institute (NEI) on the Status of Interim Staff Guidance (ISG) for License Renewal," dated February 21, 2003.

2.2 PLANT-LEVEL SCOPING RESULTS

Table 2.2-1a, Table 2.2-1b, and Table 2.2-3 list the mechanical systems, electrical systems, and structures, respectively, that are within the scope of license renewal for CNP. For mechanical systems, a reference is given to the section of this application that contains a description of the system. For electrical systems, system descriptions have not been provided, since all electrical systems are within scope (see Section 2.5). For structures, a reference is given to the section of this application that includes the structure in the screening results.

Table 2.2-2 and Table 2.2-4 list the systems and structures, respectively, that do not meet the criteria specified in 10 CFR 54.4(a) and are therefore excluded from the scope of license renewal. For each item on the systems list, Table 2.2-2 also provides a reference (if applicable) to the section of the UFSAR that describes the system.

Table 2.2-1a
Systems Within the Scope of License Renewal
Mechanical Systems

Table 2.2-1a		
System Code	**System**	**System Description**
AFW	Auxiliary feedwater	Section 2.3.4.3, Auxiliary Feedwater
AS	Auxiliary steam	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
BD	Blowdown	Section 2.3.4.4, Steam Generator Blowdown
CCW	Component cooling water	Section 2.3.3.3, Component Cooling Water
CEQ	Containment equalization / hydrogen skimmer	Section 2.3.2.4, Containment Equalization / Hydrogen Skimmer
CF	Chemical feed	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
CRD	Control rod drive	Section 2.3.1.2, Reactor Vessel and Control Rod Drive Mechanism Pressure Boundary
CTRLA	Control air	Section 2.3.3.4, Compressed Air
CTS	Containment spray	Section 2.3.2.1, Containment Spray
CVCS	Chemical and volume control system	Section 2.3.3.5, Chemical and Volume Control
DEMIN	Demineralized water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
DRAIN	Process drains – miscellaneous drain tank	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
ECCS	Emergency core cooling system	Section 2.3.2.3, Emergency Core Cooling
EDG	Emergency diesel generator	Section 2.3.3.8, Emergency Diesel Generator
ESW	Essential service water	Section 2.3.3.2, Essential Service Water

Table 2.2-1a (Continued)		
System Code	**System**	**System Description**
FP	Fire protection	Section 2.3.3.7, Fire Protection
FW	Main feedwater	Section 2.3.4.1, Main Feedwater
ICE	Ice condenser	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
LTW	Lake Township water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
MATL	Material / equipment handling	Section 2.3.3.12, Miscellaneous Systems
MS	Main steam	Section 2.3.4.2, Main Steam
MT	Main turbine	Section 2.3.4.5, Main Turbine
N2	Reactor nitrogen	Section 2.3.3.4, Compressed Air
NESW	Nonessential service water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
NF	Nuclear fuels	Section 2.3.3.12, Miscellaneous Systems
NS	Nuclear sampling	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
PA	Plant air	Section 2.3.3.4, Compressed Air
PACHM	Post-accident containment hydrogen monitoring	Section 2.3.3.10, Post-Accident Containment Hydrogen Monitoring
PASS	Post-accident sampling system	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
PW	Primary water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
RCS	Reactor coolant system	Section 2.3.1, Reactor Coolant
RF	Refueling	Section 2.3.3.12, Miscellaneous Systems

Table 2.2-1a (Continued)		
System Code	**System**	**System Description**
RHR	Residual heat removal	Section 2.3.3.12, Miscellaneous Systems
RMS	Radiation monitoring system	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
RVLIS	Reactor vessel level indication system	Section 2.3.3.12, Miscellaneous Systems
RWD	Radioactive waste disposal	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
SCRN	Screenwash	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
SD	Station drainage	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
SEC	Security	Section 2.3.3.9, Security
SFP	Spent fuel pool	Section 2.3.3.1, Spent Fuel Pool
VAB	Auxiliary building ventilation	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
VCONT	Containment ventilation	Section 2.3.3.6, Heating, Ventilation, and Air Conditioning
VCRAC	Control room ventilation	Section 2.3.3.6, Heating, Ventilation, and Air Conditioning
VEDG	Emergency diesel generator room ventilation	Section 2.3.3.6, Heating, Ventilation, and Air Conditioning
VES	Engineered safety features ventilation	Section 2.3.3.6, Heating, Ventilation, and Air Conditioning
VMISC	Miscellaneous ventilation	Section 2.3.3.11, Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
VSWGR	Switchgear ventilation	Section 2.3.3.6, Heating, Ventilation, and Air Conditioning

Table 2.2-1b
Systems Within the Scope of License Renewal
Electrical Systems (Bounding Approach)

Because of the bounding approach used for scoping electrical systems, every electrical system is within scope by default. System descriptions are not provided. UFSAR Chapters 7 and 8 describe I&C and electrical systems. For further information, see Section 2.5.

Table 2.2-1b	
System Code	**System**
120D	120/208VAC Miscellaneous safety-related power distribution
120HT	120VAC Heat tracing power distribution
12KV	Electrical distribution, 12KV
12KVP	12KVAC Protection and metering
220C	120/220VAC Control and instrumentation
24ML	24VDC Monitor light distribution
24SL	24VAC Status light distribution
250C	250VDC Control and instrumentation
250D	250VDC Distribution
26KAC	Electrical distribution, 26,000VAC
480AC	Electrical distribution, 480VAC
480VP	480VAC Bus protection and metering
4KVAC	Electrical distribution, 4160VAC
4KVP	4KVAC Bus protection and metering
600AC	Electrical distribution, 600VAC
600VP	600VAC Bus protection and metering
AMSAC	ATWS mitigating system actuation circuitry

Table 2.2-1b (Continued)	
System Code	**System**
ANN	Annunciators
BAHT	Boric acid pipe heat tracing
CCRP	120VAC Critical control room power distribution
COMM	Communications
CRID	120VAC Control room instrumentation distribution
CRL	Control room 250VDC emergency lighting
CRP	120/208VAC Control room power distribution
DIS	Distributed ignition system – hydrogen ignition
DMIM	Digital metal impact monitoring
EHR	Electric hydrogen recombiner
ELTG	Emergency lighting packs
LSI	Local shutdown indication / remote shutdown panel
LTP	Lightning protection
MIDAS	Meteorological information data acquisition system
MISAC	Miscellaneous AC protection and metering
MISAD	Miscellaneous AC distribution
MISDC	Miscellaneous DC protection and metering
MISDD	Miscellaneous DC distribution
MISIC	Miscellaneous AC instrumentation and control power
MISID	Miscellaneous DC instrumentation and control power
NI	Nuclear instrumentation
OFPW	Offsite power

Table 2.2-1b (Continued)	
System Code	**System**
PLTG	Plant lighting
PPC	Plant process computer
RPS	Reactor protection system
SEIS	Seismic monitoring
TSC	Technical support center uninterruptible power supply distribution
VMS	Video monitoring system

Table 2.2-2
Systems Not Within the Scope of License Renewal

Table 2.2-2		
System Code	**System**	**UFSAR Reference**
BS	Bleed steam	Section 10.3.2
CAR	Condenser air removal	Section 10.4
CC	Chemical cleaning	None
COND	Condensate	Sections 10.4 and 10.5.1
CW	Circulating water	Section 10.6
DA	Decontamination air	None
GEN	Main generator	Section 10.3
H2	Reactor hydrogen	Sections 11.1.2 and 9.2
HDS	Humidity detection system - containment	Sections 4.2.7 and 1.4.3
HDV	Heaters drains and vents	Section 10.5.1
LAWN	Lawn sprinkler	None
MSR	Moisture separator reheater	Section 10.3
NAOCL	Sodium hypochlorite system	Sections 2.6.4 and 10.6.2
NAPL	Not applicable (This system code is used for miscellaneous components.)	None
PHB	Plant heating boiler	None
SEWER	Sewage disposal and treatment	None
SS	Secondary sampling	None (The “Normal Sampling” system in UFSAR Section 9.6 discusses primary sampling. Blowdown sampling is discussed, but this is reviewed with the blowdown system.)

Table 2.2-2 (Continued)

System Code	System	UFSAR Reference
TACW	Turbine auxiliary cooling water	Section 10.7
VTB	Turbine building ventilation	None
VTSC	Technical support center ventilation	None

Table 2.2-3
Structures Within the Scope of License Renewal

Table 2.2-3	
Structure	**Screening Results**
Auxiliary building	Section 2.4.2, Auxiliary Building
Containment	Section 2.4.1, Containment
Turbine building and screenhouse	Section 2.4.3, Turbine Building and Screenhouse
Fire protection pump house	Section 2.4.4, Yard Structures
Flood protection earth (under roadway)	Section 2.4.4, Yard Structures
Gas bottle storage tank foundation	Section 2.4.4, Yard Structures
Roadway	Section 2.4.4, Yard Structures
Security diesel generator room	Section 2.4.4, Yard Structures
Switchyard control house	Section 2.4.4, Yard Structures
Tank area pipe tunnel (condensate storage tank, refueling water storage tank, and emergency diesel generator piping tunnel)	Section 2.4.4, Yard Structures
Tank foundations: condensate storage tank	Section 2.4.4, Yard Structures
Tank foundations: fire protection water storage tank	Section 2.4.4, Yard Structures
Tank foundations: primary water storage tank	Section 2.4.4, Yard Structures
Tank foundations: refueling water storage tank	Section 2.4.4, Yard Structures
Tower: Unit 1 power delivery to switchyard	Section 2.4.4, Yard Structures
Tower: Unit 2 power delivery to switchyard	Section 2.4.4, Yard Structures
Transformer pedestals	Section 2.4.4, Yard Structures
Trench from switchyard to startup transformers (duct bank)	Section 2.4.4, Yard Structures

Table 2.2-4
Structures Not Within the Scope of License Renewal

(The UFSAR does not contain details of these structures.)

Structure
Absorption fields
Blast and paint shop
Chlorine house
Concrete mixing house
Containment access building
Contractors access control
Deluge valve houses
Dry wells
East sewage treatment plant
Fabrication shop / contaminated equipment storage area
Fire truck house and storage
Gas cylinder storage
Grounds
Hazardous storage building
Instrument calibration facility
Loading dock
Loop feed enclosure
Meteorological towers
Miscellaneous storage and offices building
North entrance bridge
Office buildings and service building
Project management and installation services building

Structure
Microwave repeater and tower
Radioactive material building
Sanitation and sedimentation ponds
Security (north access control guardhouse)
Security fences and gates
Security, fire protection, and maintenance procedures building
Shooting range
South site access control
South security control center annex
South sewage treatment plant
Steam generator storage building
Switchyard tower and pedestal for Unit 2 power delivery
Tank foundations: neutralization tank
Tank foundations: used oil tank
Temporary trailers
Training center
Transformer deck storm basins
Trash unloading building
Visitor's center
Warehouses and storage buildings
Well pump structure

2.3 SCOPING AND SCREENING RESULTS: MECHANICAL SYSTEMS

2.3.1 Reactor Coolant System

Unless otherwise stated, the reactor coolant system (RCS) description and component descriptions are applicable to both Units 1 and 2.

System Description

The RCS is designed to contain pressurized treated (borated) water while transporting heat from the reactor core to the steam generators. The system consists of four similar heat transfer loops connected in parallel to the reactor vessel. Each loop contains a reactor coolant pump and a steam generator. In addition, the system includes a pressurizer, a pressurizer relief tank, and the necessary interconnecting piping and instrumentation. All major components are located in the reactor containment.

During operation, the reactor coolant pumps circulate pressurized water through the reactor vessel and the reactor coolant loops. The water, which serves as a coolant, moderator, and solvent for boric acid (chemical shim control), is heated as it passes through the core. The water then flows to the steam generators, where the heat is transferred to the secondary system. The coolant exits the steam generators, returning to the reactor coolant pumps to repeat the cycle.

System pressure is controlled in the pressurizer where water and steam are maintained in equilibrium by electrical heaters and water sprays. The pressurizer lower half is filled with saturated water and the top half is filled with saturated steam. Pressurizer heaters in the liquid space are used to form steam to raise and maintain pressure. Pressurizer sprays in the steam space are used to condense steam to lower pressurizer pressure.

Overpressure protection is provided by three spring-loaded safety valves and three power-operated relief valves connected to the pressurizer. The low temperature overpressure protection (LTOP) system provides overpressure protection during low temperature operation of the reactor coolant system, when the reactor vessel is vulnerable to brittle fracture failure. The LTOP system is a combination of automatic actuation devices, passive relief devices, and administrative controls designed to ensure that RCS pressure is maintained within limits defined in Appendix G of 10 CFR 50 (Reference 2.3.1-4).

Components and piping in the RCS are insulated with a material compatible with the system temperature to reduce heat loss. Insulation material used for RCS components has low soluble chloride and other halide content to minimize the possibility of stress corrosion cracking of stainless steel.

The RCS is within the scope of license renewal as a safety-related system, which meets the criterion of 10 CFR 54.4(a)(1) (Reference 2.3.1-5). Certain nonsafety-related portions of the system are within the scope of license renewal as potentially affecting safety-related components, which meets the criterion of 10 CFR 54.4(a)(2). For the criterion of 10 CFR 54.4(a)(3), the RCS is within the scope of license renewal for pressurized thermal shock requirements, station blackout (since the RCS pressure boundary must be maintained during station blackout), and fire protection for safe shutdown following a fire.

The RCS intended function to "provide a pressure and fission product barrier" was used to establish the CNP RCS Class 1 evaluation boundary. The reactor vessel internals were considered to be included in the evaluation boundary. The CNP RCS Class 1 evaluation boundary corresponds to RCS pressure boundary components within the ASME Section XI (Reference 2.3.1-7), Subsection IWB inspection boundary and includes the non-Class 1 instrumentation and vent lines attached to RCS components. The secondary side of the steam generators (i.e., vessel shell and nozzles attached to the vessel that are inspected in accordance with ASME Section XI, Subsection IWC) are also included within the evaluation boundary. Components within the RCS Class 1 evaluation boundary are hereafter referred to as Class 1 components.

UFSAR References

Chapter 4 discusses the RCS. Section 4.2.1 provides a general description. Other UFSAR references are provided in the component descriptions below.

Components Subject to Aging Management Review

The following Class 1 components support the RCS system intended functions and are subject to aging management review:

- Reactor vessel and control rod drive mechanism pressure boundary (Section 2.3.1.2)
- Reactor vessel internals (Section 2.3.1.3)
- Class 1 piping, valves, and reactor coolant pumps (RCPs) (Section 2.3.1.4)
- Pressurizer (Section 2.3.1.5)
- Steam generators (Section 2.3.1.6)

Tables 2.3.1-1 through 2.3.1-5 list the RCS components/items that require aging management review and their intended functions.

Tables 3.1.2-1 through 3.1.2-5 provide the results of the aging management review for RCS Class 1 components.

The RCS Class 1 piping evaluation boundary extends into portions of ancillary systems attached to the RCS. The Class 1 components of the systems listed below are evaluated with the RCS. The non-Class 1 portions of the systems listed below are evaluated in the referenced sections:

- Chemical and volume control system (Section 2.3.3.5)
- Emergency core cooling system (Section 2.3.2.3)
- Nuclear sampling (Section 2.3.3.11)

The following systems are included in their entirety with the RCS evaluation:

- Control rod drives (included with the reactor vessel in Section 2.3.1.2), and
- Reactor vessel level instrumentation system (RVLIS) (included with RCS piping in Section 2.3.1.4).

Containment penetrations that perform a containment isolation function and that are included as part of the RCS are evaluated in Section 2.3.1.4. Certain nonsafety-related portions of the RCS have no system intended functions other than to maintain mechanical/structural integrity such that nearby safety-related equipment is not adversely affected. These nonsafety-related portions of the RCS are outside the Class 1 evaluation boundary and are addressed in Section 2.3.3.11. RCS structural supports are evaluated in Section 2.4.

The nuclear fuels system is not included with the RCS. See Section 2.3.3.12 for discussion of the nuclear fuels system.

<u>License Renewal Drawings</u>

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5128, 5128A, 5129, 5129A, 5135D, 5141, 5142, 5143, 5143A, 5147.
- Unit 2: LRA-2-5128, 5128A, 5129, 5129A, 5135D, 5141, 5142, 5143, 5143A, 5147.

2.3.1.1 Westinghouse Owners Group Generic Technical Reports

I&M participated in a Westinghouse Owners Group effort that developed a series of generic topical reports, the purpose of which was to demonstrate that the aging effects for RCS components can be adequately managed for the period of extended operation.

The following topical reports, applicable to Westinghouse reactor coolant systems have been approved by the NRC:

- WCAP-14574-A, "License Renewal Evaluation: Aging Management Evaluation for Pressurizers," (Reference 2.3.1-1)
- WCAP-14575-A, "Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components," (Reference 2.3.1-2)
- WCAP-14577-A, "License Renewal Evaluation: Aging Management for Reactor Internals," Revision 1-A (Reference 2.3.1-3)

NRC-approved generic topical reports may be incorporated by reference pursuant to 10 CFR 54.17(e) (Reference 2.3.1-6) provided the conditions of approval contained in the safety evaluation of the specific report are met. I&M used the following process to incorporate approved Westinghouse Owners Group topical reports by reference into this license renewal application:

(1) *Comparison of the component intended functions for the reactor coolant system components under review.* The CNP-specific component screening review first identified the component intended functions and then compared these functions to those identified in the generic topical reports. Differences were noted and a justification for each difference was provided.

(2) *Identification of the items that are subject to aging management review.* CNP drawings and pertinent design and field change data were reviewed. The process established the full extent to which the scope of the generic topical reports bound the CNP RCS components. For those components requiring aging management review, a comparison of the component material and environment was considered in determining the extent to which the plant scope is bound by the generic topical report.

(3) *Identification of the applicable aging effects.* An independent assessment of the applicable aging effects was performed by reviewing plant operating environment, operating stresses, and plant-specific operating experience. This assessment revealed potential aging effects not identified in the generic topical reports. Aging effects for items determined to be subject to aging management review that were not identified in the generic topical reports were evaluated.

(4) *Review of Applicant Action Items.* In order to facilitate NRC review, applicant action items were addressed.

The results of steps (1) and (2) are provided in Sections 2.3.1.2 through 2.3.1.6; the results of step (3) are provided in Section 3.1; and the results of step (4) are included in Tables 2.3.1-6 through 2.3.1-8.

2.3.1.2 Reactor Vessel and Control Rod Drive Mechanism Pressure Boundary

The CNP reactor vessel for each unit includes the following:

- Reactor vessel shell
- Lower vessel head
- Closure head
- Nozzles and safe ends
- Interior attachments
- Associated pressure-retaining bolting
- Pressure-retaining portions of the control rod drive mechanisms (CRDMs)

The reactor vessel contains the nuclear fuel core, core support structures, control rods, and other parts directly associated with the core. The vessel is cylindrical with a welded hemispherical bottom head and a removable, hemispherical upper head. The vessel has four inlet nozzles and four outlet nozzles with weld-deposited cladding on inner surfaces. These eight nozzles are arranged circumferentially around the vessel at the nozzle belt of the vessel, below the vessel closure flange but above the top of the core.

The reactor vessel closure heads are penetrated by CRDM nozzles with attached nozzle adapters and a vent pipe. These nozzles are attached to the head with partial penetration welds. The pressure-retaining items associated with the CRDMs include pressure housings and rod travel housings. Each CRDM pressure housing is threaded onto the adapter on top of the reactor pressure vessel and seal welded or mechanically clamped. The closure at the top of the rod travel housing includes a threaded cap with a canopy seal weld or conoseal joint.

The reactor vessel closure head is sealed by two hollow, metallic O-rings. Seal leakage is detected by means of two leak-off connections, one between the inner and outer ring and one outside the outer ring. The O-rings are replaced regularly and are therefore not subject to aging management review.

The bottom head is penetrated by nozzle and conduit assemblies through which the incore instrumentation thimble tubes are inserted into the reactor core.

The CNP reactor vessels and CRDMs were constructed in accordance with the requirements of the ASME Section III (Reference 2.3.1-8).

The reactor vessel internals are discussed in Section 2.3.1.3 and the RCS piping attached to reactor vessel safe ends is discussed in Section 2.3.1.4. CNP UFSAR Section 4.2.2.1, Reactor Vessel, provides additional information regarding the CNP reactor vessels.

Components Subject to Aging Management Review

Table 2.3.1-1 lists the components that require aging management review and their intended functions.

Table 3.1.2-1 lists the mechanical components, component functions, and materials of construction for the CNP reactor vessels.

2.3.1.3 Reactor Vessel Internals

Reactor vessel internals consist of the lower core support structure (including the entire core barrel, thermal shield, and baffle/former assembly), the upper core support, and the incore instrumentation support structures. Reactor coolant flows from the vessel inlet nozzles down the annulus between the core barrel and the vessel wall, then into a plenum at the bottom of the vessel. It then reverses direction and flows up through the core support and through the lower core plate. After passing through the core, the coolant enters the region of the upper support structure, then flows radially to the core barrel outlet nozzles and directly through the vessel outlet nozzles.

Reactor vessel internals perform the following functions:

- Provide support and orientation for the reactor core
- Provide support, orientation, guidance, and protection of the control rod assemblies
- Direct reactor coolant flow past the reactor core
- Provide support, guidance, and protection for the incore instrumentation

- Limit the core support structure displacement
- Provide gamma and neutron shielding for the reactor pressure vessel

I&M reviewed the current design and operation of the reactor vessel internals using the process described in Section 2.3.1.1 and confirmed that the CNP reactor vessel internals are bounded by the description provided in WCAP-14577-A. The component intended functions for the reactor vessel internals are consistent with the intended functions identified in WCAP-14577-A. The NRC review of WCAP-14577-A resulted in applicant action items, which are documented in the corresponding NRC safety evaluation. CNP-specific responses to those applicant action items relevant to the identification of reactor vessel internals components subject to aging management review are provided in Table 2.3.1-6.

CNP UFSAR Section 3.2.1 (Unit 1), Mechanical Design and Evaluation, and Section 3.2.2 (Unit 2), Reactor Vessel Internals, provide additional information regarding the CNP reactor vessel internals.

Components Subject to Aging Management Review

Table 2.3.1-2 lists the components that require aging management review and their intended functions.

Table 3.1.2-2 lists the mechanical components, component functions, and materials of construction for the CNP reactor vessel internals.

2.3.1.4 Class 1 Piping, Valves, and Reactor Coolant Pumps

RCS Class 1 piping and associated pressure boundary components consist of the following:

- Primary loop piping interconnecting the reactor vessel with the steam generator and RCP in each loop
- Pressurizer surge, spray, and relief lines
- Auxiliary spray line
- Normal and alternate charging lines
- Letdown and excess letdown line
- Residual heat removal lines

- Safety injection lines
- Accumulator lines
- Sample/instrument lines (includes RVLIS)
- Vent pipe from the reactor vessel head
- Resistance temperature detector bypass lines, loop bypass lines, direct immersion resistance temperature detectors, thermowells, sample and spray scoops, and reactor vessel flange leak-off lines

Portions of RCS instrumentation and sampling tubing have been included within this section for convenience. This includes the reactor coolant pressure boundary items (valves and tubing) downstream of the instrument root valves. The pressure-retaining portion of Class 1 valves consists of the valve body, bonnet, and closure bolting. RCS Class 1 valves are welded in place with the exception of the pressurizer safety valves, which have flanged connections.

The following portions of the RCPs perform a pressure boundary function:

- Pump casings
- Main closure flanges
- Seals
- Thermal barrier coil heat exchangers
- Pressure-retaining closure bolting

RCP seals are periodically monitored, inspected, and replaced (as required) and are therefore not subject to aging management review.

Class 1 piping is designed and constructed in accordance with USAS B31.1 (Reference 2.3.1-9). RCS valves are designed and constructed to ASME/ANSI B-16.5 (Reference 2.3.1-10) or MSS-SP-66 (Reference 2.3.1-11), and ASME Section III. The RCPs are designed and constructed using ASME Section III as a guide. These codes are consistent with WCAP-14575-A.

I&M reviewed the current design and operation of the reactor coolant piping using the process described in Section 2.3.1.1. This review confirmed that the CNP Class 1 piping, valves, and RCPs are bounded by the description provided in WCAP-14575-A with regard to the following:

- Design criteria and features
- Materials of construction
- Fabrication techniques
- Installed configuration
- Modes of operation
- Environments/exposures

The component intended functions are consistent with the intended functions identified in WCAP-14575-A. The NRC review of WCAP-14575-A resulted in applicant action items, which are documented in the corresponding NRC safety evaluation. CNP-specific responses to those applicant action items relevant to the identification of reactor coolant piping components subject to aging management review are provided in Table 2.3.1-7. The following sections of the CNP UFSAR provide additional information regarding the CNP Class 1 piping, valves, and RCPs:

- Section 4.2.2.5, Reactor Coolant Pump
- Section 4.2.2.6, Reactor Coolant System Vents
- Section 4.2.2.7, Reactor Coolant Piping
- Section 4.2.2.8, Valves

Components Subject to Aging Management Review

Table 2.3.1-3 lists the components that require aging management review and their intended functions.

Table 3.1.2-3 lists the mechanical components, component functions, and materials of construction for the CNP Class 1 piping, valves, and RCPs.

2.3.1.5 Pressurizer

The pressurizer is a low-alloy steel, vertically oriented, cylindrical vessel with hemispherical top and bottom heads and austenitic stainless steel cladding on interior surfaces that are exposed to the reactor coolant. The pressurizer is connected to the RCS on one of the hot legs of a coolant loop. Electrical heaters are installed through the bottom head of the pressurizer, while the spray nozzle, relief and safety valve connections are located in the top head of the pressurizer. The pressurizer includes the vessel, attached nozzles, and safe ends out to the connection with RCS piping. Valves (i.e., safety and relief), instrument lines, and other piping connected to the pressurizer are discussed in Section 2.3.1.4.

I&M reviewed the current design and operation of the Unit 1 and Unit 2 pressurizers using the process described in Section 2.3.1.1 and confirmed that both CNP pressurizers are bounded by the description provided in WCAP-14574-A. The pressurizers were designed and constructed in accordance with ASME Code Section III. This is consistent with WCAP-14574-A. The component intended functions for the pressurizers are inclusive of the intended functions identified in WCAP-14574-A.

In addition to the functions identified in WCAP-14574-A, I&M identified an additional function of pressure control. The pressurizer spray head and heaters provide pressure control during certain design basis events. NRC review of WCAP-14574-A resulted in applicant action items, which are documented in the corresponding NRC safety evaluation. CNP-specific responses to those applicant action items relevant to the identification of pressurizer components subject to aging management review are provided in Table 2.3.1-8. CNP UFSAR Section 4.2.2.2, Pressurizer, provides additional information regarding the CNP pressurizers.

Components Subject to Aging Management Review

Table 2.3.1-4 lists the components that require aging management review and their intended functions.

Table 3.1.2-4 lists the mechanical components, component functions, and materials of construction for the CNP pressurizers.

2.3.1.6 Steam Generators

The steam generators are vertical shell and U-tube heat exchangers with integral moisture separating equipment. Reactor coolant flows through the inverted U-tubes, entering and leaving through nozzles located in the hemispherical bottom head of the steam generator. The head is divided into inlet and outlet chambers by a vertical partition plate extending from the head to the tube sheet. Feedwater enters the steam generators and is distributed through a feedwater ring located just below the moisture separators. Feedwater flows down between the steam generator shell and tube bundle wrapper and into the tube bundle just above the tube sheet. Steam is generated on the shell side of the tube bundle and flows upward through the moisture separators to the outlet nozzle at the top of the vessel. Each Unit 1 steam generator outlet nozzle contains an integral flow-restricting venturi that limits steam release in the event of a main steam line break.

The steam generators include the following:

- Steam generator upper and lower shells
- Transition cone
- Elliptical upper head
- Hemispherical bottom head
- Primary and secondary manways, nozzles and safe ends
- Thermal sleeves
- Partition plate
- Tubesheet
- U-tubes
- Interior attachments
- Instrumentation ports and handholes
- Associated pressure-retaining bolting

The CNP steam generators were constructed in accordance with the requirements of ASME Section III. The Unit 1 steam generator replacement in 2000 included installation of a new lower assembly (including tube bundle), new steam drum internals, and a new feedwater distribution system. The steam drum internals were installed in the refurbished, original steam drum shell. The Unit 2 steam generator replacement in 1988 included installation of a new lower assembly (including tube bundle) and refurbishment of the upper assembly (steam drum) and associated internals.

CNP UFSAR Section 4.2.2.4, Steam Generators, provides additional information regarding the CNP steam generators.

Components Subject to Aging Management Review

Table 2.3.1-5 lists the components that require aging management review and their intended functions.

Table 3.1.2-5 lists the mechanical items, intended functions, and materials of construction for the CNP steam generators.

2.3.1.7 References for Section 2.3.1

2.3.1-1 WCAP-14574-A, "License Renewal Evaluation: Aging Management Evaluation for Pressurizers," December 2000.

2.3.1-2 WCAP-14575-A, "Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components," December 2000.

2.3.1-3 WCAP-14577-A, "License Renewal Evaluation: Aging Management for Reactor Internals," Revision 1-A, March 2001.

2.3.1-4 Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix G, "Fracture Toughness Requirements."

2.3.1-5 Title 10 of the Code of Federal Regulations (CFR), Part 54, Section 54.4, "Scope."

2.3.1-6 Title 10 of the Code of Federal Regulations (CFR), Part 54, Section 54.17, "Filing of application."

2.3.1-7 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*.

2.3.1-8 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, *Rules for Construction of Nuclear Facility Components*.

2.3.1-9 U.S.A. Standard (USAS) B31.1, *Power Piping Code*.

2.3.1-10 American Society of Mechanical Engineers (ASME) / American National Standards Institute (ANSI) Standard B-16.5, *Pipe Flanges and Flanged Fittings*.

2.3.1-11 The Manufactures Standardization Society of the Valve & Fitting Industry (MSS), Standard MSS-SP-66, *Pressure Ratings for Steel Buttwelding End Valves*

Table 2.3.1-1
Reactor Vessel and CRDM Pressure Boundary Components Subject to Aging Management Review

Table 2.3.1-1	
Component Type	**Intended Function**
Bottom head Shell – nozzle course Upper head Inlet nozzles Outlet nozzles	Pressure boundary
Shell rings	Pressure boundary
Weld buildup support pads (external attachment)	Component support
Inlet nozzle safe ends Outlet nozzle safe ends	Pressure boundary
Vessel flange Closure head flange	Pressure boundary RV internals support
Closure studs Closure nuts Washers	Pressure boundary
CRDM nozzles	Pressure boundary
CRDM housing adapter	Pressure boundary
In-core instrumentation nozzles	Pressure boundary
In-core instrumentation nozzle safe ends	Pressure boundary
Bottom-mounted instrumentation (BMI) thimble guide tubes	Pressure boundary
BMI thimble tubes and bullet plugs	Pressure boundary
Thimble seal table	Pressure boundary
Core support lugs	RV internals support
Vent line (nozzle and elbow)	Pressure boundary
Vent line safe end	Pressure boundary

Table 2.3.1-1 (Continued)	
Component Type	**Intended Function**
CRDM housing Core exit thermocouple nozzle assembly, holddown nut, compression collar and lockwasher	Pressure boundary
CRDM housing cap	Pressure boundary
Lifting lugs	Note 1
Ventilation shroud support ring	Component support
Flange leak tubes	Pressure boundary

Note 1: Although the lifting lugs do not directly support any intended function, they are included for completeness.

Table 2.3.1-2
Reactor Vessel Internals
Components Subject to Aging Management Review

Table 2.3.1-2	
Component Type	**Intended Function (as defined in Table 2.0-1)**
Lower Core Support Structure	
Core barrel (Barrel, flange, outlet nozzle, and fasteners)	Core support Flow distribution Shielding
Core former plates Core baffle plates	Core support Flow distribution Shielding
Core former bolts Core baffle bolts	Core support
Lower core plate Lower support columns	Core support Flow distribution
Diffuser plate	Flow distribution
Lower support plate Lower core plate support column cap	Core support Flow distribution
Secondary core support assembly (energy absorbers)	Secondary core support
Clevis insert block and fasteners	Core support
Thermal shield	Shielding
Upper Core Support Structure	
Upper support plate Deep beam sections Upper support columns Support column bolts (upper and lower)	Core support Control rod support Flow distribution Incore support
Upper core support column mixing device Upper core support column orifice base	Core support Flow distribution

Table 2.3.1-2 (Continued)	
Component Type	**Intended Function (as defined in Table 2.0-1)**
Upper Core Support Structure (continued)	
Upper core plate Upper core plate alignment pins Radial keys	Core support Control rod support Flow distribution Incore support
Holddown spring	Core support
Control rod guide tube pin Fuel assembly guide pin	Core support Control rod support
Guide tube assemblies	Control rod support Flow distribution
In-Core Instrumentation Support Structure	
Upper system (thermocouples) Lower system (flux thimbles)	Incore support

Table 2.3.1-3
Class 1 Piping, Valves, and Reactor Coolant Pumps
Components Subject to Aging Management Review

Component Type	Intended Function
Class 1 Piping	
Hot leg pipe and fittings Cold leg pipe and fittings Crossover leg pipe and fittings	Pressure boundary
Pressurizer surge line	Pressure boundary
Pipe and fittings (including blind flanges) Nominal Pipe Size (NPS) ≥ 4”	Pressure boundary
Pipe and fittings (including blind flanges) NPS < 4”	Pressure boundary
Branch nozzles NPS ≥ 4”	Pressure boundary
Branch nozzles NPS < 4” (Includes sample and spray scoops, thermowells, and immersion RTDs)	Pressure boundary
Thermal sleeves	Pressure boundary
Orifices	Throttling Pressure boundary
Class 1 Valves	
Class 1 valve bodies and bonnets ≥ 2½”	Pressure boundary
Class 1 valve bodies and/or bonnets ≤ 2”	Pressure boundary
Bolting material (for valves and blind flanges)	Pressure boundary
Reactor Coolant Pumps	
Casing	Pressure boundary
Main closure flange	Pressure boundary
Main flange bolts	Pressure boundary
Thermal barrier heat exchanger	Pressure boundary

Table 2.3.1-4
Pressurizer
Components Subject to Aging Management Review

Table 2.3.1-4	
Component Type	**Intended Function**
Lower head Shell Upper head	Pressure boundary
Surge nozzle Spray nozzle Relief nozzle Safety nozzle	Pressure boundary Pressure control (spray nozzle only)
Surge nozzle safe end Spray nozzle safe end Relief nozzle safe end Safety nozzle safe end	Pressure boundary Pressure control (spray nozzle safe end only)
Surge and spray nozzle thermal sleeve	Pressure boundary Pressure control (spray nozzle thermal sleeve only)
Heater well nozzles and coupling	Pressure boundary
Immersion heater sheaths	Pressure boundary
Heater support plates Heater support plate brackets Heater support plate bracket bolts	Pressure control
Spray head	Pressure control
Spray head locking bar Spray head coupling	Pressure control
Support skirt and flange	Component support
Seismic lugs	Component support
Valve support bracket lugs	Component support
Instrument nozzles and couplings	Pressure boundary
Manway insert	Pressure boundary
Manway forging	Pressure boundary

Table 2.3.1-4 (Continued)	
Component Type	**Intended Function**
Manway cover	Pressure boundary
Manway cover bolts/studs	Pressure boundary

Table 2.3.1-5
Steam Generator
Components Subject to Aging Management Review

Table 2.3.1-5	
Component Type	**Intended Function**
Primary Side	
Primary head	Pressure boundary
Primary nozzles	Pressure boundary
Primary nozzle safe ends	Pressure boundary
Partition plates Nozzle dam retention rings	Pressure boundary
Primary manway insert plate	Pressure boundary
Primary manway cover	Pressure boundary
Primary manway closure bolting	Pressure boundary
Tubes/plugs	Pressure boundary Heat transfer
Tubesheet	Pressure boundary
Secondary side externals	
Lower shell Upper shell Transition cone Steam drum Elliptical upper head	Pressure boundary
Feedwater nozzles	Pressure boundary
Feedwater nozzle thermal sleeve (Unit 1 only)	Pressure boundary
Main steam nozzles	Pressure boundary
Feedwater safe ends (Unit 1 only)	Pressure boundary
Secondary blowdown and instrumentation connections Recirculation connections (Unit 1 only) Secondary shell drain connections (Unit 2 only)	Pressure boundary

Table 2.3.1-5 (Continued)	
Component Type	**Intended Function**
Secondary side externals (continued)	
Secondary handhole ports Inspection ports	Pressure boundary
Secondary handhole port covers Inspection port covers Recirculation port covers (Unit 1 only)	Pressure boundary
Secondary manways	Pressure boundary
Secondary manway covers	Pressure boundary
Secondary manway, handhole, recirculation (Unit 1 only), and inspection port closure bolting	Pressure boundary
Steam flow restrictors (Unit 1 only)	Throttling
Feedwater elbow thermal liners (Unit 2 only) Feedwater liner piston rings (Unit 2 only)	Pressure boundary
Secondary side internals	
Tube wrappers (shroud)	Pressure boundary (Note 1)
Tube support plates (Unit 2 only) Anti-vibration bar (AVB) (Unit 2 only)	Pressure boundary (Note 1)
Tube support plate stayrods (Unit 2 only) Tube support plate spacers (Unit 2 only)	Pressure boundary (Note 1)
Tube support plate stayrod nuts (Unit 2 only)	Pressure boundary (Note 1)
Tube support plate stayrod washers (Unit 2 only) AVB retaining rings (Unit 2 only)	Pressure boundary (Note 1)
Lattice grid ring (Unit 1 only) U-bend arch bars (Unit 1 only)	Pressure boundary (Note 1)
Lattice grid ring studs (Unit 1 only)	Pressure boundary (Note 1)
Lattice grid bars (Unit 1 only) U-bend flat bars (Unit 1 only) J-tabs (Unit 1 only)	Pressure boundary (Note 1)

Note 1: These components perform the intended function of providing structural and/or functional support for in-scope equipment (i.e., the steam generator tubes), and are therefore within the scope of license renewal requiring an aging management review.

Table 2.3.1-6
Renewal Applicant Action Items for
WCAP-14577-A, License Renewal Evaluation: Aging Management for Reactor Internals

Table 2.3.1-6: WCAP-14577-A		
RAAI Number	**RAAI Description**	**CNP Response**
4.1 (1)	To ensure applicability of the results and conclusions of WCAP-14577 to the applicant's plant(s); the license renewal applicant is to verify that the critical parameters for the plant are bounded by the topical report. Further, the renewal applicant must commit to programs described as necessary in the topical report to manage the effects of aging during the period of extended operation on the functionality of the reactor vessel components. Applicants for license renewal will be responsible for describing any such commitments and proposing the appropriate regulatory controls. Any deviations from the aging management programs described in this topical report as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel internal components or other information presented in the report, such as materials of construction, must be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	As summarized in Section 2.3.1.3, the CNP reactor vessel internals are bounded by the topical report with regard to design criteria and features, materials of construction, fabrication techniques, installed configuration, modes of operation, and environments. The results of the aging management review for the reactor vessel internals are provided in Section 3.1.2.1.2 and summarized, along with the intended function and the programs necessary to manage the effects of aging, in Table 3.1.2-2. A description of these programs is provided in Appendix B.

Table 2.3.1-6: WCAP-14577-A (Continued)		
RAAI Number	**RAAI Description**	**CNP Response**
4.1 (2)	A summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs must be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).	Program activities to manage the effects of aging for reactor vessel internals are summarized in the proposed UFSAR supplement provided in Appendix A. Changes to the UFSAR sections affected by the TLAA evaluations are also included in the proposed UFSAR supplement.
4.1 (3)	For the holddown spring, applicants for license renewal are expected to address intended function, aging management review, and appropriate aging management program(s).	The holddown spring is in-scope for the reactor vessel internals. The results of the aging management review for the reactor vessel internals are provided in Section 3.1.2.1.2 and summarized, along with the intended function and the programs necessary to manage the effects of aging, in Table 3.1.2-2. A description of these programs is provided in Appendix B.

Table 2.3.1-6: WCAP-14577-A (Continued)

RAAI Number	RAAI Description	CNP Response
4.1 (4)	The license renewal applicant must address aging management review, and appropriate aging management program(s), for guide tube support pins.	The guide tube support pins are part of the guide tube support assemblies, which are in scope for the reactor vessel internals. The results of the aging management review for the reactor vessel internals are provided in Section 3.1.2.1.2 and summarized along with the intended function and the programs necessary to manage the effects of aging in Table 3.1.2-2. A description of these programs is provided in Appendix B.
4.1 (5)	The license renewal applicant must explicitly identify the materials of fabrication of each of the components within the scope of the topical report. The applicable aging effect should be reviewed for each component based on the materials of fabrication and the environment.	The material and environment for all reactor vessel internal components requiring aging management review and the corresponding aging effects are summarized in Table 3.1.2-2.

Table 2.3.1-6: WCAP-14577-A (Continued)

RAAI Number	RAAI Description	CNP Response
4.1 (6)	The license renewal applicant must describe its aging management plans for loss of fracture toughness in cast austenitic stainless steel RVI components, considering the synergistic effects of thermal aging and neutron irradiation embrittlement in reducing the fracture toughness of these components.	CASS reactor vessel internal components, the associated environment and aging effects, and the program to manage reduction in fracture toughness (Reactor Vessel Internals Cast Austenitic Stainless Steel Program) are summarized in Table 3.1.2-2. A description of this aging management program is provided in Appendix B.
4.1 (7)	The license renewal applicant must describe its aging management plans for void swelling during the license renewal period.	A description of the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program, which will manage void swelling, is provided in Appendix B.
4.1 (8)	Applicants for license renewal must describe how each plant-specific AMP addresses the following elements: (1) scope of the program, (2) preventative actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	Programs necessary to manage the effects of aging for CNP reactor vessel internals address the 10 elements identified. These programs are described in Appendix B.

Table 2.3.1-6: WCAP-14577-A (Continued)

RAAI Number	RAAI Description	CNP Response
4.1 (9)	The license renewal applicant must address plant-specific plans for management of cracking (and loss of fracture toughness) of RVI components, including any plans for augmented inspection activities.	The programs necessary to manage cracking and reduction of fracture toughness are identified in Table 3.1.2-2 and described in Appendix B.
4.1 (10)	The license renewal applicant must address plant-specific plans for management of age-related degradation of baffle/former and barrel/former bolting, including any plans for augmented inspection activities.	The programs necessary to manage age-related degradation of baffle/former and barrel/former are identified in Table 3.1.2-2 and described in Appendix B.
4.1 (11)	The license renewal applicant must address the TLAA of fatigue on a plant-specific basis.	I&M has performed an evaluation to identify and evaluate TLAAs applicable to the reactor vessel internals. The results of this evaluation are included in Section 4.3.

Table 2.3.1-7
Renewal Applicant Action Items for
WCAP-14575-A, Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components

Table 2.3.1-7: WCAP-14575-A		
RAAI Number	**RAAI Description**	**CNP Response**
4.1-1	The license renewal applicant is to verify that its plant is bounded by the topical report. Further, the renewal applicant is to commit to programs described as necessary in the topical report to manage the effects of aging during the period of extended operation on the functionality of the reactor coolant system piping. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMPs within this topical report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor coolant system piping and associated pressure boundary components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	As summarized in Section 2.3.1.4, the CNP Class 1 piping, valves, and RCPs are bounded by the topical report with regard to design criteria and features, materials of construction, fabrication techniques, installed configuration, modes of operation, and environments. Program activities to manage the effects of aging for Class 1 piping, valves, and RCPs are described in Appendix B and are summarized in the proposed UFSAR supplement provided in Appendix A.

Table 2.3.1-7: WCAP-14575-A (Continued)

RAAI Number	RAAI Description	CNP Response
4.1-2	Summary description of the programs and evaluation of TLAAs are to be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).	A summary of the programs identified to manage the effects of aging for Class 1 piping, valves, and RCPs is included in the proposed UFSAR supplement in Appendix A. Changes to the UFSAR sections affected by the TLAA evaluations are also included in the proposed UFSAR supplement.
4.1-3	The renewal applicant should complete the updated review of generic communications and capture any additional items not identified by the original review.	A review of the generic communications related to the RCS has been completed. The aging management review of the RCS detailed in Section 3.1 captures industry issues with no additional aging effects identified.
4.1-4	The license renewal applicant must provide a description of all insulation used on austenitic stainless steel NSSS piping to ensure the piping is not susceptible to stress-corrosion cracking from halogens.	Insulation materials that do not cause chloride-stress corrosion are required for the insulation of CNP stainless steel RCS components and for those adjacent nonstainless surfaces where moisture from the insulation could contact the stainless steel.

Table 2.3.1-7: WCAP-14575-A (Continued)		
RAAI Number	**RAAI Description**	**CNP Response**
4.1-5	The license renewal applicant should describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventative actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	Programs necessary to manage the effects of aging for Class 1 piping, valves, and RCPs address the ten elements identified. These programs are identified in Table 3.1.2-3 and described in Appendix B.
4.1-6	The license renewal applicant should perform additional inspection of small-bore RCS piping, that is, less than 4-inch-size piping, for license renewal to provide assurance that potential cracking of small-bore RCS piping is adequately managed during the period of extended operation.	The aging management review and specific program commitments for Class 1 small bore piping are addressed in Section 3.1.2.1.3 and summarized in Table 3.1.2-3. These inspections are detailed in the Small Bore Piping Program described in Appendix B.
4.1-7	Components that have delta ferrite levels below the susceptibility screening criteria have adequate fracture toughness and do not require supplemental inspection. As a result of thermal embrittlement, components that have delta ferrite levels exceeding the screening criterion may not have adequate fracture toughness and do require additional evaluation or examination. The license renewal applicant should address thermal-aging issues in accordance with the staff's comments in Section 3.3.3 of this evaluation.	The aging management review and specific program commitments for susceptible Class 1 cast austenitic stainless steel components are addressed in Section 3.1.2.1.3 and summarized in Table 3.1.2-3. These inspections are detailed in the Cast Austenitic Stainless Steel Evaluation Program described in Appendix B.

Table 2.3.1-7: WCAP-14575-A (Continued)

RAAI Number	RAAI Description	CNP Response
4.1-8	The license renewal applicant should perform additional fatigue evaluation or propose an AMP to address the components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.	I&M has performed a plant-specific fatigue review of Class 1 piping, valves, and RCPs. The results of this evaluation are included in Section 4.3.
4.1-9	The staff recommendation for the closure of GSI-190 "Fatigue Evaluation of Metal Components for 60-Year Plant Life" is contained in a December 26, 1999, memorandum from Asok Thadani to William Travers. The license renewal applicant should address the effects of the coolant environment on component fatigue life as aging management programs are formulated in support of license renewal. The evaluation of a sample of components with high-fatigue usage factors using the latest available environmental fatigue data is an acceptable method to address the effects of the coolant environment on component fatigue life.	I&M has performed a plant-specific evaluation of the environmental effects on fatigue of Class 1 piping, valves, and reactor coolant pumps. The results of this evaluation are included in Section 4.3.

Table 2.3.1-7: WCAP-14575-A (Continued)

RAAI Number	RAAI Description	CNP Response
4.1-10	The license renewal applicant should revise AMP-3.6 to include an assessment of the margin on loads in conformance with the staff guidance provided in Reference 11 [Section 5.3 item (i) of NUREG 1061]. In addition, AMP-3.6 should be revised to indicate if the CASS component is repaired or replaced per ASME Code, Section XI IWB-4000 or IWB-7000, a new LBB analysis based on the material properties of the repaired or replaced component (and accounting for its thermal aging through the period of extended operation, as appropriate), is required to confirm the applicability of LBB. The inservice examination/flaw evaluation option is, per the basis on which the NRC staff has approved LBB in the past, insufficient to reestablish LBB approval.	The CNP leak-before-break (LBB) analysis has been evaluated for the period of extended operation in Section 4.0. If a CASS component encompassed by an LBB analysis is repaired or replaced, the CNP Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program requires a new LBB analysis to confirm the applicability of LBB.

Table 2.3.1-8
Renewal Applicant Action Items for
WCAP-14574-A, License Renewal Evaluation: Aging Management Evaluation for Pressurizers

Table 2.3.1-8: WCAP-14574-A		
RAAI Number	**RAAI Description**	**CNP Response**
3.3.1.1-1	License renewal applicants should identify the TLAAs for the pressurizer components, define the associated CUF and, in accordance with 10 CFR 54.21(c)(1), demonstrate that the TLAAs meet the CLB fatigue design criterion, CUF ≤ 1 .0, for the extended period of operation, including the insurge/outsurge and other transient loads not included in the CLB which are appropriate to such an extended TLAA, as described in the WOG report "Mitigation and Evaluation of Thermal Transients Caused by Insurges and Outsurges," MUHP-5060/5061/5062, and considering the effects of the coolant environment on critical fatigue location. The applicant must describe the methodology used for evaluating insurge/outsurge and other off-normal and additional transients in the fatigue TLAAs.	I&M has performed an evaluation to identify and evaluate TLAAs applicable to the pressurizer. The results of this evaluation are included in Section 4.3.

Table 2.3.1-8: WCAP-14574-A (Continued)		
RAAI Number	**RAAI Description**	**CNP Response**
3.2.2.1-1	In the report, WOG concluded that general corrosion is nonsignificant for the internal surfaces of Westinghouse-designed pressurizers and that no further evaluations of general corrosion are necessary. While the staff concurs that hydrogen overpressure can mitigate the aggressive corrosion effect of oxygen in creviced geometrics on the internal pressurizer surfaces, applicants for license renewal will have to provide a basis (statement) in their plant-specific applications about how their water chemistry control programs will provide for a sufficient level of hydrogen overpressure to manage crevice corrosion of the internal surfaces of their pressurizer.	The CNP Water Chemistry Control Program is based on the Electric Power Research Institute (EPRI) guidance in TR-105714 (PWR Primary Water Chemistry Guidelines) for primary water chemistry. These guidelines establish strict limits on chemistry parameters, which are verified through periodic sampling. This program is described in Appendix B.

Table 2.3.1-8: WCAP-14574-A (Continued)

RAAI Number	RAAI Description	CNP Response
3.2.2.1-2	The staff finds that the criteria in GL 88-05 and the Section XI requirements for conducting system leak tests and VT-2 type visual examinations of the pressurizer pressure boundary are acceptable programs for managing boric acid corrosion of the external, ferritic surfaces and components of the pressurizer. However, the report fails to refer to the actual provisions in the ASME Code, Section XI that require mandatory system leak tests of the pressurizer boundary. The applicants must identify the appropriate Code inspection requirements from ASME Code Table IWB-2500-1.	I&M does not credit ASME Section XI for management of boric acid corrosion of the pressurizer. Boric acid corrosion of the pressurizer is managed by the Boric Acid Corrosion Prevention Program, which is comparable with the program described in Section XI.M10 of NUREG-1801. The program relies on implementation of recommendations of NRC Generic Letter (GL) 88-05 to monitor the condition of the reactor coolant pressure boundary for borated water leakage. Therefore, identification of the code inspection requirements for system leak tests of the pressurizer boundary is not relevant.

Table 2.3.1-8: WCAP-14574-A (Continued)

RAAI Number	RAAI Description	CNP Response
3.2.2.3.2-1	The staff concurs that the potential to develop SCC in the bolting materials will be minimized if the yield strength of the material is held to less than 150 ksi, or the hardness is less than 32 on the Rockwell C hardness scale; however, the staff concludes that conformance with the minimum yield strength criteria in ASME Specification SA-193 Grade B7 does not in itself preclude a quenched and tempered low-alloy steel from developing SCC, especially if the acceptable yield strength is greater than 150 ksi. To take credit for the criteria in EPRI Report NP-5769, the applicant needs to state that the acceptable yield strengths for the quenched and tempered low-alloy steel bolting materials (e.g., SA-193, Grade B7 materials) are in the range of 105-150 ksi.	I&M does not take credit for the criteria in EPRI-NP-5769. Instead, the bolting is conservatively identified as requiring management for cracking, which is managed by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program and Bolting and Torquing Activities Program.

Table 2.3.1-8: WCAP-14574-A (Continued)

RAAI Number	RAAI Description	CNP Response
3.2.5-1	The staff considers the discussion in Section 3.5.2 to be extremely confusing in that it appears WOG is making three different conclusions that conflict with one another: a. That fluid flow velocity and particulate conditions are not sufficient in the pressurizer to consider that erosion is a plausible degradation mechanism that could affect the integrity of the subcomponents in the pressurizer. b. That seven components in the pressurizer (refer to the list above) [in WCAP-14574] are exposed to fluid flows that have the potential to result in erosion of the components. c. That only one component in the pressurizer (the spray head) is exposed to fluid flow that has the potential to result in erosion of the component. The applicant should state why erosion is not plausible for the surge nozzle thermal sleeve, spray nozzle thermal sleeve, surge nozzle safe-end, and spray nozzle safe-end. If erosion is plausible, then an AMP is required.	The CNP surge and spray nozzle thermal sleeves and pressurizer safe ends are fabricated from austenitic stainless steel, which exhibits high resistance to erosion. I&M defines operating limits on the RCS fluid particulate concentration, which precludes the buildup of particulates that could contribute to abrasive erosion of stainless steel. In addition, flows in the pressurizer spray lines and surge lines are not sufficient to cause a concern. Therefore, loss of material due to erosion is not an aging effect requiring management.

Table 2.3.1-8: WCAP-14574-A (Continued)		
RAAI Number	**RAAI Description**	**CNP Response**
3.3-1	Applicants for license renewal must describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventive action, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	Programs necessary to manage the effects of aging for CNP pressurizers address the ten elements identified. These programs are described in Appendix B.

Table 2.3.1-8: WCAP-14574-A (Continued)

RAAI Number	RAAI Description	CNP Response
3.3.2.1-1	Applicants for license renewal must provide sufficient details in their LRAs about how the GL 88-05 programs and ISI programs will be sufficient to manage the corrosive effects of boric acid leakage on their pressurizer components during the proposed extended operating terms for their facilities, including postulated leakage from the pressurizer nozzles, pressurizer nozzle-to-vessel welds, pressurizer nozzle-to-safe end welds, and pressurizer manway bolting materials.	The Boric Acid Corrosion Prevention Program was established to address the corrosive effects of boric acid leakage in response to Generic Letter 88-05. The program relies on implementation of recommendations of GL 88-05 to monitor the condition of the reactor coolant pressure boundary for borated water leakage. Periodic visual inspection of adjacent structures, components, and supports for evidence of leakage and corrosion is an element of the Boric Acid Corrosion Prevention Program. The Inservice Inspection Program is not credited for management of boric acid corrosion of the pressurizer. The Boric Acid Corrosion Prevention Program is described in Appendix B.

Table 2.3.1-8: WCAP-14574-A (Continued)

RAAI Number	RAAI Description	CNP Response
3.3.2.2-1	The staff concludes that an AMP is necessary to control and manage the potential for SCC to occur in welded pressurizer penetration nozzles and manway bolting materials, and recommends that a licensee could credit the following programs as the basis for managing the phenomena of PWSCC/IGSCC of the pressurizer components: (1) the primary coolant chemistry control program; (2) the ISI program for the pressurizers; and (3) the plant-specific quality assurance program as it pertains to assuring that previous welding activities on welds in the pressurizer have been controlled in accordance with the pertinent requirements of 10 CFR Part 50, Appendix B, and with the pertinent welding requirements of the ASME Code for Class 1 systems. The staff concludes that applicants need to extend AMP-2-1 to the pressurizer penetration nozzles, to the nozzle-to-vessel welds, and to the manway bolting materials, and to include the appropriate Code requirements among the program attributes listed in Table 4-1 and summarized in the text in Section 4.1 of the report. Applicants for license renewal must provide sufficient details in their LRAs as to how their primary coolant chemistry control programs, ISI programs, and 10 CFR Part 50, Appendix B, quality assurance programs will be sufficient to manage the potential for SCC to occur in the pressurizer nozzle components and bolted manway covers during the proposed extended operating terms for their facilities.	Cracking in penetration nozzles using stainless steel weld materials is managed by of combination of the Water Chemistry Control Program and the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program. Cracking in penetration nozzles using nickel-based alloy weld materials is managed by a combination of the Alloy 600 Aging Management Program, the Water Chemistry Control Program, and the Inservice Inspection Program. Cracking of the manway bolting materials is managed by the Inservice Inspection Program. The Alloy 600 Aging Management Program will identify locations for inspection using risk-informed methods. The Water Chemistry Control Program limits mitigate stress corrosion cracking of stainless steel items in the RCS. The Inservice Inspection Program manages the aging effect of cracking through a combination of visual, surface and volumetric examinations. These aging management programs are described in Appendix B.

Table 2.3.1-8: WCAP-14574-A (Continued)		
RAAI Number	**RAAI Description**	**CNP Response**
3.3.2.2-2	Applicants must propose an AMP to verify whether or not thermal fatigue-induced cracking has propagated through the clad into the ferritic base metal or weld metal beneath the clad.	The Pressurizer Examinations Program will manage the aging effect of clad crack propagation. I&M performs volumetric examinations on selected pressurizer items with high usage factors (e.g., surge nozzle and shell-to-lower head weld). Cracking of the cladding that would extend into the base metal would be detected by ASME Section XI volumetric examinations at those locations. The Pressurizer Examinations Program is described in Appendix B.

Table 2.3.1-8: WCAP-14574-A (Continued)

RAAI Number	RAAI Description	CNP Response
3.3.2.2-3	The staff is concerned that IGSCC in the heat-affected zones of 304 stainless steel supports that are welded to the pressurizer cladding could grow as a result of thermal fatigue into the adjacent pressure boundary during the license renewal term. The staff considers that these welds will not require aging management in the extended operating periods if applicants can provide a reasonable justification that sensitization has not occurred in these welds during the fabrication of these components. Therefore, applicants for license renewal must provide a discussion of how the implementation of their plant-specific procedures and quality assurance requirements, if any, for the welding and testing of these austenitic stainless steel components provides reasonable assurance that sensitization has not occurred in these welds and their associated heat-affected zones. In addition, the staff requests that applicants for license renewal identify whether these welds fall into Item B8.20 of Section XI Examination Category B-H, Integral Attachments for Vessels, and if applicable, whether the applicants have performed the mandatory volumetric or surface examinations of these welds during the ISI intervals referenced in the examination category.	I&M review could not confirm that there are no sensitized welds attached to the pressurizer cladding. Cracking due to stress corrosion cracking is conservatively considered an aging effect requiring management for all pressurizer interior attachments. The Water Chemistry Control Program limits mitigate stress corrosion cracking of stainless steel items in the RCS. Internal attachment welds are not inspected in accordance with Examination Category B-H. However, these will be included within the Pressurizer Examinations Program. The Pressurizer Examinations Program and Water Chemistry Control Program are described in Appendix B.

2.3.2 Engineered Safety Features

Section 6.0 of the UFSAR lists four engineered safety features: the containment structure, the ice condenser, the emergency core cooling system, and the containment spray system. However, in keeping with the format of NUREG-1800, the containment structure and ice condenser are discussed with structures in Section 2.4. Emergency core cooling and containment spray are discussed as ESF systems, as are two additional systems: containment isolation and containment equalization / hydrogen skimmer.

2.3.2.1 Containment Spray

System Description

The purpose of the containment spray system is to provide spray cooling water to the containment atmosphere during a LOCA or steam line break accident inside containment. This cooling water limits the peak pressure in the containment to below the containment design pressure. A secondary function of the containment spray system is the removal of radioactive iodine from the containment atmosphere during a LOCA.

The refueling water storage tank (RWST) is included in the containment spray system boundary. The RWST provides a source of borated water for the ECCS and containment spray system during the injection phase of an accident. Sodium hydroxide (NaOH) solution from a single spray additive tank is mixed into both spray flow trains to provide adequate iodine removal. Once the RWST supply of water is exhausted, the containment spray system takes suction from the water accumulated in the containment recirculation sump. Additional spray ring headers, supplied by a portion of the recirculation flow from the RHR system, supplement the heat removal capability of the containment spray system and are included in the review of containment spray.

The containment spray system consists of two independent, 100 percent capacity flow trains with diverse power sources. Each train includes the following:

- A pump;
- Spray additive eductor;
- Heat exchanger;
- Ring headers in both the upper and lower containment volumes, with the associated spray nozzles, piping, valves and instrumentation necessary for operation.

In support of Appendix R requirements, the RWST provides a sufficient volume of borated water to support shutting down the unit or the opposite unit. Therefore the containment spray system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

UFSAR References

Sections 6.1, 6.2, and 6.3 discuss the containment spray system.

Components Subject to Aging Management Review

Table 2.3.2-1 lists the component types that require aging management review.

Table 3.2.2-1, Containment Spray System — Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5129, 5129A, 5135A, 5142, 5143, 5144
- Unit 2: LRA-2-5129, 5129A, 5135A, 5142, 5143, 5144
- Common: LRA-12-5136, 5137A

2.3.2.2 Containment Isolation

System Description

Mechanical penetrations are provided to ensure the primary containment can be isolated under accident conditions to limit the release of radioactivity. For license renewal, the scope of the containment isolation system is the passive mechanical penetration components (piping and valves) that are not included with another aging management review. In general, the mechanical penetrations for systems with a system-level aging management review are reviewed with that system. Aging management for the structural elements of the mechanical penetrations is addressed in Section 2.4.1.

This grouping of the containment isolation components from various plant systems into one consolidated review is appropriate, as indicated in NUREG-1800, Section 2.1.3.1, which states, “An applicant may take an approach in scoping and screening that combines similar components from various systems. For example, containment isolation valves from the various systems may be identified as a single system for purpose of license renewal." NUREG-1801, Section V.C, "Containment Isolation Components," recognizes the grouping by stating: "The system consists of isolation barriers in lines for BWR and PWR nonsafety systems such as the plant heating, waste gas, plant drain, liquid waste, and cooling water systems."

The function of penetrations is to allow the passage of required fluids across the containment boundary to support the functions of a system. The component intended function is to provide a barrier between fission products released inside the containment and the outside environment. This is a safety function that must also be met for the nonsafety-related systems that penetrate the containment. Therefore the containment isolation system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1).

UFSAR References

Section 5.2.4 and Section 5.4 discuss containment mechanical penetrations.

Components Subject to Aging Management Review

Table 2.3.2-2 lists the component types that require aging management review.

Table 3.2.2-2, Containment Isolation System – Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5114A, 5124, 5128A, 5129, 5140, 5141, 5142, 5143, 5145, 5146B, 5147A
- Unit 2: LRA-2-5114A, 5124, 5128A, 5129, 5140, 5141, 5142, 5143, 5145, 5146A, 5146B, 5147A
- Common: LRA-12-5115D, 5120B, 5136, 5137A, 5141C, 5141F

2.3.2.3 Emergency Core Cooling

System Description

The primary purpose of the ECCS is to automatically deliver cooling water to the reactor core in the event of a LOCA. This limits the fuel clad temperature and thereby ensures the core will remain substantially intact and in place, with its essential heat transfer geometry preserved. For the rupture of a steam line or feedwater line and the associated rapid heat removal from the core, the ECCS adds shutdown reactivity so there is no consequential damage to the reactor coolant system and so the core remains intact and in place.

The ECCS includes the safety injection system (including the accumulators), the RHR system, and portions of the CVCS. The RHR spray header components have been evaluated with the containment spray system (Section 2.3.2.1). The portions of the CVCS evaluated with the ECCS for license renewal are the two centrifugal charging pumps and the piping and components used for safety injection. The remainder of the CVCS is evaluated in Section 2.3.3.5.

The RHR system is also used for normal shutdown cooling. Each train of the RHR system is able to remove sensible heat from the core while cooling down the plant.

Portions of the ECCS support the requirements of 10 CFR 50.48. These include:

- Those portions of the RHR system required for removal of decay heat from the core to achieve and maintain safe shutdown;
- The centrifugal charging pumps (which provide RCS makeup); and
- Components that provide manual isolation capability for the accumulators following a fire.

Therefore the ECCS is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

UFSAR References

Sections 6.1 and 6.2 discuss the ECCS.

Components Subject to Aging Management Review

Table 2.3.2-3 lists the component types that require aging management review.

Table 3.2.2-3, Emergency Core Cooling System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Class 1 components in the reactor coolant pressure boundary are evaluated with the RCS (see Section 2.3.1.4).

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5129, 5135A, 5141, 5142, 5143, 5143A, 5144
- Unit 2: LRA-2-5129, 5135A, 5141, 5142, 5143, 5143A, 5144

2.3.2.4 Containment Equalization / Hydrogen Skimmer

System Description

The purpose of the containment equalization / hydrogen skimmer (CEQ) system is to function post-accident to reduce pressure in the containment and to redistribute hydrogen gas from pocketed areas to the general containment volume. These functions are the primary safety intended functions of this system. Therefore the CEQ system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1).

The system consists of two redundant independent systems that include fans, backdraft dampers, valves, piping, and ductwork.

UFSAR References

Section 5.5 discusses the CEQ system, where it is referred to as the containment air recirculation / hydrogen skimmer system.

Components Subject to Aging Management Review

Table 2.3.2-4 lists the component types that require aging management review.

Table 3.2.2-4, Containment Equalization / Hydrogen Skimmer System — Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5135E, 5147, 5147A
- Unit 2: LRA-2-5135E, 5147, 5147A

Table 2.3.2-1
Containment Spray System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Eductor	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing (RWST electric heater)	Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Spray nozzle	Flow control Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing (instrument piping)	Pressure boundary
Valve	Pressure boundary

Table 2.3.2-2
Containment Isolation System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Piping	Pressure boundary
Valve	Pressure boundary

Table 2.3.2-3
Emergency Core Cooling System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flex hose	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing (boron injection tank heater)	Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank (including accumulators)	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

**Table 2.3.2-4
Containment Equalization / Hydrogen Skimmer System
Components Subject to Aging Management Review**

Component Type	Intended Function
Bolting	Pressure boundary
Damper housing	Pressure boundary
Ductwork	Pressure boundary
Fan housing	Pressure boundary
Heat exchanger	Heat transfer Pressure boundary
Piping	Pressure boundary
Valve	Pressure boundary

2.3.3 Auxiliary Systems

2.3.3.1 Spent Fuel Pool

System Description

The purpose of the spent fuel pool (SFP) system is to maintain adequate water inventory for shielding and to prevent criticality of the stored fuel. The inventory maintenance function is provided by the spent fuel pool itself (the SFP walls including the stainless steel liner, gate, and racks that support the fuel). These are evaluated with the auxiliary building structural components in Section 2.4. The function of preventing criticality by storage rack geometry in the spent fuel pool and the new fuel vault is completed by the racks and the neutron absorber (Boral). The neutron absorber is evaluated as part of the SFP system in this section. As stated above, the racks are evaluated with the auxiliary building structural components.

Components providing containment isolation (fuel transfer tube) are evaluated in Section 2.3.2.2.

The portion of the spent fuel pool ventilation (VSFP) subject to aging management review is evaluated in Section 2.3.3.6 as the fuel handling area exhaust system.

In accordance with 10 CFR 54.4(a)(2), nonsafety-related component types in the SFP system are subject to aging management review if their failure could prevent satisfactory accomplishment of a safety function. Nonsafety-related component types that require aging management review for 10 CFR 54.4(a)(2) are in the SFP cooling portion of the system. Section 2.3.3.11 includes the evaluation of spent fuel pool cooling.

The primary safety intended function of the SFP system is to maintain adequate water inventory for shielding and to prevent criticality of the stored fuel. The system also provides a containment isolation function. The system is included in the scope of license renewal due to the potential for spatial interactions with safety-related equipment. Therefore the SFP system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(2).

UFSAR References

Section 9.7 describes the spent fuel pool structure and function.

Components Subject to Aging Management Review

Table 2.3.3-1 lists the component type that requires aging management review.

Table 3.3.2-1, Spent Fuel Pool System – Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawing.

- Common: LRA-12-5136

2.3.3.2 Essential Service Water

System Description

The purpose of the essential service water (ESW) system is to supply cooling water from the ultimate heat sink to essential heat loads, including the following components:

- Component cooling heat exchangers
- Containment spray heat exchangers
- Emergency diesel generators
- Auxiliary feedwater pumps
- Control room air conditioners (coolers and chiller condensers)
- Auxiliary feedwater pump enclosure coolers

The ESW system is an emergency water supply for the emergency diesel generator jacket water surge tank. The Unit 1 east ESW train is cross-connected to the Unit 2 west header; the Unit 1 west train is cross-connected to the Unit 2 east header.

In addition to its primary intended function of providing cooling water, the ESW system is a back-up suction source for the auxiliary feedwater pumps for use when the condensate storage tank is unavailable as a source of supply. The ESW system unit cross-tie is credited in the Appendix R safe shutdown analysis, so the system is required for compliance with 10 CFR 50.48.

In accordance with 10 CFR 54.4(a)(2), nonsafety-related portions of the system are subject to aging management review if their failure could prevent satisfactory accomplishment of a safety function. Nonsafety-related component types in the ESW system that require aging management review for 10 CFR 54.4(a)(2) are in the auxiliary building and screenhouse and consist of bolting, valves, tubing and piping. The environment and materials are the same in safety-related and nonsafety-related portions of the system. The aging management review results in Table 3.3.2-2 are applicable to the portions of the system requiring aging management review for 10 CFR 54.4(a)(2).

The ESW system is the safety-related source of cooling to engineered safety features equipment. The ESW system also provides cooling to 10 CFR 50, Appendix R safe shutdown equipment. Nonsafety-related portions of the system must maintain mechanical and structural integrity so that nearby safety-related equipment is not adversely affected. Consequently, the system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 9.8.3 describes the ESW system.

Components Subject to Aging Management Review

Table 2.3.3-2 lists the component types that require aging management review.

Table 3.3.2-2, Essential Service Water System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Portions of the ESW system are not required to function during emergency operation and are not safety-related as identified on the LRA drawings; therefore, those portions are not subject to aging management review. Those portions include the discharge headers in the turbine building and screenhouse, since the pressure boundary function is not required to be maintained for this piping. The sluice gates have no licensing basis requirement for operation and are not identified as safety-related.

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawings.

- Unit 1: LRA-1-5113, 5113A, 5113B, 5113C, 5149, 5151B, 5151D

- Unit 2: LRA-2-5113, 5113A, 5113B, 5113C, 5149, 5151B, 5151D

The license renewal drawings do not indicate components that are within the scope of license renewal for 10 CFR 54.4(a)(2) only.

2.3.3.3 Component Cooling Water

System Description

The purpose of the component cooling water (CCW) system is to provide cooling to potentially radioactive heat sources and to ensure that leakage of radioactive fluid from those heat sources is contained within the plant. The CCW system is an intermediate closed loop system between heat sources and the ultimate heat sink (Lake Michigan). Components cooled by the CCW system are split between two redundant safeguards trains and a miscellaneous service train that may be supported by either safeguards train. The CCW system removes heat from the RCS, the SFP, and various plant heat exchangers and components; and transfers that heat to the ESW system.

The CCW system is the safety-related source of cooling to engineered safety features equipment. The CCW system also provides cooling to 10 CFR 50, Appendix R safe shutdown equipment.

In accordance with 10 CFR 54.4(a)(2), nonsafety-related component types in the CCW system are subject to aging management review if their failure could prevent satisfactory accomplishment of a safety function. Nonsafety-related component types that require aging management review for 10 CFR 54.4(a)(2) are in the auxiliary building; and consist of the following:

- Bolting
- Tanks
- Eductors
- Valves
- Manifolds
- Tubing
- Piping

Nonsafety-related heat exchangers supplied with component cooling water are addressed as required with the systems they cool. The environment and materials are the same in safety-related and nonsafety-related portions of the system. The aging management review results in Table 3.3.2-3 are applicable to the portions of the CCW system requiring aging management review for 10 CFR 54.4(a)(2).

The CCW system is the safety-related source of cooling to engineered safety features equipment. The CCW system also provides cooling to 10 CFR 50, Appendix R safe shutdown equipment. Portions of the system without a safety function must maintain mechanical and structural integrity so that nearby safety-related equipment is not adversely affected. Consequently, the CCW system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 9.5 discusses the CCW system.

Components Subject to Aging Management Review

Table 2.3.3-3 lists the component types that require aging management review.

Table 3.3.2-3, Component Cooling Water System – Summary of Aging Management Evaluation, provides the results of the aging management review.

Portions of the CCW system are not required to function during emergency operation, including:

- Radiation detectors
- Demineralized water makeup to the CCW surge tank
- Base plate drains
- Relief valve discharge piping
- Chemical charging tanks that are used only to add chemicals to the CCW system
- Piping and components that branch from the miscellaneous header, beginning after the first isolation valves

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawings.

- Unit 1: LRA-1-5113; 5129A; 5135A, B, C, D, E, F, and G; 5143
- Unit 2: LRA-2-5113; 5129A; 5135A, B, C, D, E, F, and G; 5143

The license renewal drawings do not indicate components that are within the scope of license renewal for 10 CFR 54.4(a)(2) only.

2.3.3.4 Compressed Air

System Description

This section covers the components in the compressed air system, which includes both the plant air and control air systems. The reactor nitrogen (N2) system is also included in this section, since portions of the N2 system provide a backup supply to the compressed air system.

Control Air

The purpose of the control air (CTRLA) system is to provide a continuous supply of dry, oil-free, filtered compressed air to pneumatic instruments and air-operated valves and dampers for various process systems. Compressed control air is supplied to components in the turbine building, auxiliary building, and containment. Major components of the CTRLA system include the following:

- Control air compressors
- Wet control air receivers
- Prefilters
- Air dryers
- Afterfilters
- Dry control air receivers
- Associated distribution piping and valves

The CTRLA system is part of the compressed air system described in the UFSAR. The CTRLA system has a safety intended function of providing control air required to support the operation of a limited number of safety-related components. It also has a containment isolation function. Control air is supplied to components required to operate for the 10 CFR 50, Appendix R safe shutdown analysis and for the station blackout event. Therefore, this system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

Plant Air

The purpose of the plant air (PA) system is to provide compressed air throughout the plant for service usage and ice condenser outage support. Compressed air is supplied to Units 1 and 2 through an air distribution system located in the turbine building, auxiliary building, containment, and screenhouse building. This distribution system consists of a shared plant air ring header extending throughout the turbine building, a pair of parallel plant air headers in the auxiliary building, and a plant air header in each containment. One plant air compressor, plant air receiver, and plant air aftercooler is located in each unit. The PA system is part of the compressed air system described in the UFSAR.

Because some components of the PA system are associated with containment isolation, the PA system is within the scope of license renewal based on 10 CFR 54.4(a)(1). The system provides no other function that meets the scoping criteria for license renewal.

Reactor Nitrogen

The function of the reactor nitrogen (N2) system is to provide nitrogen for purging and blanketing tanks and equipment in the RCS and nuclear auxiliary systems for both Units 1 and 2. The N2 system also supplies nitrogen to the ECCS accumulators and to the steam generator power-operated relief valves (back-up supply).

Because some components of the N2 system are associated with containment isolation, the N2 system is within the scope of license renewal based on 10 CFR 54.4(a)(1). The containment isolation components for the N2 system are evaluated in Section 2.3.2.2. The nitrogen supply to the ECCS accumulators is evaluated in Section 2.3.2.3.

The backup nitrogen supply to the steam generator power-operated relief valves supports operation of these valves for a controlled cooldown for the Appendix R safe shutdown analysis. Therefore, the system is within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3).

UFSAR References

Section 9.8.2 describes the compressed air system, which includes the CTRLA and PA systems. The UFSAR provides no additional details of the N2 system.

Components Subject to Aging Management Review

Table 2.3.3-4 lists the component types that require aging management review.

Table 3.3.2-4, Compressed Air Systems – Summary of Aging Management Evaluation, provides the results of the aging management review.

The following are not safety-related or required for the license renewal regulated events:

- Control air compressors
- Wet control air receivers
- Prefilters
- Air dryers
- Afterfilters
- Dry control air receivers

The control air system utilizes a number of safety-related solenoid valves with an active function to ensure the control air is bled off from the associated damper or valve so the component achieves the desired position. The integrity of the passive compressed air pressure boundary is not required for these installations, since the component fails to the desired position on a loss of control air. Therefore, these safety-related compressed air valves do not require aging management review.

In the control air system, a number of safety-related relief valves are installed on nonsafety-related piping. The relief valves perform the active function of providing overpressure protection in the event of a regulator failure. The pressure boundary function is not required to be maintained for these components (they are not in the safety-related containment isolation boundary or in portion of the system with a required backup accumulator). Therefore, an aging management review is not required for these components.

License Renewal Drawings

For additional details of control air and plant air components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5120D, E, NN, R, S
- Unit 2: LRA-2-5120D, E, KK, R, S
- Common: LRA-12-5118B, 5120B

For additional details of reactor nitrogen components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5120R, 5120S, 5128A
- Unit 2: LRA-2-5120R, 5120S, 5128A
- Common: LRA-12-5118B

2.3.3.5 Chemical and Volume Control

System Description

The purpose of the chemical and volume control system (CVCS) is to support the RCS in a variety of ways. The CVCS is used to:

- Adjust the concentration of boric acid,
- Maintain the proper water inventory in the RCS,
- Provide the required seal water flow for the RCP shaft seals,
- Process reactor coolant effluent for reuse of boric acid and reactor makeup water,
- Maintain the proper concentration of corrosion-inhibiting chemicals in the reactor coolant,
- Maintain the reactor coolant activities within design limits, and
- Provide borated water for safety injection.

The system is also used to fill and hydrostatically test the RCS.

The centrifugal charging pumps and piping and components used for safety injection are evaluated as part of the ECCS, which is described in Section 2.3.2.3. Class 1 piping and associated pressure boundary components in the reactor coolant pressure boundary are evaluated with the RCS, which is described in Section 2.3.1.4.

The CVCS system intended functions include:

- Maintaining the RCS pressure boundary
- Providing RCS inventory control
- Providing borated water for reactivity control
- Supporting ECCS injection
- Providing RCP seal injection and processing seal leakoff
- Providing cross-unit charging to support Appendix R-required safe shutdown of the opposite unit, which includes RCP seal injection, RCS inventory makeup, and reactivity control

In accordance with 10 CFR 54.4(a)(2), nonsafety-related portions of the system are subject to aging management review if their failure could prevent satisfactory accomplishment of a safety function. Certain nonsafety-related component types in the CVCS, including those components that provide RCP seal injection and seal leakoff processing, meet the criterion of 10 CFR 54.4(a)(2). These components are in the auxiliary building and containment. The environment and materials of the components are the same in safety-related and nonsafety-related portions of the system. The aging management review results in Table 3.3.2-5 are applicable to the portions of the system requiring aging management review for 10 CFR 54.4(a)(2).

The CVCS (including the pump discharge cross-tie) is credited in the Appendix R safe shutdown analysis for RCP seal injection, RCS inventory makeup, and reactivity control. CVCS components are credited with minimizing the loss of RCP seal water during a station blackout.

The CVCS is in scope as a safety-related system and portions are in scope as nonsafety-related affecting safety-related components. Portions of the CVCS are required to support fire protection requirements and requirements for station blackout. Therefore, the CVCS is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 9.2 discusses the CVCS.

Components Subject to Aging Management Review

Table 2.3.3-5 lists the component types that require aging management review.

Table 3.3.2-5, Chemical and Volume Control System — Summary of Aging Management Evaluation, provides the results of the aging management review.

Components used for boron holdup and recovery (north boric acid evaporator) and the CVCS demineralizers, which receive and process the letdown liquid from the RCS are not safety-related or required for the 10 CFR 54.4(a)(3) regulated events.

The reciprocating charging pumps are not safety-related and are not required for the 10 CFR 54.4(a)(3) regulated events. These pumps are spared–in-place and isolated by valves from the operating portions of the system. An aging management review of these pumps has conservatively been performed to address the possibility of their use in the future, at which time they would be required to maintain the pressure boundary of the system.

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5128A, 5129, 5129A, 5135C, 5142, 5143
- Unit 2: LRA-2-5128A, 5129, 5129A, 5135C, 5142, 5143
- Common: LRA-12-5131

The license renewal drawings do not indicate components that are within the scope of license renewal for 10 CFR 54.4(a)(2) only.

2.3.3.6 Heating, Ventilation, and Air Conditioning

System Description

This section covers the heating, ventilation, and air conditioning subsystems and components in the scope of license renewal for CNP, with exceptions. The exceptions are the CEQ system, which is an engineered safeguards system covered in Section 2.3.2.4, and the auxiliary building ventilation and miscellaneous ventilation systems, which are only in scope for 10 CFR 54.4(a)(2) and are discussed in Section 2.3.3.11.

This section covers the following ventilation systems.

Engineered Safety Features Ventilation

The purpose of the engineered safety features ventilation (VES) system is to maintain temperatures in the portions of the building housing engineered safety features equipment within design limits for operation of equipment and for personnel access for inspection, maintenance and testing, as required. The enclosures for engineered safety features equipment are in the lower three levels of the auxiliary building and are ventilated by two separate ventilation systems.

The areas serviced by the VES system are as follows:

- Containment spray pump enclosures
- RHR pump enclosures
- Safety injection pump enclosures
- RHR heat exchanger enclosures
- Containment spray heat exchanger enclosures
- Reciprocating and centrifugal charging pump enclosures

For the purposes of license renewal, the ventilation subsystems servicing the following areas have been reviewed with the VES system:

- CCW pump rooms
- AFW pump rooms
- ESW pump rooms
- Fire protection pump house

The safety intended functions of this system are to maintain a suitable operating environment for equipment located in the serviced areas, and to remove iodine and particulates from ECCS leakage following an accident. The system also supports the Appendix R safe shutdown analysis by providing cooling to safe shutdown equipment of the opposite unit. Therefore, the VES system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4 (a)(3).

Control Room Ventilation

The purposes of the control room ventilation (VCRAC) system are to maintain control room temperature and humidity, and to provide a fresh air supply to the control rooms during normal operation and accident conditions. Conditioned air is supplied to the control room envelope by either of two full-capacity air handling units. Continuous pressurization of the control room envelope is normally provided by the air conditioning system to prevent entry of dust and dirt. Emergency filtration and pressurization is provided by a separate air-handler with roughing filters, high efficiency particulate air filters, and charcoal adsorbers.

The safety intended functions of the VCRAC system are to maintain control room temperature during normal and accident conditions, and to maintain dose to control room operators less than General Design Criterion (GDC)-19 limits. In the event of a fire in the cable enclosure below the control room, the system prevents CO_2 intrusion into the control room. Therefore, the VCRAC system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

Emergency Diesel Generator Ventilation

The purpose of the emergency diesel generator ventilation (VEDG) system is to maintain temperatures in the emergency diesel generator (EDG) rooms within acceptable limits for operation of the diesel generators and associated components, including the EDG control cabinets. The system is also designed to provide ventilation and removal of fuel oil vapors from the fuel oil day tank enclosure and the fuel oil pump room.

The VEDG system performs the safety intended function of maintaining a suitable operating environment for the operation of the diesels. The system provides the additional fire protection function of removing fumes from the diesel generator fuel oil day tank room and the fuel oil pump room. Therefore, the VEDG system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

Switchgear Ventilation

The purpose of the switchgear ventilation (VSWGR) system is to maintain temperature in various areas of the switchgear complex and N-train battery room within acceptable limits for operation of safety-related equipment located in the rooms. Portions of the system provide a high-energy line break (HELB) barrier. The VSWGR system also prevents accumulation of combustible concentrations of hydrogen gases inside the battery rooms.

The safety intended functions of the VSWGR system are to maintain room temperatures for safety-related equipment, and to provide a HELB barrier. The system also performs a function related to fire protection. Therefore, the VSWGR system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

Containment Ventilation

The purpose of the containment ventilation (VCONT) system is to maintain temperatures in the various portions of the containment within acceptable limits for operation of equipment, and for personnel access for inspection, maintenance, and testing as required. The system also has capability for purging the containment atmosphere to the environment via the plant vent. The system can also remove airborne contamination from containment prior to personnel entry.

The VCONT system consists of several essentially independent subsystems, including the following:

- Containment purge supply and exhaust system
- Instrumentation room purge supply and exhaust system
- Containment pressure relief system
- Upper compartment ventilation system
- Lower compartment ventilation system
- CRDM ventilation system
- Reactor cavity ventilation system
- Pressurizer compartment ventilation system
- Containment instrumentation room ventilation system
- Hot sleeve ventilation system

The CEQ system, which is another independent containment ventilation system, is treated as a separate system (see Section 2.3.2.4).

Of the independent subsystems included in the containment ventilation system, the only safety intended function is containment isolation, provided by certain system components.

In accordance with 10 CFR 54.4(a)(2), nonsafety-related component types in the VCONT system are subject to aging management review if their failure could prevent satisfactory accomplishment of a safety function. The only nonsafety-related component type that requires aging management review for 10 CFR 54.4(a)(2) is housings, which are evaluated in Section 2.3.3.11.

The VCONT system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(2).

Security Diesel Generator Room Ventilation

The purpose of the security diesel generator room ventilation is to maintain security diesel generator room temperature. System components requiring aging management review are the intake and exhaust fans and associated ductwork. This ventilation system is considered part of the security system.

The security diesel provides power for emergency lighting for access to the nitrogen regulator valves (N2 valves). The N2 valves are credited in the Appendix R safe shutdown analysis and are considered safe shutdown equipment. Therefore, the security diesel is required to support the safe shutdown analysis, which brings the security diesel generator room ventilation within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3).

Fuel Handling Area Exhaust

The fuel handling area exhaust system is a sub-system of the SFP system discussed in Section 2.3.3.1. There are two 30,000 cubic feet per minute (cfm) exhaust fans associated with this system that normally draw directly from the area. If the high radiation setpoint is reached, a radiation monitor in the spent fuel pool area trips the supply fans to the fuel handling area, opens the outlet dampers from the charcoal filters, and closes the dampers that bypass the charcoal filter bed. This is done to minimize the consequences of a fuel handling accident and minimize the release to the environs.

Therefore, the fuel handling area exhaust system performs a safety function, and is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1).

UFSAR References

Ventilation System	**UFSAR Reference**
Engineered safety features ventilation	Section 9.9
Control room ventilation	Section 9.10
Emergency diesel generator ventilation	No additional information
Switchgear ventilation	No additional information
Containment ventilation	Section 5.5
Security diesel room ventilation	No additional information
Fuel handling area exhaust	Section 9.9 (included with auxiliary building ventilation system)

Components Subject to Aging Management Review

Table 2.3.3-6 lists the component types that require aging management review.

Table 3.3.2-6, Heating, Ventilation, and Air Conditioning Systems – Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

For additional details of VES components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5113, 5113B, 5113C
- Unit 2: LRA-2-5113, 5113B, 5113C
- Common: LRA-12-5123B, 5148, 5148A, 5148B, 5148K, 5148L, 5148M, 5148P, 5152E

For additional details of VCRAC components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5113, 5149
- Unit 2: LRA-2-5113, 5149
- Common: LRA-12-5123B, 5152E

For additional details of VEDG components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5148C
- Unit 2: LRA-2-5148C

For additional details of VSWGR components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5148C
- Unit 2: LRA-2-5148C
- Common: LRA-12-5148B

For additional details of VCONT penetration components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5147A
- Unit 2: LRA-2-5147A

For additional details of VSFP components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5147A
- Common: LRA-12-5148, 5123B, 5152E

The license renewal drawings do not indicate components that are within the scope of license renewal for 10 CFR 54.4(a)(2) only. Drawings for the security diesel generator room ventilation contain safeguards information; therefore, no license renewal drawings were prepared for this system.

2.3.3.7 Fire Protection

System Description

The purpose of the fire protection (FP) system is to rapidly detect and control/suppress fires while limiting their damage. The FP system comprises several FP subsystems and design features, including the following:

FP subsystems (detection and suppression)

- Fire detection system
- Fire alarm and annunciation systems
- Fire water supply distribution system
- Fire water pumping systems
- Water suppression systems
- Gaseous suppression systems
- Turbine bearing - dry chemical system
- Manual fire fighting systems

Design features (limit damage)

- Fire barriers - plant layout
- Penetration seals
- Fire doors
- Fire dampers
- Raceway fire barrier materials
- Cable tray fire stops
- Separation of engineered safety features actuation system and reactor protection system - Marinite board and Quelpyre tape
- West motor-driven auxiliary feedwater pump enclosure, Units 1 and 2
- Roof smoke and heat vents
- Floor drains

The water supply for the fire water tanks is the municipal water supply.

The FP system is credited in the Appendix R safe shutdown analysis, since it supplies cooling water to the security diesel, which powers lighting needed to achieve safe shutdown.

In accordance with 10 CFR 54.4(a)(2), nonsafety-related portions of the system are subject to aging management review if their failure could prevent satisfactory accomplishment of a safety function. Components that require aging management review for 10 CFR 54.4(a)(2) are liquid-filled FP components in the containment, auxiliary building, screenhouse, and the portion of the turbine building that contains the auxiliary feedwater pumps. Because these portions of the system are also within the scope of license renewal for 10 CFR 54.4(a)(3), no additional evaluation of FP system components is required for 10 CFR 54.4(a)(2).

The FP system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(2) and 10 CFR 54.4(a)(3).

UFSAR References

Section 9.8.1 describes the FP system.

Components Subject to Aging Management Review

Table 2.3.3-7 lists the component types that require aging management review.

Table 3.3.2-7, Fire Protection System – Summary of Aging Management Evaluation, provides the results of the aging management review.

The review of HVAC systems in Section 2.3.3.6 includes the fire protection pump house ventilation. Fire barriers are included in the structural reviews in Section 2.4.

The fire protection license renewal boundary excludes fire protection equipment and piping that are not required to meet 10 CFR 50.48. Equipment in the following areas performs no safe shutdown function and is not otherwise required for compliance with 10 CFR 50.48:

- Computer rooms; generator unit and shared equipment; and service building: records storage vault, telephone equipment room, and file chart storage room (protected by 7½ ton CO2 system)

- Turbine bearing area (protected by dry chemical system)
- Security building
- Fabrication shop warehouse
- Store room and warehouses
- Visitors center
- Access control building
- Screenhouse diesel fire pump room (equipment abandoned)
- Auxiliary building drumming room/personnel passageway
- Radioactive waste material handling building
- Turbine building: crane bay area, plant heating boiler, auxiliary boiler office area, technical support center (TSC) charcoal filter platform open head nozzles, consultation rooms
- Service building: miscellaneous oil storage room, gas bottle shed, open/closed head sprinklers
- Office buildings and road overhang
- Training building (including simulator): word processing rooms underfloor, communications underfloor, simulator underfloor, computer room underfloor, communications room underfloor (protected by Halon system)

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5152B, 5152J, 5153C, 5153E, 5153F
- Unit 2: LRA-2-5152C, 5152K, 5153D, 5153G, 5153H
- Common: LRA-12-5148J, 5150B, 5152, 5152A, 5152D, 5152E, 5152L, 5152N, 5152R, 5152S, 5152T, 5152U, 5153, 5153A, 5153K, 5153L, 5154A

2.3.3.8 Emergency Diesel Generator

System Description

The purpose of the emergency diesel generator (EDG) system is to provide a reliable, automatic onsite power source with sufficient capacity to operate engineered safety features and protection system loads to ensure the safe shutdown of the reactor and mitigate the consequences of a design basis accident in the event offsite power is lost. Each diesel engine is equipped with its own auxiliaries, including:

- Starting and control air
- Fuel oil
- Lube oil
- Cooling water
- Intake and exhaust system
- Voltage regulator
- Controls

The safety intended function of the EDG system is to provide power to engineered safety features and protection system loads. The EDG is credited in the Appendix R safe shutdown analysis and is a potential source of alternating current (AC) power for recovery from a station blackout. Therefore, the EDG system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

UFSAR References

Section 8.4 describes the EDG system.

Components Subject to Aging Management Review

Table 2.3.3-8 lists the component types that require aging management review.

Table 3.3.2-8, Emergency Diesel Generator – Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5151A, 5151B, 5151C, 5151D, 5120Y
- Unit 2: LRA-2-5151A, 5151B, 5151C, 5151D, 5120Y

2.3.3.9 Security

System Description

The purposes of the security system are to protect against radiological sabotage pursuant to 10 CFR 73, and to provide adequate lighting for access to the nitrogen regulator valves to perform safe shutdown functions (10 CFR 50, Appendix R, Section III.J). The security system consists of security diesel generator, lights, alarms, doors, intrusion detection devices, metal detectors, explosive detectors, gates, and communication equipment.

The security diesel provides power for emergency lighting for access to the nitrogen regulator valves (N_2 valves). The N_2 valves are credited in the Appendix R safe shutdown analysis and are considered safe shutdown equipment. Therefore, the security diesel is required to support the safe shutdown analysis, and the system is within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3).

The security diesel generator room ventilation is evaluated with the HVAC systems in Section 2.3.3.6.

UFSAR References

The UFSAR provides no additional details on the security system.

Components Subject to Aging Management Review

Table 2.3.3-9 lists the component types that require aging management review.

Table 3.3.2-9, Security Diesel — Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawings:

- Common: LRA-12-5150B.

2.3.3.10 Post-Accident Containment Hydrogen Monitoring

System Description

The purpose of the post-accident containment hydrogen monitoring system (PACHMS) is to monitor the containment atmosphere for hydrogen concentrations following a LOCA to assist in determining the need for initiation of the hydrogen recombiners. The PACHMS comprises two sampling-analyzing control trains. Each train has a hydrogen analyzer panel and a remote control panel. The PACHMS can take samples from nine locations within the containment. After analysis, the sample is returned to the containment.

The primary safety intended functions of the system include sampling and analyzing containment hydrogen following an accident and providing containment isolation. Therefore, the PACHMS is within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(1).

UFSAR References

Section 7.8 describes the post-accident containment hydrogen monitoring system.

Components Subject to Aging Management Review

Table 2.3.3-10 lists the component types that require aging management review.

Table 3.3.2-10, Post-Accident Containment Hydrogen Monitoring System —Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawings:

- Unit 1: LRA-1-5141D
- Unit 2: LRA-2-5141D

2.3.3.11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2)

I&M's scoping effort took place prior to the development of industry guidance on scoping based on the criterion of 10 CFR 54.4(a)(2). Consequently, a separate scoping effort was undertaken to incorporate existing industry guidance (specifically, spatial interaction). The result of this additional scoping effort is reflected in this section. Systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) were identified using the method described in Section 2.1.1.2. These systems may be categorized in two groups:

Group 1: Systems that are within the scope of license renewal for 10 CFR 54.4(a)(1) or 10 CFR 54.4(a)(3), as well as 10 CFR 54.4(a)(2), whose aging management review results are presented in sections other than Section 3.3.2.1.11; or

Group 2: Systems that are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) whose aging management review results are presented in Section 3.3.2.1.11. As discussed in the system descriptions, some of these systems have components that are included in the evaluation of other systems, such as containment isolation.

System Description

Group 1 Systems

For systems in Group 1, the environment and materials are the same in the portion of the system affected by 10 CFR 54.4(a)(2) as for those portions evaluated under 10 CFR 54.4(a)(1) or 10 CFR 54.4(a)(3). Therefore, the aging management review results discussed for these systems in Section 3 also apply to the portion of the system affected by 10 CFR 54.4(a)(2). Section 3.3.2.1.11 does not include components from these systems.

The following systems, described in the referenced sections, are Group 1 systems:

- Blowdown (Section 2.3.4.4)
- Component cooling water (Section 2.3.3.3)
- Chemical and volume control (Section 2.3.3.5)
- Essential service water (Section 2.3.3.2)
- Feedwater (Section 2.3.4.1)
- Main steam (Section 2.3.4.2)
- Reactor coolant (Section 2.3.1)
- Fire protection (Section 2.3.3.7)

Group 2 Systems

Group 2 systems are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2). The aging management review results for those portions of the system affected by 10 CFR 54.4(a)(2) are presented in Section 3.3.2.1.11. These systems are described below. Table 2.3.3-11 lists the components in these systems evaluated based on 10 CFR 54.4(a)(2). In some cases, components in these systems are included in other system evaluations. As appropriate, these are noted to provide a complete system description.

Auxiliary Steam

The purpose of the auxiliary steam (AS) system is to provide reduced-pressure steam to various plant subsystems to support plant operation. Some of the subsystems supplied by the AS system are plant heating, steam jet air ejectors, turbine steam seals, and fire protection. The AS system is in the form of a ring header and is cross-connected between the CNP units. The plant heating boiler supplies steam to the AS system when both units are out of service.

Chemical Feed

The purpose of the chemical feed (CF) system is to inject chemicals for pH and dissolved oxygen control into the condensate system and into the steam generators. The CF system includes the condensate and feedwater chemical tanks, pumps, and piping. Safety-related isolation valves and piping in the chemical feed lines to the main feedwater headers are evaluated with the main feedwater system in Section 2.3.4.1.

Containment

Containment includes mechanical components providing containment drainage. Containment drainage collects and transports liquid from floor, equipment, and ice condenser equipment drains to the waste disposal system via drain pots or sumps. Certain components used for containment drainage are subject to aging management review based on the criterion of 10 CFR 54.4(a)(2) and are not covered by any other aging management review. Structural portions of containment are evaluated in Section 2.4.1 and with the bulk structural commodities in Section 2.4.5.

Demineralized Water

The purpose of the demineralized water (DEMIN) system is to produce high-purity, degassified water for make-up to the reactor coolant and condensate-feedwater systems and to other plant services. Lake water from the nonessential service water (NESW) system is filtered, chlorinated, and held in a retention tank to effect complete sterilization. An alternate source of supply is the Lake Charter Township public water system.

The DEMIN system includes containment penetrations that supply demineralized water to the refueling cavity and containment pipe tunnel during outages. Under accident conditions, these penetrations provide containment isolation. Containment isolation components are evaluated in Section 2.3.2.2.

Process Drains

The purpose of the process drains – miscellaneous drain tank (DRAIN) system is to collect drainage from various process systems. The system collects drainage from the waste evaporator and north and south boric acid evaporators and pumps it to the miscellaneous drain tank. The DRAIN system also collects drainage from various secondary plant SSCs and directs it either to the main condenser for reuse or to the turbine room sump for discharge.

Ice Condenser

The purpose of the ice condenser (ICE) system is to provide a flowpath and sufficient ice to absorb thermal energy from a LOCA or an MSLB in order to limit containment pressure rise to less than design pressure immediately following an accident. The ICE system assists in iodine removal from containment atmosphere and provides an inventory source for the containment recirculation sump to support sump recirculation level, pH, and boron requirements. ICE system refrigeration components maintain the ice bed temperature within analyzed limits and replenish the ice beds during outages. The ICE system includes:

- System structural steel,
- Ice baskets,
- Pressure- activated doors,
- Various components that cool the ice bed

The safety intended functions of the system (post-accident containment pressure and temperature control, iodine removal, and sump inventory source) are provided by the ice baskets that support the ice blowdown flowpath pressure-activated doors, and associated structural components. These components are evaluated with structural components in Section 2.4.1 and Section 2.4.5. Safety-related portions of the system refrigeration components also provide containment isolation when required. Containment isolation components are evaluated in Section 2.3.2.2.

Lake Charter Township Water

The purpose of the Lake Charter Township water (LTW) system is to supply water for the makeup pretreatment and filtration plant and the dedicated fire protection water supply tanks. The LTW system also supplies cooling water for the nonessential service water pump seals and potable water for the plant site.

Nonessential Service Water

The purpose of the nonessential service water (NESW) system is to provide cooling water to various plant heat loads that have no safety functions. The heat loads supplied by NESW include the turbine oil coolers, air compressors, upper and lower containment ventilation units, and RCP motor air coolers. The NESW pumps take suction from either Unit 1 or Unit 2 circulating water intake tunnels or discharge tunnels and discharge into either Unit 1 or Unit 2 circulating water discharge tunnels.

The NESW lines to containment are isolated during accident conditions. The containment isolation components are evaluated in Section 2.3.2.2.

Nuclear Sampling

The purpose of the nuclear sampling (NS) system is to process and condition representative samples from designated plant fluid systems for in-line analyzers and grab samples for laboratory analysis. Samples are drawn from the following:

- Pressurizer steam space
- Pressurizer liquid space
- Two reactor coolant hot legs (loops 1 and 3)
- Each of the four accumulators
- Two residual heat removal lines
- CVCS letdown line at the demineralizer inlet and outlet headers
- Volume control tank gas space
- Each of the four steam generator blowdown lines

The safety intended functions of the nuclear sampling system are to provide containment isolation and to maintain the pressure boundary of the safety-related system being sampled, including the reactor coolant pressure boundary. Maintaining the reactor coolant pressure boundary also supports the Appendix R safe shutdown analysis and the station blackout event. Therefore, this system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3), as well as 10 CFR 54.4(a)(2).

NS system components that meet the criterion of 10 CFR 54.4 (a)(2) are evaluated in this section. The remaining components of the NS system subject to aging management review are evaluated with a number of different systems. Portions of the NS system that have the safety-related function of maintaining the system pressure boundary are evaluated in the respective system review as follows:

- Reactor coolant system in Section 2.3.1
- Emergency core cooling system in Section 2.3.2.3
- Blowdown in Section 2.3.4.4
- Main steam in Section 2.3.4.2

Containment penetration isolation components for sample lines from various systems in containment are evaluated either with the sampled system or as part of the consolidated containment isolation evaluation in Section 2.3.2.2.

Post-Accident Sampling

The purpose of the post-accident sampling system (PASS) is to provide representative samples for laboratory analysis following a LOCA. The system is common to both Units 1 and 2. Samples are provided from RCS loops 1 and 3 hot legs, the pressurizer steam space, the containment sump, and the RHR system. Provisions have been made for drawing gas samples in each unit from the containment air space. These samples can be analyzed by in-line equipment or collected and transported to the laboratory in a shielded container.

Components in the PASS that provide containment isolation are evaluated in Section 2.3.2.2.

Primary Water

The purpose of the primary water (PW) system is to supply water to miscellaneous services within the auxiliary building and the containment, primarily for reactor coolant make-up. Major components include the primary water storage tanks and primary water pumps.

The primary water line to containment is isolated in accident conditions. Containment isolation components are evaluated in Section 2.3.2.2.

Radioactive Waste Disposal

The purpose of the radioactive waste disposal (RWD) system is to collect and process liquid, gas, and solid radioactive wastes. The gaseous waste subsystem collects and processes potentially radioactive gases discharged from various components and systems for recycling, storage, and discharge at concentrations below the regulatory limits. The liquid waste subsystem collects, processes, and stores radioactive liquid waste from various plant systems and drains in the auxiliary building and containment. The solid waste subsystem stores resin for a short decay time before subsequent packaging for shipment and provides for compression and drumming of solid wastes.

Components in the RWD system that provide containment isolation are evaluated in Section 2.3.2.2.

Station Drainage

The station drainage (SD) system collects spillage, drains and overflows in the auxiliary building, containment, and turbine building. Collected fluids are routed to various sumps for disposal. The system includes station drainage piping, floor drains, and sump pumps.

Containment isolation components associated with this system are evaluated in Section 2.3.2.2.

Spent Fuel Pool Cooling

The purpose of spent fuel pool cooling is to remove, from the spent fuel pool, the heat generated by stored spent fuel elements. The components of the CNP spent fuel pool cooling provide no intended functions. The maintenance of pool inventory, which assures cooling, is provided by the spent fuel pit as discussed in Section 2.3.3.1. The spent fuel pool is shared by the two units. The design incorporates two separate cooling trains sharing a common return line to the spent fuel pool. Piping is arranged so that failure of any pipe does not drain the spent fuel pool below the top of the stored fuel elements.

The clarity and purity of the spent fuel pool water is maintained by passing the cooling flow through a filter and a demineralizer. Skimmers are provided to prevent dust and debris from accumulating on the surface of the water. The refueling water purification pump and filter can be used separately or in conjunction with the spent fuel pool demineralizer to regain refueling water clarity after a crud burst in either unit. Spent fuel pool cooling is also used to maintain water quality in the refueling water storage tanks of both units.

Screen Wash System

The purpose of the screen wash (SCRN) system is to supply water from Lake Michigan (the ultimate heat sink) to the circulating water (CW) system and the ESW system for Units 1 and 2 and return it to the lake. Traveling water screens are provided in the intake structure to remove debris and fish. The screen wash system includes:

- Intake crib;
- Intake piping;
- Discharge piping;

- Forebay;
- Traveling screens (baskets, drives, trash collection, etc.);
- Screen wash pumps; and
- Associated valves and sluice gates.

The intended function of this system is to provide a flow path to and from the ultimate heat sink to the ESW system via the intake and discharge tunnels. Failure of this function, performed by nonsafety-related equipment, could affect a safety function. For license renewal, this equipment is evaluated with the screenhouse structure (Section 2.4.3). Therefore, no components in the SCRN system are evaluated in this section. The SCRN system does not have the potential for spatial interaction with safety-related equipment.

Radiation Monitoring

The purpose of the radiation monitoring system (RMS) is to detect, compute, and record radiation levels. The RMS comprises a collection of small, independent systems located at selected points in and around the plant. These systems are composed of area monitors, process monitors, and environmental monitors.

The RMS has a containment isolation function. Containment isolation components associated with this system are evaluated in Section 2.3.2.2.

Ventilation Systems: Auxiliary Building Ventilation, Miscellaneous Ventilation, and Containment Ventilation

As described in UFSAR Section 9.9, the auxiliary building ventilation (VAB) system encompasses four different ventilation subsystems in the auxiliary building. The organization of these subsystems in this application is consistent with their safety functions. The engineered safety features ventilation (VES) and fuel handling area exhaust (fuel handling ventilation) are described in Section 2.3.3.6. The two remaining VAB subsystems, as described in UFSAR Section 9.9, are the general ventilation systems and the general supply system. Other than the potential for spatial interactions with safety-related equipment, no VAB functions meet the criteria for inclusion within the scope of license renewal.

The miscellaneous ventilation (VMISC) system includes ventilation subsystems in various locations throughout the plant site. The purpose of the ventilation subsystems is to maintain appropriate environmental conditions for the location served. Other than the potential for spatial interactions with safety-related equipment, no VMISC functions meet the criteria for inclusion within the scope of license renewal.

The containment ventilation (VCONT) system is described in Section 2.3.3.6 and has components evaluated with the ventilation systems. As discussed below, certain fan housings are included with the aging management review results in Section 3.3.2.1.11.

In these three ventilation systems, the majority of passive, nonsafety-related components contain only air and therefore do not require aging management review. However, components that contain liquid do require aging management review. Some of these components (cooling coils) are contained in packaged ventilation units that isolate these components from leakage or spray onto safety-related components. Housings for these ventilation units are subject to aging management review.

Components not contained in housings are part of chilled water systems that supply cooling water to ventilation units in the VAB and VMISC systems. These components are in the auxiliary building and consist of the following:

- Bolting
- Condensers
- Strainers
- Pumps
- Valves
- Tanks
- Glass level gauges
- Tubing and piping

UFSAR References

System in scope for (a)(2)	UFSAR Reference
Auxiliary steam	No additional details
Chemical feed	Section 10.10
Demineralized water	Section 10.9
Process drains	No additional details
Ice condenser	Section 5.3
Lake Charter Township water	No additional details
Nonessential service water	Section 9.8.3
Nuclear sampling	Section 9.6
Post-accident sampling	Section 9.6
Primary water	Section 10.9
Radioactive waste disposal	Section 11.1
Station drainage	Section 11.1.2.1.4
Spent fuel pool cooling	Section 9.4
Screen wash systems	Section 10.6
Radiation monitoring	Section 11.3
Ventilation systems Containment Auxiliary Miscellaneous	 Section 5.5 Section 9.9 No additional details on miscellaneous ventilation

Components Subject to Aging Management Review

Table 2.3.3-11 lists the component types that require aging management review based on the criterion of 10 CFR 54.4(a)(2) for systems as described above.

Table 3.3.2-11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2) – Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

License renewal drawings do not specifically indicate equipment that is subject to aging management review based on the criterion in 10 CFR 54.4(a)(2). This is the result of the location-based scoping evaluation and the identification of in-scope components as commodities within the bounds of a given structural area rather than equipment highlighted on a flow diagram.

Containment isolation components are indicated on the license renewal drawings referenced in Section 2.3.2.2.

The NS system is also within the scope of license renewal based on the criteria in 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3). Affected components are included in the license renewal drawings for the sections referenced above in the system description.

2.3.3.12 Miscellaneous Systems

This section discusses various systems that are within the scope of license renewal but the components subject to aging management review have been included in the mechanical system reviews or the structural reviews. The system descriptions include discussions of the components subject to aging management review and references to the sections containing the component evaluations.

System Description

Material/Equipment Handling

The purpose of the material/equipment handling (MATL) system is to safely move material and equipment as required to support operations and maintenance activities. The system consists of plant cranes (including associated components such as trolleys, bridges, etc.) that lift, control, and transport loads in the auxiliary building, turbine building, containment, screenhouse, service building, sewage treatment building, radioactive waste handling building, and other miscellaneous buildings.

Major equipment in the MATL system are:

- East auxiliary building crane
- West auxiliary building crane
- Containment polar cranes
- Main turbine building crane
- Auxiliary turbine building cranes
- Ice condenser cranes

No MATL system normal functions require inclusion of the system in the scope of license renewal. However, the system is included due to the potential for spatial interactions with safety-related equipment, which meets the criterion of 10 CFR.54.4(a)(2). The cranes are evaluated in Section 2.4 as structural components.

Nuclear Fuels

The nuclear fuel (NF) system includes the nuclear fuel assemblies and the rod cluster control assemblies (including the wet annular burnable absorber) that together provide and enable control of the nuclear heat source. Also included are the fuel racks. The purpose of the fuel and control components is to provide a safe and controllable source of power to heat the reactor coolant water. The purpose of the fuel racks is to store new and used fuel that is not in service in the reactor core.

The primary safety intended function of the fuel and control components is to provide a barrier for fission products, provide a coolable configuration for the nuclear fuel, and provide control and shutdown capability for the core. The ability to safely shutdown the reactor core also supports the Appendix R safe shutdown analysis and the station blackout event. Therefore, the NF system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3). These components are not subject to aging management review because they are periodically replaced.

The primary safety intended function of the fuel racks is to prevent criticality of the stored fuel. The fuel racks are evaluated in Section 2.4.2 as structural components in the auxiliary building.

Refueling

The purpose of the refueling (RF) system is to perform core alterations and other fuel movements including movements within the spent fuel pool. The system includes:

- Fuel transfer system
- Upending devices
- Refueling cavity manipulator cranes
- New and spent fuel handling crane
- New fuel elevator
- A variety of handling tools

No RF system normal functions require inclusion of the system in the scope of license renewal. However, the system is included due to the potential for spatial interactions with safety-related equipment, which meets the criteria of 10 CFR 54.4(a)(2). The refueling cavity manipulator cranes and the new and spent fuel handling crane require aging management review. The cranes are evaluated in Section 2.4 as structural components in the structures that house them.

Residual Heat Removal

For license renewal, the residual heat removal system has been evaluated as part of the emergency core cooling system in Section 2.3.2.3. Portions of the spray header that are supplied by the RHR system are included in the containment spray evaluation in Section 2.3.2.1.

Reactor Vessel Level Indication

The purpose of the reactor vessel level indication system (RVLIS) is to indicate the relative vessel water level or the relative void content of fluid in the vessel during post-accident conditions. This level indication assists personnel in recognizing conditions that may lead to damage of the vessel or the core. Sensors measuring the differential pressure between the vessel head and bottom and between the head and the hot legs provide the basis for level and void fraction indication.

The safety intended function of the mechanical portions of the system is to maintain the reactor coolant pressure boundary, which meets the criterion of 10 CFR 54.4(a)(1). This system is included in the review of the reactor coolant system in Section 2.3.1.

UFSAR References

System in scope for (a)(2)	**UFSAR Reference**
Material/equipment handling	Section 12.2.1 (control of heavy loads)
Nuclear fuels	Chapter 3 describes the fuel and control components. Section 9.7 describes the new and spent fuel racks.
Refueling	Section 9.7 describes the fuel handling cranes. Section 12.2.1 describes the control of heavy loads.
Reactor vessel level indication system	Section 4.2.11

Table 2.3.3-1
Spent Fuel Pool Systems
Components Subject to Aging Management Review

Component Type	Intended Function
SFP poison	Neutron absorption

Table 2.3.3-2
Essential Service Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Detector well	Pressure boundary
Expansion joint	Pressure boundary
Fittings	Pressure boundary
Flex hose	Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-3
Component Cooling Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Detector well	Pressure boundary
Expansion joint	Pressure boundary
Fittings	Pressure boundary
Heat exchanger	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer - tee	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-4
Compressed Air System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Fittings	Pressure boundary
Flex hose	Pressure boundary
Piping	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-5
Chemical and Volume Control System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Filter housing	Pressure boundary
Flow element body	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Level glass gauge	Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Piping-spool assembly	Pressure boundary
Pulsation dampener	Pressure boundary
Pump casing	Pressure boundary
Strainer – tee	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-6
Heating, Ventilation and Air Conditioning Systems
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Compressor casing	Pressure boundary
Damper housing	Pressure boundary
Dryer	Pressure boundary
Ductwork	Pressure boundary
Fan housing	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Sight glass housing	Pressure boundary
Tank	Pressure boundary
Test canister housing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary
Ventilation unit housing	Pressure boundary

Table 2.3.3-7
Fire Protection System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Fittings	Pressure boundary
Flange	Pressure boundary
Flex hose	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Hydrant	Pressure boundary
Level glass gauge	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Silencer	Pressure boundary
Spray nozzles	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-8
Emergency Diesel Generator
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Compressor	Pressure boundary
Dryer	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Fittings	Pressure boundary
Flex hose	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Level glass gauge	Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pneumatic cylinder	Pressure boundary
Pump casing	Pressure boundary
Sight flow indicator	Pressure boundary
Silencer	Pressure boundary
Strainer	Filtration Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-9
Security
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Compressor casing	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Fittings	Pressure boundary
Flange	Pressure boundary
Flex hose	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Silencer	Pressure boundary
Strainer	Filtration
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-10
Post-Accident Containment Hydrogen Monitoring System
Components Subject to Aging Management Review

Component Type	Intended Function
Analyzer body	Pressure boundary
Bolting	Pressure boundary
Filter	Filtration
Fittings	Pressure boundary
Flex hose	Pressure boundary
Heat exchanger	Heat transfer Pressure boundary
Moisture separator	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-11
Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Condenser shell	Pressure boundary
Evaporator housing	Pressure boundary
Filter housing	Pressure boundary
Flex hose	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heater coil	Pressure boundary
Heater housing	Pressure boundary
Level glass gauge	Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Trap	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary
Ventilation unit housing	Pressure boundary

2.3.4 Steam and Power Conversion Systems

2.3.4.1 Main Feedwater

System Description

The purpose of the main feedwater system is to supply feedwater to the steam generators at appropriate temperature, pressure, and flow rates under all steady-state and transient load conditions. The main feedwater system uses turbine-driven feedwater pumps to supply water from the condensate system to the steam generators. The main feedwater system includes high pressure feedwater heaters to improve plant thermal efficiency by preheating the feedwater.

The main feedwater flowpath from the main feedwater check valves to the steam generators is safety-related. This portion of the system provides an extension of the containment liner and provides a flowpath for the auxiliary feedwater to the steam generators. In addition to these safety intended functions, the system also provides engineered safety features actuation system (ESFAS) feedwater isolation and feedwater regulating valve (FRV) closure when required.

The mechanical function required of the main feedwater system during a station blackout is to maintain the secondary system pressure boundary from the main feedwater check valves to the steam generators. The mechanical functions required of the main feedwater system during an Appendix R safe shutdown are to maintain the same portion of the secondary system pressure boundary and to support auxiliary feedwater addition to the steam generators.

The main feedwater system is also included in the scope of license renewal due to the potential for spatial interactions with safety-related equipment. The main feedwater system nonsafety-related components requiring an aging management review for 10 CFR 54.4(a)(2) are in the auxiliary building.

Therefore, the main feedwater system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 10.5.1 describes the feedwater system.

Components Subject to Aging Management Review

Table 2.3.4-1 lists the component types that require aging management review.

Table 3.4.2-1, Main Feedwater System — Summary of Aging Management Evaluation, provides the results of the aging management review.

The functions of ESFAS feedwater isolation and FRV closure rely on the active closure of motor-operated isolation valves or pneumatic-operated feedwater control valves. Both of these functions prevent feedwater from being supplied to the steam generators and do not require pressure boundary integrity of the system. (Loss of the pressure boundary will not affect the ability to prevent feedwater from reaching the steam generator.) Therefore, these valves and the related piping do not require aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5105D
- Unit 2: LRA-2-5105D

2.3.4.2 Main Steam

System Description

The purpose of the main steam system is to deliver steam from the steam generators to the turbine and to other equipment or systems requiring main steam, including:

- Turbine driver of an auxiliary feedwater pump
- Main feed pump turbines
- Reheaters
- Turbine bypass system (steam dump)
- Auxiliary steam system
- Turbine steam seals (Unit 2 only)

The main steam flowpath from the steam generators to the main steam isolation valves is safety-related. The primary safety intended functions are provided by this portion of the main steam system. These functions include removing heat from the RCS via the main steam safety valves to prevent RCS overpressurization. This portion of the system provides an extension of the containment liner and provides a flowpath to the main steam safety valves, auxiliary feedwater pump turbine, and steam generator power-operated relief valves.

With the main steam isolation valves closed, the steam generator power-operated relief valves can be used to provide a controlled cooldown. In addition to these safety intended functions, the system also provides containment isolation of the steam sampling lines when required. The controlled cooldown function with the steam generator power-operated relief valves also supports the Appendix R safe shutdown (SSD) and station blackout (SBO) events.

The main steam system is also included in the scope of license renewal due to the potential for spatial interactions with safety-related equipment. The nonsafety-related components in the main steam system that require aging management review for 10 CFR 54.4(a)(2) are in the auxiliary building and the turbine building in the auxiliary feedwater pump rooms.

Therefore, the main steam system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 10.2 describes the main steam system.

Components Subject to Aging Management Review

Table 2.3.4-2 lists the component types that require aging management review.

Table 3.4.2-2, Main Steam System — Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5105D, 5141A
- Unit 2: LRA-2-5105D, 5141A

2.3.4.3 Auxiliary Feedwater

System Description

The purpose of the auxiliary feedwater (AFW) system is to provide feedwater to the steam generators when the main feedwater supply is not available. The system is the safety-related source of feedwater for cooling as required during design basis events. The system also provides feedwater as required for the SBO and fire protection regulated events.

Installed in each unit is one turbine-driven AFW pump (TDAFP), which feeds all four steam generators, and two motor-driven auxiliary feedwater pumps (MDAFPs), each of which feeds two steam generators. Train orientation is maintained throughout the AFW system including the AFW pumps, all associated valves, instrumentation, and controls. The normal water source for AFW pumps is from the condensate storage tank (CST). An emergency water source is provided from the ESW system. The MDAFPs are capable of supplying the corresponding sets of steam generators in the opposite unit through manual cross-tie supply valves.

Therefore, the auxiliary feedwater system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(3).

UFSAR References

Section 10.5.2 discusses the auxiliary feedwater system.

Components Subject to Aging Management Review

Table 2.3.4-3 lists the component types that require aging management review.

Table 3.4.2-3, Auxiliary Feedwater System — Summary of Aging Management Evaluation, provides the results of the aging management review.

The CST and the associated piping and valves that supply the AFW system require aging management review because they support the intended functions of the auxiliary feedwater system. The floating head seal and associated support posts are included in the aging management review because the failure of the seal could cause flow blockage.

The 10-inch CST overflow line does not require aging management review because it does not provide a pressure boundary function for the tank contents since its purpose is to prevent overfilling the tank and provide venting of the tank.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5105D, 5105E, 5106A, 5110A, 5110B, 5113
- Unit 2: LRA-2-5105D, 5105E, 5106A, 5110B, 5113

2.3.4.4 Steam Generator Blowdown

System Description

The purpose of the steam generator blowdown (BD) system is to maintain the proper water chemistry within the steam generators on the secondary side. The system has a safety intended function of blowdown isolation for AFW flow conservation and automatic isolation capability. The portion of the BD system in the containment fulfills the safety function of providing an extension of the containment liner. The system is required to maintain the secondary system pressure boundary for Appendix R SSD and SBO events. Some portions of the BD system have the potential for spatial interaction with other safety-related equipment.

Steam generator blowdown is routed to the startup blowdown flash tank during startup or under abnormal operating conditions, such as during high condenser in-leakage. The steam produced in the startup blowdown flash tank is vented to the atmosphere through a moisture separator. The water is routed to the screen house forebay. When the plant reaches normal full power operation, the startup blowdown flash tank is taken out of service and the blowdown is routed to the normal blowdown flash tank. The steam from the normal blowdown flash tank is returned to the condensate system through the condensers and the water is routed to the screen house forebay either directly or through mixed-bed demineralizers.

Therefore, the blowdown system is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 10.11 discusses the blowdown system.

Components Subject to Aging Management Review

Table 2.3.4-4 lists the component types that require aging management review.

Table 3.4.2-4, Blowdown System — Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

Additional details for components subject to aging management review are provided in the following license renewal drawings:

- Unit 1: LRA-1-5105, 5105B, 5105D, 5141A
- Unit 2: LRA-2-5105B, 5105D, 5141A

2.3.4.5 Main Turbine

System Description

The purpose of the main turbine generator is to convert the thermal energy of steam into mechanical shaft power used to rotate the generator field. The main turbine (MT) system includes the main turbine and the following supporting systems:

- Main turbine lube oil
- Main turbine lube oil clean-up
- Main turbine steam seals
- Turbine controls
- Electro-hydraulic controls
- Turbine supervisory instruments

The capability to trip the main turbine is a required function in support of the anticipated transient without scram (ATWS) and SBO events. This is the only intended function of the mechanical components of the main turbine.

Therefore, the main turbine is within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3).

UFSAR References

Section 10.3.1 describes the main turbine.

Components Subject to Aging Management Review

Tripping the main turbine requires releasing hydraulic oil from the main turbine control system. Although pressure boundary is required of mechanical components to support normal plant operation and electricity generation, failure of the pressure boundary of the mechanical components in the main turbine control system will produce the trip signal, which is a failure to the safe state. If hydraulic control oil pressure is lost, the trip function is completed. Mechanical pressure boundary integrity is not required for this function to be met.

Therefore, no passive mechanical components of the main turbine require aging management review.

License Renewal Drawings

There are no license renewal drawings associated with the main turbine.

Table 2.3.4-1
Main Feedwater System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Piping	Pressure boundary
Valve	Pressure boundary

Table 2.3.4-2
Main Steam System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

**Table 2.3.4-3
Auxiliary Feedwater System
Components Subject to Aging Management Review**

Component Type	Intended Function
Bolting	Pressure boundary
Fittings	Pressure boundary
Governor housing	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Manifold (piping)	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Sight glass housing	Pressure boundary
Strainer housing	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Valve	Pressure boundary

Table 2.3.4-4
Blowdown System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES

The major structures in the scope of license renewal are the containment buildings, auxiliary building, turbine building, and screenhouse, all of which house safety-related equipment. The aging management review for the containment buildings includes the ice condensers and internal structures. The aging management review for the turbine building and screenhouse (Section 2.4.3) includes the intake and discharge structural components as well as the turbine building and screenhouse structures and structural components that support and protect safety-related equipment.

A separate review addresses miscellaneous structures and structural components in the yard surrounding the major structures (Section 2.4.4). The yard structures included in this review protect or support safety-related equipment not housed in the major structures.

Structural commodities (piping and conduit supports, electrical cabinets, tank foundations, etc.) are addressed in the bulk commodities review (Section 2.4.5).

2.4.1 <u>Containment</u>

Description

The purpose of the containment structure is to serve as both a biological shield and a pressure container during a LOCA or steam line break accident. The containment structure, including all penetrations and the interior structure, is part of the engineered safety features incorporated in the design of CNP and is classified as a safety-related, seismic Class I structure. CNP Units 1 and 2 use ice condenser reactor containment systems. The containment building is a reinforced concrete structure consisting of a vertical cylinder, a hemispherical dome, and a flat base slab. A steel liner is attached to the inside face of the concrete (shell, dome, and the base slab) to ensure a high degree of leak tightness. The interior of the containment structure is divided into three compartments:

- A lower compartment that houses the reactor and the reactor coolant system;
- An intermediate compartment that houses the energy absorbing ice bed (ice condenser compartment); and
- An upper compartment that accommodates the air displaced from the other two compartment volumes during an accident condition.

The ice condenser is essentially a well-insulated cold storage room in which ice is maintained in an array of vertical cylindrical columns. The ice columns are formed by perforated sheet metal baskets of ice, with the space between columns forming the flow channels for steam and air. The ice condenser is contained in the annulus formed by the containment vessel wall and the crane wall, circumferentially over a 300-degree arc. The refueling canal and equipment hatch are located in the remaining 60-degree arc. The ice condenser compartment extends from below the operating deck to the top of the crane wall. The uppermost section of the ice condenser forms a plenum, which accommodates the air cooling equipment and provides access for ice loading and maintenance. A small bridge crane is provided at the top of the ice condenser compartment for construction and maintenance purposes.

In the event of an accident, lower inlet doors located below the operating deck at the bottom of the ice condenser open due to the pressure rise in the lower compartment. This allows steam to flow from the lower compartment into the ice condenser compartment. The steam is condensed as it enters the ice condenser compartment, thus limiting the peak pressure in the containment. (The condensation of steam in the ice bed limits the containment pressure to a value substantially lower than that of a comparable dry-type containment under the same conditions.) Upon pressure increase in the ice compartment, the intermediate and top doors in the ice condenser compartment open to allow air to flow into the upper compartment. Seals are provided on the boundary of the lower and upper compartments and on the hatches in the operating deck to limit steam bypassing the ice condenser.

The primary safety intended function of the containment is to limit the release of radioactive fission products following an accident thereby limiting the dose to the public and control room operators. The containment structure also provides physical support for itself, the reactor coolant system, engineered safety features, and other systems and equipment located within the structure. The exterior walls and dome provide protection for the reactor vessel and all other safety-related SSCs inside the containment from missiles (internal and external) and natural phenomena.

The containment includes nonsafety-related commodity groups that must maintain mechanical and structural integrity so that nearby safety-related equipment is not adversely affected. The containment also supports, protects, and provides penetrations for 10 CFR 50, Appendix R safe shutdown equipment, environmentally qualified electrical equipment, and equipment used to cope with a station blackout.

Therefore, the containment is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

<u>UFSAR References</u>

Chapter 5 describes the containment structure and systems.

Evaluation Boundaries

The following structures, systems, and components are evaluated for the containment building:

- Interior and exterior structural concrete, including concrete pads and supports (e.g., reactor vessel supports)
- The containment liner, including applicable structural components and commodities attached to the liner
- Structural steel, including component supports, grating, catwalks, platforms, stairs, ladders, handrails, and their associated supports
- Containment mechanical penetrations (excluding piping and valves) and electrical penetrations, including their associated attachment points and testing connections
- Containment airlocks, equipment hatch, and penetration piping that is blank flanged while the unit is at power (e.g., fuel transfer tube, containment service penetration CPN-71)
- The divider barrier that physically separates the upper and lower containment volumes inside containment
- The containment penetration and weld channel pressurization system (CPWCPS), from the outlet side of the associated air receivers (portions of the system that have been abandoned in place are also included within the containment system boundary)
- The recirculation sump and lower containment sump
- Structural components of the ice condenser system
- Cranes and other lifting devices within the containment building

Supports for the reactor coolant system components (the reactor vessel, reactor coolant pumps, steam generators, and pressurizer) are considered unique and are therefore included in this evaluation. All other component and piping supports, including RCS piping supports, are addressed in the bulk commodity evaluation in Section 2.4.5.

Components Subject to Aging Management Review

Table 2.4-1 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-1, Containment — Summary of Aging Management Evaluation, provides the results of the aging management review.

2.4.2 Auxiliary Building

Description

The purpose of the auxiliary building is to support and protect plant equipment, including much of the nuclear steam supply system and other auxiliary systems necessary for the safe operation of CNP Units 1 and 2. The two CNP units share the auxiliary building, which houses common areas, as well as sections dedicated to each unit. The auxiliary building encloses the fuel storage areas, diesel generator rooms, switchgear rooms, control facilities, and other equipment. The auxiliary building is primarily a T-shaped structure located between the Unit 1 and Unit 2 containment buildings. The auxiliary building also includes the C-shaped structures that border each of the containment buildings and enclose the electrical tunnels and main steam lines. The building is principally a reinforced concrete structure consisting mainly of exterior and interior walls, flat roofs, floor slabs, and a flat foundation mat. The building is classified as a safety-related, seismic Class I structure.

The safety intended functions of the auxiliary building are to support and protect safety-related plant equipment. The auxiliary building provides physical support for itself, engineered safety features, and other systems and equipment located within the structure. The exterior walls and roofs of the auxiliary building protect against tornado-generated or turbine-generated missiles and provide protection against the weather for systems and equipment within the structure. The auxiliary building includes the spent fuel pool and liner, which maintain a sufficient water inventory to provide shielding and cooling for the fuel.

The auxiliary building also supports and protects 10 CFR 50, Appendix R safe shutdown equipment and equipment used to cope with a station blackout. The auxiliary building includes nonsafety-related commodity groups that must maintain mechanical and structural integrity so that nearby safety-related equipment is not adversely affected.

Therefore, the auxiliary building is within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 2.9 describes structural criteria for the auxiliary building.

Evaluation Boundaries

The following structural elements are evaluated for the auxiliary building:

- Auxiliary building foundation mat

- Structural steel that supports grating, catwalks, service platforms, stairs, ladders, and equipment
- Auxiliary building reinforced concrete and steel superstructure
- Interior and exterior masonry, including concrete walls and slabs, concrete block walls, concrete pads, and embedded equipment supports
- Structural steel elements, such as floor framing, columns, and bracing, that do not provide direct support for components of other systems
- External penetrations, doors, and louvers, including pressure-relief panels and tornado vents
- Embedded items (including unistruts and anchors)
- Crane rails and crane support structures
- Emergency diesel generator enclosures
- Main steam enclosures and pipe tunnels
- Spent fuel pit and liner, fuel racks
- HELB, missile, and fire barriers (such as walls, floors, and doors)

There are no unique supports for the auxiliary building. Supports are addressed in the bulk commodity evaluation in Section 2.4.5.

Components Subject to Aging Management Review

Table 2.4-2 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-2, Auxiliary Building – Summary of Aging Management Evaluation, provides the results of the aging management review.

2.4.3 Turbine Building and Screenhouse

Description

CNP Units 1 and 2 share the turbine building and screenhouse, which house several common areas (such as the make-up plant) as well as sections dedicated to each unit. The purpose of the turbine building and screenhouse is to house and protect plant equipment. This includes the main turbine, generator, and auxiliary equipment in the turbine building and the circulating water (CW) pumps and essential service water (ESW) pumps in the screenhouse.

The turbine building is a three-tiered structure that adjoins the auxiliary building. It includes the turbine room, the heater bay areas, and the service bay areas. The turbine building and screenhouse share a masonry wall and a seismic Class I foundation. The AFW and ESW pumps and their associated piping systems are housed within protective seismic Class I structures supported by the foundation.

The screenhouse is a concrete structure located adjacent to Lake Michigan. Below the superstructure of the building are the pump bays and piers, which guide traveling screens that collect debris and fish. Below grade on the north and south sides of the screenhouse are discharge tunnels that connect the condensers and discharge piping. Two discharge pipes run out into Lake Michigan. Between the screenhouse and the shore, there is a 20-foot-wide concrete roadway. Below this roadway are the screenhouse forebay and its connection to the de-icing tunnels and intake pipes. The three intake pipes connect the intake cribs, located underwater, to the forebay.

The turbine building is principally reinforced concrete at and below grade elevation, consisting mainly of exterior and interior walls, floor slabs, turbine and generator pedestals, and a flat, seismic Class I foundation mat. Above grade, the turbine building is essentially a steel superstructure covered by aluminum siding.

Within the screenhouse, concrete barriers protect the ESW pumps against turbine missiles and from fires or other accidents in the adjacent ESW pump compartments. In addition, the ESW pump compartments are designed to withstand tornado-velocity wind effects and tornado-borne missiles. Flood protection to elevation 595’ is provided for safety-related components. The ESW pump motors are above elevation 595’ and are therefore adequately protected from the maximum flood condition anticipated due to a seiche or surge phenomenon.

The intended functions of the turbine building and screenhouse are to support and protect safety-related plant equipment. The turbine building and screenhouse provide physical support for themselves and other systems and equipment located within the structures. The walls and roofs of the turbine building and screenhouse protect against tornado-generated or turbine-generated missiles and provide weather protection to the systems and equipment within the structure. The turbine building and screenhouse include nonsafety-related commodity groups that must maintain mechanical and structural integrity so that nearby safety-related equipment is not adversely affected. The turbine building and screenhouse also support and protect 10 CFR 50, Appendix R safe shutdown equipment and equipment used to cope with a station blackout.

Therefore, the turbine building and screenhouse are within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3).

UFSAR References

Section 2.9 describes structural criteria for the turbine building and screenhouse.

Evaluation Boundaries

The following structural elements are evaluated for the turbine building and screenhouse:

- Sump structures excluding piping, equipment, instrumentation, and controls associated with the sump
- Structural steel that supports grating and catwalks
- Service platforms, stairs, and ladders required for general access, equipment support, and maintenance activities
- Screenhouse superstructure, which houses the ESW and CW pumps, as well as the traveling screens, stop logs, and bar grills
- Interior and exterior masonry, including concrete walls and slabs, concrete block walls, concrete pads, and embedded equipment supports
- Structural steel elements such as floor framing, columns, bracing, platforms, and catwalks that do not provide direct support for components of other systems
- Exterior siding and roofing
- External penetrations, doors, and louvers
- Embedded items (including unistruts and anchors)
- Crane rails and crane support structures
- HELB barriers such as walls, floors, and doors
- Structural components and commodities from, and including, the intake cribs up to but not including the CW pump intake piping
- Structural components and commodities from, and including, the intake cribs up to but not including the ESW pump intake piping
- Structural components and commodities from, and including, the discharge tunnels up to, and including, the discharge jets
- Structural components and commodities that support CW pumps and intake piping
- Structural components and commodities that support ESW pumps and intake piping

- Structural components and commodities associated with the following:
    - Intake cribs
    - Discharge piping
    - Forebay
    - Traveling screens
    - Trash baskets
    - Trash collection
    - Sluice gates
    - De-icing tunnels
    - Discharge tunnels
    - Screenhouse
    - Piping supports, pump supports, baseplates, and anchors contained within the screenhouse

There are no unique supports for the turbine building and screenhouse. Supports are addressed with bulk commodities in Section 2.4.5.

Components Subject to Aging Management Review

Table 2.4-3 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-3, Turbine Building and Screenhouse — Summary of Aging Management Evaluation, provides the results of the aging management review.

2.4.4 Yard Structures

Description

Yard structures are structures at CNP not contained within major buildings such as the screenhouse, turbine building, auxiliary building, and containment buildings. The in-scope yard structures are:

- Fire protection pump house
- Flood protection earth (under roadway)
- Gas bottle storage tank rack and foundation

- Roadway
- Security diesel generator room
- Switchyard control house
- Tank area pipe tunnel (condensate storage, refueling water storage, and emergency diesel generator piping tunnel)
- Tank foundations:
    - Condensate storage tank
    - Fire protection water storage tank
    - Primary water storage tank
    - Refueling water storage tank
- Towers:
    - Unit 1 power delivery to switchyard tower
    - Unit 2 power delivery to switchyard tower
- Transformer pedestals
- Trench from switchyard to startup transformers (duct bank)

Yard structures do not have a specific structural function; rather they generally support other plant system functions (e.g., fire protection, containment spray, component cooling water, and essential service water). There are no unique supports for the yard structures. Supports are addressed with the bulk commodities in Section 2.4.5. Refer to Table 2.2-4 for a list of structures not in scope for license renewal.

The following table lists the scoping criterion from 10 CFR 54.4 met by each yard structure.

Table 2.4.4-1
10 CFR 54.4 Scoping Criterion for Yard Structures

Component/ Commodity	10 CFR 54.4 Criterion	Remarks
Steel		
Fire protection pump house superstructure	(a)(3)	Provides shelter to components required for 10 CFR 50.48.
Gas bottle storage tank rack	(a)(3)	Supports the gas bottle tanks required for 10 CFR 50.48.
Tower: Unit 2 power delivery to switchyard	(a)(2)	Tower failure could impact the safety-related refueling water storage tank and the in-scope condensate storage tank in the vicinity of the tower.
Concrete		
Fire protection pump house walls	(a)(3)	The pump house provides shelter and support to components required for 10 CFR 50.48.
Fire protection pump house foundation	(a)(3)	The pump house provides shelter and support to components required for 10 CFR 50.48.
Gas bottle storage tank foundation	(a)(3)	Supports the gas bottle tanks which are required for 10 CFR 50.48.
Roadway	(a)(2)	Credited for flood protection in the flooding evaluation.
Security diesel generator room	(a)(3)	Shelters and supports the diesel generator, which provides lighting required for 10 CFR 50.48.
Switchyard control house (breakers)	(a)(3)	The switchyard control house supports the breakers used for station blackout.
Tank area pipe tunnel	(a)(2)	Houses safety-related piping for the refueling water storage tank and emergency diesel generator, as well as piping for the condensate storage tank.
Tank foundations: refueling water storage tanks	(a)(1)	Supports the safety-related refueling water storage tanks.
Tank foundations: condensate storage tanks	(a)(2)	Supports the in-scope condensate storage tanks.

Table 2.4.4-1 (Continued)
10 CFR 54.4 Scoping Criterion for Yard Structures

Component/ Commodity	10 CFR 54.4 Criterion	Remarks
Concrete (continued)		
Tank foundations: fire protection water storage tank	(a)(3)	Supports the in-scope fire protection water storage tank.
Tank foundations: primary water storage tanks	(a)(2)	The primary water storage tanks are conservatively included in scope due to proximity to condensate storage tanks, which are within the scope of license renewal.
Tower: Unit 1 power delivery to switchyard	(a)(2)	Tower failure could potentially impact safety-related function of SSC in vicinity of the tower.
Transformer pedestals	(a)(3)	Support the transformers that may be used for recovery from station blackout.
Trench from switchyard to start-up transformers (duct bank)	(a)(3)	Houses power cable from the switchyard to the start-up transformers that may be used for recovery from station blackout.
Earth		
Flood protection earth	(a)(2)	The built-up shoreline and the earth underneath the roadway are required for flood protection per the flooding evaluation.

UFSAR References

The UFSAR does not contain structural details of these structures.

Evaluation Boundaries

Yard structures include

- Buildings
- Concrete trenches (in-scope buried piping lines are addressed in mechanical AMRs)
- Concrete duct banks and manholes (in-scope electrical components are addressed in electrical AMRs)
- Earthen structures

- Tank foundations and supports (in-scope tanks are addressed in mechanical AMRs)
- Towers
- Transformer foundations

Structural commodities (i.e., structural members that support or protect plant equipment) that are unique to yard structures are evaluated with the yard structures. Those that are common to multiple CNP in-scope systems and structures (e.g., consumables, anchors, embedments, equipment supports, instrument panels, racks, cable trays and conduits) are evaluated with the bulk commodities in Section 2.4.5.

Components Subject to Aging Management Review

Table 2.4-4 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-4, Yard Structures — Summary of Aging Management Evaluation, provides the results of the aging management review.

2.4.5 Structural Commodities

Description

Structural commodities are structural members that support or protect system components, mechanical piping, electrical lines, and plant equipment. Structural commodities that are unique to a specific structure are evaluated with that structure. Structural commodities that are common to CNP in-scope systems and structures (e.g., anchors, embedments, equipment supports, instrument panels, racks, cable trays, conduits) are evaluated as bulk commodities.

UFSAR References

The UFSAR does not contain details of aging effects or aging management of these commodities.

Evaluation Boundaries

The evaluation of bulk commodities covers structural commodities that are common to in-scope systems and structures.

Components Subject to Aging Management Review

Table 2.4-5 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-5, Structural Commodities — Summary of Aging Management Evaluation, provides the results of the aging management review.

Table 2.4-1
Containment
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Steel	
Air lock doors	FB, PB
Air lock hinges, locks, closing mechanisms	FB, PB
Containment liner and associated anchorage	FD, PB, SNS, SRE, SSR
Containment penetrations (mechanical and electrical)	PB, SNS, SRE, SSR
CRDM support structure	SSR
Divider barrier access doors and associated framing	FC
Divider barrier equipment hatches and associated framing	FC
Fuel transfer tube penetration	PB
Ice baskets	SSR
Ice condenser bridge cranes, crane rails, and supports	SNS
Ice condenser intermediate deck door frames	FC, SSR
Ice condenser lattice frame	FC, SSR
Ice condenser lower deck door frames	FC, SSR
Ice condenser lower support structure	SSR
Ice condenser turning vanes	SSR
Ice condenser wall duct panels	SNS
Polar cranes, crane rails, and supports	SNS
Pressurizer supports	SSR
Reactor cavity missile block embedded steel and associated framing	FC, HELB, MB, SSR
Reactor coolant pump supports	SSR
Reactor vessel supports	SSR

Table 2.4-1 (Continued)
Containment
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Steel (continued)	
Removable gate (bulkhead)	FC, HELB, MB, SSR
Seal table	SSR
Steam generator enclosure permanent interior form plate	SSR
Steam generator supports	SSR
Structural steel framing (including embedded steel)	SNS, SSR
Sump screens (coarse) and associated framing	SSR
Sump screens (fine)	SSR
Threaded fasteners: CRDM support structure	SSR
Threaded fasteners: ice basket	SSR
Threaded fasteners: reactor coolant system component support (reactor vessel, steam generators, reactor coolant pumps, pressurizer)	SSR
Concrete	
Containment base slab foundation	SSR
Containment dome	SSR, SP, SNS, MB, FB
Containment operating deck	SP, FC, HELB, MB, SNS, SSR
Containment wall	SP, FB, FLB, MB, SNS, SSR
Crane wall (upper) and ice condenser end walls	SP, FC, HELB, MB, SNS, SSR
Exhaust dome and exhaust duct	SSR
Fuel transfer canal walls and flood-up overflow structure	SP, FC, HELB, MB, SNS, SSR
Ice condenser support slab	SSR
Ice condenser wear slab	SSR
Lower containment concrete walls and floor slabs	SP, FD, HELB, MB, SNS, SSR
Pressurizer enclosure	FC, HELB, MB, SSR

Table 2.4-1 (Continued)
Containment
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Concrete (continued)	
Reactor cavity missile blocks	FC, MB, SSR
Regenerative heat exchanger room wall	SP, SSR
Steam generator enclosures	FC, HELB, MB, SSR
Sump concrete	SSR
Rubber	
Air lock seals	SSR
Reactor pit membrane waterproofing	SP
Removable gate (bulkhead) seals	FC
Other	
Ice condenser intermediate and upper deck curtains	SNS

Table 2.4-2
Auxiliary Building
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Steel	
Block wall grating and framing	SP, FB
Cranes, rails and supports	SNS
Elevator support steel	SNS
Emergency diesel generator air intake missile shield framing	SNS
Emergency diesel generator air intake missile shield grating	SNS
Louver framing (emergency diesel generator and switchgear)	SSR, HELB
Missile shield	MB
New fuel storage racks	SSR
Spent fuel pit steel (including swing gate, attachments, liner, and fuel racks)	SF, SNS, SSR
Superstructure framing	SNS, SRE, SSR
Concrete	
Electrical tunnel	SP, SNS, SSR
Elevator masonry block	SNS
Exterior walls	SP, FB, FLB, MB, SNS, SRE, SSR
Floor slabs	SP, FB, HELB, MB, SNS, SRE, SSR
Fuel transfer canal	SSR
Foundation	SNS, SRE, SSR
Interior walls	SP, FB, FLB, HELB, MB, SNS, SRE, SSR
Internal flood curbs	FLB
Main steam line enclosure	SP, HELB

Table 2.4-2 (Continued)
Auxiliary Building
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Concrete (continued)	
Masonry block	SP, SNS, FB
Roof	SP, FB, MB, SNS, SSR
Spent fuel pit walls and slab	SF, SNS, SSR
Sump	SSR

Table 2.4-3
Turbine Building and Screenhouse
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Steel	
Auxiliary feedwater pump room doors # 226, 227, 228, 229	FB, HELB, MB, SRE
Intake corrugated piping	SCW
Intake crib framing and plate	SCW, SNS
Miscellaneous steel (catwalks, handrails, ladders, platforms, stairs, and associated supports) in ESW and AFW pump rooms	SNS
Miscellaneous steel (ladders and associated supports) in forebay	SNS
Screenhouse forebay bar grille and base	SP, SNS
Sheet piling	FLB
Superstructure framing	SP, SNS, SRE
Concrete	
12-inch thick concrete wall, essential motor control center room walls, ESW pump room	SP, FB, FLB, MB,SSR
Auxiliary feedwater pump room (walls, floor, and ceiling)	SP, FB, HELB, MB, SNS, SRE, SSR
De-icing tunnels	SSR
Discharge tunnels and bays	SNS, SSR
Foundation mat (turbine building and screenhouse)	SNS, SRE
Intake cribs (surrounding sacked concrete)	SSR
Masonry block (4-hour rated)	FB
Screenhouse below grade walls, beams and slabs	FB, FLB, SSR
Screenhouse exterior above grade walls	FB, FLB, SSR
Superstructure steel column concrete encasing	SP, SNS

Table 2.4-4
Yard Structures
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Steel	
Fire protection pump house superstructure	SRE
Gas bottle storage tank rack	SRE
Tower: Unit 2 power delivery to switchyard	SNS
Concrete	
Fire protection pump house walls	SRE
Fire protection pump house foundation	SRE
Gas bottle storage tank foundation	SRE
Roadway	FLB
Security diesel generator room	SRE
Switchyard control house	SRE
Tank area pipe tunnel	SP
Tank foundations: refueling water storage	SSR
Tank foundations: condensate storage	SNS
Tank foundations: fire protection water storage	SNS
Tank foundations: primary water storage	SNS
Tower: Unit 1 power delivery to switchyard	SNS
Transformer pedestals: start-up	SRE
Trench from switchyard to start-up transformers (duct bank)	SRE
Earth	
Roadway (shoreline)	FLB

Table 2.4-5
Structural Commodities
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Steel	
Baseplates	SNS, SRE, SSR
Baseplates, embedded unistrut	SNS, SRE, SSR
Battery racks	SRE, SSR
Blowout panels	PB, SNS, SRE, SSR
Cable tray and conduit supports	SNS, SRE, SSR
Cable trays and conduits	SNS, SRE, SSR
Component supports	SNS, SRE, SSR
Cranes, rails, and girders	SNS
Doors and framing (non-fire-rated)	SP, FB, FLB, HELB, MB, PB, SSR
Electrical instrument panels and enclosures	SP, SNS, SRE, SSR
Fire damper framing (in-wall)	FB
Fire doors	FB
HVAC duct supports	SNS, SSR
Instrument line supports	SNS, SRE, SSR
Instrument racks and frames	SNS, SRE, SSR
Miscellaneous embedments	SNS, SSR
Pipe sleeves (mechanical and electrical, not penetrating the containment liner plate)	PB, SNS, SSR
Piping supports	PW, SNS, SRE, SSR
Roof flashing	FS
Stairs, ladders, platforms, and grating (supports)	SNS, SSR
Tube tracks	SNS, SRE, SSR
Steel (threaded fasteners)	
Anchor bolts	SNS, SRE, SSR

**Table 2.4-5 (Continued)
Structural Commodities
Components Subject to Aging Management Review**

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Steel (threaded fasteners) (continued)	
Equipment hatch and personnel access openings threaded fasteners	FB, SNS, SSR
Other threaded fasteners	SNS, SSR
Other threaded fasteners (spent fuel pool SS fasteners)	SNS, SSR
Reactor cavity missile block tie-downs	SP, HELB, MB, PW, SSR
Concrete	
Cable trays and conduits	SNS, SRE, SSR
Flood curbs	FS, FLB, SNS, SSR
Hatches	SP, FB, FLB, HELB, MB, PB, SSR
Fireproofing	FB, SRE
Support pedestals	SNS, SRE, SSR
Trenches (pipe and cable)	SNS, SRE, SSR
Elastomer	
Building pressure boundary sealant	FLB, PB
Cable trays and conduits	SNS, SRE, SSR
Divider barrier penetration seals	SP, PB
Fire barrier seals	FB, FLB, HELB, PB, SNS, SRE, SSR
Floor plugs	SSR
Joint elastomer at seismic gaps	FB, SNS, SSR
Penetration seals	SP, PB
Roof elastomer	SP, FLB, SNS, SSR
Water stops	FLB
Non-elastomer	
Fire barriers (cable trays)	FB

Table 2.4-5 (Continued)
Structural Commodities
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Other	
Roofing above battery rooms	SSR

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROL SYSTEMS

Description

As stated in Section 2.1.1, plant electrical and I&C systems (Table 2.2-1b) are included in the scope of license renewal, as are electrical and I&C components in mechanical systems. The inclusion of all electrical and I&C systems in the scope of license renewal reflects the method used for the IPA of electrical systems, which is different from the methods used for mechanical systems and structures.

The basic philosophy for electrical and I&C component IPA was that all components were included in the review. Including components beyond those actually required is referred to as an "encompassing" or a "bounding" review. This method eliminates the need for unique identification of each component and its specific location. This method also assured components were not inadvertently excluded from an AMR.

The electrical and I&C IPA began by grouping the total population of components into commodity groups that included similar electrical and I&C components with common characteristics. Component-level intended functions of these commodity groups were identified. System-level intended functions of electrical and I&C components were not considered for the IPA.

Commodity groups were eliminated from the IPA if they were listed as active in NEI 95-10, Appendix B. Commodity groups or portions of groups were also eliminated from further review if they were determined not to have intended functions. The isolated-phase buses and uninsulated ground conductors do not perform an intended function and are therefore not subject to aging management review.

In addition to the plant electrical systems, certain switchyard components were included based on recent NRC guidance pertaining to SBO. The purpose of the offsite power (OFPW) system is to provide the electrical interconnection between the Unit 1 and Unit 2 generators and the offsite transmission network. The OFPW system also provides the electrical interconnections between the offsite network and the station auxiliary buses, as well as electrical interconnections among other buildings and facilities located on the CNP site.

At CNP, the equipment relied upon to support 10 CFR 50.63 is that equipment required to ensure the reactor core is cooled and containment integrity is maintained for four hours (coping duration) before offsite or onsite AC power is restored. The NRC has also required that systems and structures relied upon to restore offsite AC power (including the on-site portion of the offsite power sources) and onsite AC power be included within the license renewal scope for SBO. Therefore, the OFPW system is included in the scope of license renewal.

UFSAR References

Chapter 8 discusses electrical systems; Chapter 7 discusses I&C systems.

Section 8.2 describes the station offsite power connections.

Evaluation Boundaries

A bounding approach is used for electrical and I&C systems. Plant electrical and I&C systems are included in the scope of license renewal.

To support SBO recovery actions, the only offsite power source required is the source fed through the reserve auxiliary transformers. Specifically, the path includes the following:

- Switchyard circuit breakers feeding the reserve auxiliary transformers;
- Reserve auxiliary transformers;
- Circuit breaker-to-transformer and transformer-to-onsite electrical distribution interconnections; and
- Associated control circuits and structures.

Components Subject to AMR

Table 2.5-1 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.6.2-1, Electrical Components — Summary of Aging Management Evaluation, provides the results of the aging management review.

License Renewal Drawings

For additional details of components subject to aging management review, refer to the following license renewal drawing:

Common: 12-LRA-Electrical1

Table 2.5-1
Electrical and Instrumentation and Control Systems
Components Subject to Aging Management Review

Structure/Component/Commodity	Intended Function (as defined in Table 2.0-1)
Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	CE
Electrical cables used in instrumentation required by the Technical Specifications for high voltage, low current circuits not subject to 10 CFR 50.49 EQ requirements	CE
Inaccessible medium-voltage (4.16kV to 34.5kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	CE
Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage	CE
Switchyard bus for SBO, connections	CE
High-voltage insulators	IN

3.0 AGING MANAGEMENT REVIEW RESULTS

This section provides the results of the AMR for in-scope structures and components identified in Section 2. Tables 3.0-1, 3.0-2, and 3.0-3 provide descriptions of the mechanical, structural, and electrical service environments, respectively, used in the AMRs to determine aging effects requiring management.

Results of the AMRs are presented in the following two table types:

- **Table 3.x.1** where,
  - **3** indicates the application section number
  - **x** indicates the table number from NUREG-1801, Volume 1
  - **1** indicates that this is the first table type in Section 3.x

For example, in the reactor coolant system subsection, this is Table 3.1.1; and in the engineered safety features subsection, this is Table 3.2.1. For ease of discussion, these tables will hereafter be referred to as "Table 1." These tables are derived from the corresponding tables in NUREG-1801, Volume 1, and present summary information from the AMRs.

- **Table 3.x.2-y** where,
  - **3** indicates the application section number
  - **x** indicates the table number from NUREG-1801, Volume 1
  - **2** indicates that this is the second table type in Section 3.x
  - **y** indicates the system table number

For example, within the reactor coolant system subsection, the AMR results for the reactor vessel are presented in Table 3.1.2-1, and the results for the reactor vessel internals are in Table 3.1.2-2. In the engineered safety features subsection, the containment spray system results are presented in Table 3.2.2-1, and the containment isolation system is in Table 3.2.2-2. For ease of discussion, these tables will hereafter be referred to as "Table 2." These tables present the results of the AMRs.

TABLE DESCRIPTION

NUREG-1801 contains the NRC Staff's generic evaluation of existing plant programs. It documents the technical basis for determining whether existing programs are adequate without modification, or should be augmented for the extended period of operation. Evaluation results documented in the report indicate that many existing programs are adequate, without modification, to manage the aging effects for particular structures or components within the scope of license renewal. The report also contains recommendations on specific areas for which existing programs should be augmented for license renewal.

To take full advantage of NUREG-1801, CNP AMR results have been compared with information set forth in the tables of NUREG-1801. Results of that comparison are provided in the following two table types, Table 1 and Table 2.

Table 1

The purpose of Table 1 is to provide a summary comparison of how the CNP AMR results align with the corresponding table of NUREG-1801, Volume 1. These tables are essentially the same as Tables 1 through 6 provided in NUREG-1801, Volume 1, with the following exceptions:

- The "Type" column has been replaced by an "Item Number" column; and
- The "Item Number in GALL" column has been replaced by a "Discussion" column.

The "Item Number" column provides a means to cross-reference from Table 2 to Table 1.

Further information is provided in the "Discussion" column. The following are examples of information that might be contained within this column:

- Any "Further Evaluation Recommended" information or reference to the location of that information (including a hyperlink to the location of the information in this application);
- The name of a plant-specific program being used (including a hyperlink to the program description in this application);
- Exceptions to the NUREG-1801 assumptions;
- A discussion of how the line item is consistent with the corresponding line item in NUREG-1801, Volume 1, when it may not be intuitively obvious;

- A discussion of how the line item is different than the corresponding line item in NUREG-1801, Volume 1, when it may appear to be consistent.

Table 2

Table 2 provides the detailed results of the AMRs for those structures and components identified in Section 2 of this application as being subject to aging management review. There will be a Table 2 for each of the subsystems within a "system" grouping. For example, the engineered safety features system group contains tables specific to containment spray, containment isolation, emergency core cooling, and containment equalization / hydrogen skimmer.

Table 2 consists of the following nine columns:

1. *Component Type*

   Column 1 identifies all of the component types from Section 2 of this application that are subject to aging management review. Similar to Section 2, component types are listed in alphabetical order. In the structural tables in Section 3.5, component types are sub-grouped by material.

2. *Intended Function*

   Column 2 identifies the license renewal intended functions (using abbreviations where necessary) for the listed component types. Definitions and abbreviations of intended functions are listed in Table 2.0-1 in Section 2.

3. *Material*

   Column 3 lists the particular materials of construction for the component type being evaluated.

4. *Environment*

   Column 4 lists the environment to which the component types are exposed. Internal and external service environments are indicated. A description of these environments is provided in Tables 3.0-1, 3.0-2, and 3.0-3 for mechanical, structural, and electrical components, respectively.

5. Aging Effect Requiring Management

Column 5 lists the aging effects identified as requiring management for material and environment combinations for each component type.

6. Aging Management Programs

Column 6 lists the programs used to manage the aging effects requiring management.

7. NUREG-1801, Vol. 2, Item

Each combination of the following factors listed in Table 2 is compared to NUREG-1801, Volume 2, to identify consistencies:

- Component type,
- Material,
- Environment,
- Aging effect requiring management, and
- Aging management program.

Column 7 documents identified consistencies by noting the appropriate NUREG-1801, Volume 2, item number. If there is no corresponding item number in NUREG-1801, Volume 2, for a particular combination of factors, column 7 is left blank.

8. Table 1 Item

Each combination of the following that has an identified NUREG-1801, Volume 2 item number must also have a Table 1 line item reference number:

- Component type
- Material
- Environment
- Aging effect requiring management
- Aging management program

Column 8 lists the corresponding line item from Table 1. If there is no corresponding item in NUREG-1801, Volume 1, column 8 is left blank.

9. Notes

Column 9 contains notes that are used to describe the degree of consistency with the line items in NUREG-1801, Volume 2. Notes that use letter designations are standard notes from Reference 3.0-4. Notes that use numeric designators are specific to CNP. The notes are located at the end of each 3.x section.

TABLE USAGE

Table 1

Information in the following columns is taken directly from NUREG-1801, Volume 1:

- Component
- Aging Effect/Mechanism
- Aging Management Programs
- Further Evaluation Recommended

The Discussion column explains, in summary, how the CNP evaluations align with NUREG-1801, Volume 1.

Table 2

Table 2 contains the aging management review results and indicates whether or not the results correspond to line items in NUREG-1801, Volume 2. This table provides the following information:

- Component type
- Component intended function
- Material
- Environment
- Aging effect requiring management
- AMP credited

If there is a correlation between the combination in Table 2 and a combination for a line item in NUREG-1801, Volume 2, this will be identified by the NUREG-1801, Volume 2, item number in column 7. If the column is blank, no appropriately corresponding combination in NUREG-1801, Volume 2, was identified.

If a NUREG-1801, Volume 2, line item is identified, the next column provides a reference to a Table 1 row number. This reference corresponds to the NUREG-1801, Volume 2, "roll-up" to the NUREG-1801, Volume 1, tables.

REFERENCES FOR SECTION 3.0

3.0-1 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, U. S. Nuclear Regulatory Commission, July 2001.

3.0-2 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Volumes 1 and 2, U. S. Nuclear Regulatory Commission, July 2001.

3.0-3 NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, Nuclear Energy Institute (NEI), Revision 3, April 2001.

3.0-4 Letter from A. Nelson, NEI, to P. T. Kuo, NRC, "U.S. Nuclear Industry's Proposed Standard License Renewal Application Format Package, Request NRC Concurrence," dated January 24, 2003.

Table 3.0-1
Service Environments for Mechanical Aging Management Reviews

This table lists the environments for the internal and external surfaces for the mechanical AMRs. Many of the environments are self-explanatory, but additional descriptions have been provided as necessary.

Table 3.0-1	
Environment	**Description**
Class 1 Mechanical Environments	
External Ambient	Containment building atmosphere with potential for limited periods of leaking borated water and steam
Treated borated water	Demineralized or chemically purified water that contains boric acid; for the pressurizer, this environment includes steam
Treated water	Demineralized or chemically purified water; for the steam generator secondary side, this environment includes steam
Non-Class 1 Mechanical Environments	
Air	Indoor atmospheric air and non-dried compressed air
Carbon dioxide	Carbon dioxide gas or liquid in bottled supply
Concrete	Concrete is listed as an external environment for large surfaces exposed to concrete, such as a tank bottom or piping embedded in concrete
Condensation	Water condensed from humidity in the air
Exhaust gas	Gasses present in a diesel engine exhaust
Freon	Freon gas used in HVAC equipment
Fuel oil	Fuel oil used for in-scope plant equipment
Halon	Halon gas from a bottled supply
Hydrogen	Hydrogen gas from a bottled supply

Table 3.0-1 (Continued)	
Environment	**Description**
Lube oil	Lubricating oils used for in-scope plant equipment
Lube oil and borated water leakage	Both lube oil and borated water leakage together (specific to the RCP lube oil leakage collection system)
Nitrogen	Nitrogen gas or liquid from a bottle or tank supply
Outdoor air	Atmospheric air exposed to the weather
Oxygen	Oxygen gas from a bottled supply
Raw water (fresh)	Water from a lake that is rough-filtered but not fully chemically treated
Sodium hydroxide	Treated water containing sodium hydroxide
Soil	External environment for components buried in the soil, including groundwater in the soil
Steam >270°F	Steam that is greater than 270°F
Treated air	Air downstream of dryers, such as those in the control air system
Treated borated water	Demineralized or chemically purified water that contains boric acid and is less than or equal to 270ºF
Treated borated water >270°F	Demineralized or chemically purified water greater than 270°F that contains boric acid
Treated water	Demineralized or chemically purified water that is less than or equal to 270ºF
Treated water >270°F	Demineralized or chemically purified water that is greater than 270°F
Untreated air	Compressed air that is not dried

Table 3.0-1 (Continued)	
Environment	**Description**
Untreated water	Water (other than raw water from a lake) that is not treated with chemicals, may contain contaminants, and is less than or equal to 270ºF
Untreated water >270°F	Water (other than raw water from a lake) that is not treated with chemicals, may contain contaminants, and is greater than 270°F
Untreated water with boron	Water (other than raw water from a lake) less than 270°F that is not treated with chemicals, may contain contaminants, and is likely to contain boron

Table 3.0-2
Service Environments for Structural Aging Management Reviews

Environment	Description
Protected from weather	Air with temperature less than 150°F, humidity up to 100% and protected from precipitation
Protected from weather with elevated temperatures	Air with temperature less than 200°F, humidity up to 100% and protected from precipitation
Exposed to weather (includes above grade and below grade)	Exposed to the weather with air temperature less than 115°F, humidity up to 100%
Exposed to raw water	Raw water at CNP is fresh water, defined as raw water having a sodium chloride content below 1000 parts per million. It may be acidic or contain chlorides or sulfates.
Exposed to borated water or borated ice	Water or ice containing boron
Exposed to treated water	Demineralized or chemically purified water that is less than or equal to 270ºF

Table 3.0-3
Service Environments for Electrical Aging Management Reviews

Environment	Description
Borated water leakage	Demineralized or chemically purified water that contains boric acid
Heat and/or radiation and air[1]	Containment Operating temperature: 160°F With ohmic heating: 162°F Cumulative radiation dose: 2.7E+07 rads Areas outside containment (harsh areas) Operating temperature: 150°F With ohmic heating: 162°F Cumulative radiation dose: 1.29E+06 rads All other areas (mild areas) Operating temperature: 115°F With ohmic heating: 162°F Cumulative radiation dose: 1.0E+04 rads
Moisture and voltage stress	A wetted environment with a medium-voltage range (4.16kV to 34.5kV for CNP). At CNP, these are underground, medium-voltage cables that are energized at least 25% of the time.
Outdoor weather	Temperature up to 105°F, precipitation, negligible radiation

1. The temperatures and radiation values are based on nominal maximum design values. Localized adverse environments are addressed in the cable inspection program presented in Appendix B to this application.

3.1 REACTOR VESSEL, INTERNALS AND REACTOR COOLANT SYSTEM

3.1.1 Introduction

This section provides aging management review results for components in the reactor coolant system (RCS). The following component groups are addressed below in Subsections 3.1.2.1.1 through 3.1.2.1.5:

- Reactor vessel and control rod drive mechanism (CRDM) pressure boundary (Section 2.3.1.2)
- Reactor vessel internals (Section 2.3.1.3)
- Class 1 piping, valves, and reactor coolant pumps (Section 2.3.1.4)
- Pressurizer (Section 2.3.1.5)
- Steam generators (Section 2.3.1.6)

Table 3.1.1, Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the RCS component groups. Hyperlinks to the program evaluations in Appendix B are provided in the CD-ROM version of this application.

3.1.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for Class 1 components:

- Table 3.1.2-1 Reactor Vessel and CRDM Pressure Boundary — Summary of Aging Management Evaluation
- Table 3.1.2-2 Reactor Vessel Internals (Westinghouse) — Summary of Aging Management Evaluation
- Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps — Summary of Aging Management Evaluation
- Table 3.1.2-4 Pressurizer — Summary of Aging Management Evaluation
- Table 3.1.2-5 Steam Generators — Summary of Aging Management Evaluation

3.1.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the RCS components. Programs are described in Appendix B of this application. Further details are provided in Tables 3.1.2-1 through 3.1.2-5.

3.1.2.1.1 Reactor Vessel and Control Rod Drive Mechanism Pressure Boundary

Materials

Reactor vessel and control rod drive mechanism (CRDM) pressure boundary components are constructed of the following materials:

- Low alloy steel clad with stainless steel
- Low alloy steel clad with nickel-based alloy
- Low alloy steel
- Stainless steel
- Carbon steel
- Nickel-based alloy

Environment

Reactor vessel and CRDM pressure boundary components are exposed to the following environments:

- Treated (borated) water
- External - ambient

The external - ambient environment, as applied to all portions of the RCS, is the containment building internal atmosphere. This environment has the potential for limited periods of leaking borated water and steam.

Aging Effects Requiring Management

The following aging effects associated with the reactor vessel and CRDM pressure boundary components require management:

- Cracking

- Loss of material
- Reduction in fracture toughness (reactor vessel beltline materials only)
- Loss of mechanical closure integrity

The beltline region of the Unit 1 reactor vessel includes the intermediate shell, the three longitudinal welds joining the intermediate shell plates, the circumferential weld that connects the intermediate shell to the lower shell, the lower shell, and the three longitudinal welds joining the lower shell plates.

The beltline region of the Unit 2 reactor vessel includes the intermediate shell plates, two longitudinal welds joining the intermediate shell plates, the circumferential weld that connects the intermediate shell to the lower shell, the lower shell plates, and the two longitudinal welds that connect the lower shell plates.

Aging Management Programs

The following aging management programs will manage the aging effects for the reactor vessel and CRDM pressure boundary components:

- Reactor Vessel Integrity
- Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD
- Water Chemistry Control
- Boric Acid Corrosion Prevention
- Alloy 600 Aging Management
- Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection
- Bottom-Mounted Instrumentation Thimble Tube Inspection

3.1.2.1.2 Reactor Vessel Internals

Materials

Reactor vessel internals components are constructed of the following materials:

- Stainless steel
- Nickel-based alloy
- Cast austenitic stainless steel (CASS)

Environment

Reactor vessel internals components are exposed to the following environment:

- Treated (borated) water

Aging Effects Requiring Management

The following aging effects associated with the reactor vessel internals components require management:

- Cracking
- Loss of material
- Loss of preload
- Reduction in fracture toughness
- Distortion
- Loss of mechanical closure integrity

Distortion includes change in dimensions due to void swelling.

Aging Management Programs

The following aging management programs will manage the aging effects for the reactor vessel internals components:

- Reactor Vessel Internals Plates, Forgings, Welds, and Bolting
- Reactor Vessel Internals Cast Austenitic Stainless Steel
- Water Chemistry Control
- Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD

3.1.2.1.3 Class 1 Piping, Valves, and Reactor Coolant Pumps

Materials

Class 1 piping, valves, and reactor coolant pump (RCP) components are constructed of the following materials:

- Stainless steel
- CASS

- Low alloy steel

Environment

Class 1 piping, valves, and RCP components are exposed to the following environments:

- Treated (borated) water
- External - ambient
- Treated water

Aging Effects Requiring Management

The following aging effects associated with the Class 1 piping, valves, and RCP components require management:

- Cracking
- Reduction in fracture toughness
- Loss of material
- Loss of mechanical closure integrity
- Fouling

Reduction in fracture toughness includes thermal embrittlement that degrades the mechanical properties (strength, ductility, toughness) of CASS as a result of prolonged exposure to high temperatures (greater than 482ºF). Castings with high ferrite and high molybdenum contents are more susceptible to thermal embrittlement than those with lower values. The RCP casings are not susceptible to a reduction in fracture toughness due to thermal embrittlement based on a less than or equal to 20 percent δ-ferrite level threshold for statically cast, low molybdenum steels. No weld repairs of RCP casings have been required.

Aging Management Programs

The following aging management programs will manage the aging effects for the Class 1 piping, valves, and RCP components:

- Water Chemistry Control
- Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD

- Cast Austenitic Stainless Steel Evaluation
- Small Bore Piping
- Boric Acid Corrosion Prevention
- Bolting and Torquing Activities

3.1.2.1.4 Pressurizer

Materials

Pressurizer components are constructed of the following materials:

- Low alloy steel
- Low alloy steel clad with stainless steel
- Carbon steel
- Stainless steel
- Nickel-based alloy (weld buttering)
- CASS

Environment

Pressurizer components are exposed to the following environments:

- Treated (borated) water
- External – ambient

The pressurizer treated (borated) water environment includes steam.

Aging Effects Requiring Management

The following aging effects associated with the pressurizer components require management:

- Cracking
- Loss of material
- Reduction of fracture toughness
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the pressurizer components:

- Water Chemistry Control
- Pressurizer Examinations
- Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD
- Boric Acid Corrosion Prevention
- Alloy 600 Aging Management
- Bolting and Torquing Activities

3.1.2.1.5 Steam Generators

Materials

Steam generator components are constructed of the following materials:

- Low alloy steel
- Carbon steel
- Low alloy steel clad with stainless steel
- Low alloy steel clad with nickel-based alloy
- Stainless steel
- Nickel-based alloy

Environment

Steam generator components are exposed to the following environments:

- Treated (borated) water
- Treated water
- External - ambient

The treated water environment is on the secondary side of the steam generators. The secondary side treated water environment includes steam.

Aging Effects Requiring Management

The following aging effects associated with the steam generator components require management:

- Cracking
- Loss of material
- Fouling
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the steam generator components:

- Water Chemistry Control
- Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD
- Boric Acid Corrosion Prevention
- Alloy 600 Aging Management
- Bolting and Torquing Activities
- Steam Generator Integrity
- Flow-Accelerated Corrosion

3.1.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation by the NRC reviewer is necessary for certain aging effects, particularly those that require plant-specific programs or that involve TLAAs. Section 3.1.2.2 of NUREG-1800 discusses the aging effects that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain I&M's approach to addressing the areas requiring further evaluation. Programs are described in Appendix B of this application.

3.1.2.2.1 Cumulative Fatigue Damage (BWR/PWR)

Cracking due to fatigue is an aging effect applicable to all RCS components subject to aging management review. Fatigue evaluations are TLAAs, since they are based on design transients (cyclic loadings) defined for the life of the plant. Fatigue evaluations were performed in the design of the Class 1 RCS components in accordance with the requirements specified in ASME Section III and USAS B31.1. Fatigue evaluations are contained in calculations and stress reports. Design cyclic loadings and thermal and pressure conditions for the RCS Class 1 components are defined by the component design specifications.

RCS design cyclic loadings are monitored through the Fatigue Monitoring Program. The cumulative usage factors for the Class 1 components were determined to remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The evaluation of this TLAA is documented in Section 4.3

3.1.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion (BWR/PWR)

1) NUREG-1801 refers to NRC Information Notice (IN) 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," dated January 26, 1990, and recommends augmented inspection to manage pitting and corrosion. IN 90-04 states that if general corrosion pitting of the steam generator shell is known to exist, the requirements of ASME Section XI may not be sufficient to differentiate isolated cracks for inherent geometric conditions. The concerns of IN 90-04 are not applicable to CNP, since a review of operating experience has indicated that CNP has not experienced significant pitting corrosion of the steam generator shell. Unit 1 steam generators were replaced in 2000 and Unit 2 steam generators were replaced in 1988. The Water Chemistry Control Program and the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will manage loss of material due to pitting and crevice corrosion on the internal surfaces of the steam generator shell.

2) The discussion in this paragraph of NUREG-1800 is applicable to BWRs only.

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement (BWR/PWR)

1) Neutron irradiation embrittlement is a TLAA to be evaluated for the period of license renewal for all ferritic materials that have a neutron fluence of greater than 10^{17}n/cm2 (E >1 MeV) at the end of the license renewal term. The beltline region, as described in Section 3.1.2.1.1, was verified to be the limiting region in evaluating loss of fracture toughness due to neutron irradiation embrittlement for both units. The TLAA is to evaluate the impact of neutron embrittlement on the following:

- RT_{PTS} value based on the requirements in 10 CFR 50.61

- Adjusted reference temperature
- Pressure-temperature limits
- Charpy upper shelf energy
- Equivalent margins analyses performed in accordance with 10 CFR 50, Appendix G

Analysis has demonstrated that a Charpy upper-shelf energy of no less than 50 ft-lb will be maintained throughout the life of the reactor vessel. Therefore, no equivalent margins analysis is required. This TLAA is required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is addressed in Section 4.2.

2) Loss of fracture toughness due to irradiation embrittlement of the reactor vessel beltline materials will be managed by the Reactor Vessel Integrity Program. This program includes a plant-specific material surveillance program that monitors the effect of operational fluence on material specimens located in surveillance capsules in the reactor vessel during power operations. Proposed unit-specific capsule withdrawal schedules are included as part of this program, which is detailed in Appendix B of this application.

3) Neutron irradiation embrittlement and void swelling of the baffle/former bolts could cause loss of intended function of the reactor vessel internals. The effects of aging on the reactor vessel internals baffle/former bolts will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program. Volumetric inspection of baffle/former bolt critical locations will be performed to assess cracking. For baffle bolts, any detectable crack indication is unacceptable for a particular baffle bolt. The critical number of baffle bolts needed to be intact and their locations will be determined by analysis as part of this program.

3.1.2.2.4 Crack Initiation and Growth due to Thermal and Mechanical Loading or Stress Corrosion Cracking (BWR/PWR)

1) The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program and the Water Chemistry Control Program will manage cracking of reactor coolant piping. However, in accordance with ASME Section XI, 1995 Edition, Examination Category B-J or B-F, small bore piping, defined as piping less than 4-inch nominal pipe size (NPS), does not receive volumetric inspection. A risk-informed method will be used to select a sample of these Class 1 piping welds for volumetric inspection. A one-time

inspection of the selected welds will confirm that cracking is not occurring and that the intended function of the small bore piping can be maintained. I&M will perform the one-time inspection under the Small Bore Piping Program prior to the period of extended operation.

2) The discussion in this paragraph of NUREG-1800 is applicable to BWRs only.

3) The discussion in this paragraph of NUREG-1800 is applicable to BWRs only.

3.1.2.2.5 Crack Growth due to Cyclic Loading (PWR)

The aging effect of intergranular separations (underclad cracking) in low alloy steel heat-affected zones under austenitic stainless steel weld claddings is applicable to CNP, since the vessel and closure head flanges and inlet and outlet nozzles are fabricated from clad SA 508, Class 2 forgings. An evaluation for Westinghouse reactor vessels has been completed to include the latest fracture toughness information, applied stress intensity solutions, fatigue crack growth correlations for SA-508, Class 2 material, and the ASME Section XI acceptance criteria for a 60-year plant life. The reactor vessel components fabricated of the SA-508 material are bound by this evaluation and are therefore not susceptible to underclad cracking. The evaluation of underclad cracking is a TLAA addressed in Section 4.7.4.

3.1.2.2.6 Changes in Dimension due to Void Swelling (PWR)

The visual inspections of the reactor vessel internals completed as part of the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program according to Examination Category B-N-3 are not sufficient to detect changes in dimension due to void swelling. Therefore, void swelling of reactor vessel internals will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program. The examinations described in the Reactor Vessel Internals Program may be supplemented to incorporate requirements for dimensional verification of critical reactor vessel internals. Further understanding of this aging effect through industry programs will provide additional bases for the inspections under this program.

3.1.2.2.7 Crack Initiation and Growth due to Stress Corrosion Cracking or Primary Water Stress Corrosion Cracking (PWR)

1) Cracking of nickel-based alloy components due to primary water stress corrosion cracking (PWSCC) will primarily be managed by the Alloy 600 Aging Management Program, supplemented by the Water Chemistry Control Program and the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program. The EPRI Material Reliability Program in conjunction with the PWR Owners Groups is developing a strategic plan to manage PWSCC of nickel-based alloy items. The guidance developed by the Material Reliability Program and the Owners Groups is expected to be used to identify critical locations for inspection and to augment existing inservice inspections, as appropriate. Cracking of the pressurizer spray head assembly will be managed by a one-time visual inspection as detailed in the Pressurizer Examinations Program.

2) The main reactor coolant piping and fittings (hot, cold, and crossover legs) are fabricated of CASS. Crack initiation and growth due to stress corrosion cracking in this piping will be managed by the Water Chemistry Control Program and the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program. The Water Chemistry Control Program is in accordance with EPRI guidelines.

3) Nickel-based alloy weld material is identified for the pressurizer nozzles and thermal sleeves. The programs that will manage PWSCC of these nickel-based alloy items are the Alloy 600 Aging Management Program and Water Chemistry Control Program, supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program. As described in item 1 above, the Alloy 600 Aging Management Program will include participation in industry programs to identify critical locations for inspection and augment existing ISI inspections at CNP where appropriate.

3.1.2.2.8 Crack Initiation and Growth due to Stress Corrosion Cracking or Irradiation-Assisted Stress Corrosion Cracking (PWR)

Historically, the VT-3 visual examinations required by ASME Section XI have not identified baffle/former bolt cracking because cracking occurs at the juncture of the bolt head and shank, which is not accessible for visual inspection. The Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program, in conjunction with the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program, will use volumetric inspections of baffle/former bolt critical locations to assess cracking. For baffle bolts, any detectable crack indication is unacceptable for a particular baffle bolt. The critical number of baffle bolts needed to be intact and their locations will be determined by analysis as part of this program.

The industry is addressing the issue of baffle bolt cracking through the activities of the PWR Materials Reliability Project, Issues Task Group (ITG). Those activities are to determine, develop, and implement the necessary steps and plans to manage the applicable aging effects on a plant-specific basis. Further understanding of these aging effects will provide additional bases for the inspections under this program. Additionally, the Water Chemistry Control Program maintains an operating environment that will mitigate damage caused by stress corrosion cracking.

3.1.2.2.9 Loss of Preload due to Stress Relaxation (PWR)

Loss of preload due to stress relaxation could occur in baffle/former bolts, resulting in loss of intended function of this component. Visual inspections as required by ASME Section XI should be augmented to detect relevant conditions of stress relaxation because only the heads of the baffle/former bolts are visible. As described in Section 3.1.2.2.8, the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program, in conjunction with the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program, will use volumetric inspections of baffle/former bolt critical locations to assess degradation. This program will manage the loss of preload for the baffle/former bolts of the reactor vessel internals.

3.1.2.2.10 Loss of Section Thickness due to Erosion (PWR)

CNP does not have steam generator feedwater impingement plates. Therefore, the discussion in this paragraph of NUREG-1800 is not applicable.

3.1.2.2.11 Crack Initiation and Growth due to PWSCC, ODSCC, or Intergranular Attack; or Loss of Material due to Wastage and Pitting Corrosion; or Loss of Section Thickness due to Fretting and Wear; or Denting due to Corrosion of Carbon Steel Tube Support Plate (PWR)

Any of the following could occur in nickel-based alloy components of the steam generator tubes and plugs:

- Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), or intergranular attack (IGA)
- Loss of material due to wastage and pitting corrosion
- Deformation due to corrosion

The Steam Generator Integrity Program, supplemented by the Water Chemistry Control Program and the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program, will manage these aging effects. The Steam Generator Integrity Program assessment of tube integrity and plugging or repair criteria of flawed tubes is conducted in accordance with the plant Technical Specifications and NEI 97-06, S*team Generator Program Guidelines*, Revision 1, January 2001. Aging effects of Alloy 690 steam generator tube plugs are also managed by the Steam Generator Integrity and Water Chemistry Control Programs. For general and pitting corrosion, the acceptance criteria are in accordance with NEI 97-06 guidelines.

3.1.2.2.12 Loss of Section Thickness due to Flow-Accelerated Corrosion

The discussion in this paragraph of NUREG-1800 applies to tube support lattice bars made of carbon steel. As the CNP steam generators have stainless steel lattice bars, this discussion is not applicable.

3.1.2.2.13 Ligament Cracking due to Corrosion (PWR)

The discussion in this paragraph of NUREG-1800 applies to carbon steel components in the steam generator tube support plate. The Unit 1 CNP steam generators do not have tube support plates and the Unit 2 CNP steam generators have stainless steel tube support plates. Therefore, this discussion is not applicable to CNP.

3.1.2.2.14 Loss of Material due to Flow-accelerated Corrosion (PWR)

The discussion in this paragraph of NUREG-1800 is applicable to CE System 80 steam generators. CNP has Babcock and Wilcox Type 51R and Westinghouse Model 51 steam generators. Therefore, this discussion is not applicable to CNP.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The CNP Corrective Action Program applies to both safety-related and nonsafety-related structures and components. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing CNP Document Control Program in accordance with the Quality Assurance Program Description (QAPD). See Section B.0.3 of this application for further discussion.

3.1.2.3 Time-Limited Aging Analyses

TLAAs identified for the RCS include:

- Metal fatigue
- Flaw growth acceptance evaluations
- Leak-before-break
- Reactor vessel beltline fracture toughness evaluations
- Steam generator flow-induced vibration analyses

These topics are addressed in Section 4.

3.1.3 Conclusion

The RCS Class 1 piping, fittings, and components (as well as secondary side steam generator portions) that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). The aging management programs selected to manage aging effects for the RCS Class 1 components (and secondary side steam generator portions) are identified in the following tables and Section 3.1.2.1. A description of these aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the RCS components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.1.1
Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-1	Reactor coolant pressure boundary components	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800, Subsection 3.1.2.2.1)	Cracking due to fatigue is an aging effect applicable to all reactor coolant pressure boundary items subject to aging management review. Because of the uniform applicability of this effect, the effect and the comparison to the associated NUREG-1801 line items have not been listed in the Class 1 tables (3.1.2-1 through 3.1.2-5) below. The metal fatigue TLAA associated with Class 1 components is addressed in Section 4.3.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-2	Steam generator shell assembly	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry	Yes, detection of aging effects is to be further evaluated (see NUREG-1800, Subsection 3.1.2.2.2)	The Water Chemistry Control Program will manage general, crevice and pitting corrosion. The Water Chemistry Control Program will be supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for secondary side external components of the steam generator within the scope of the Inservice Inspection Program. The Water Chemistry Control Program will be supplemented by the Steam Generator Integrity Program for secondary side internal components of the steam generator. This grouping includes the steam generator shell assembly and attached components, and components of the secondary side internals.
3.1.1-3	BWR only				
3.1.1-4	Pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E >1 MeV)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99	Yes, TLAA (see NUREG-1800, Subsection 3.1.2.2.3)	Evaluation of these TLAAs is addressed in Section 4.2. For further evaluation, see Section 3.1.2.2.3.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-5	Reactor vessel beltline shell and welds	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.3)	Consistent with NUREG-1801. The Reactor Vessel Integrity Program will manage the reduction of fracture toughness of reactor vessel beltline materials. For further evaluation, see Section 3.1.2.2.3.
3.1.1-6	Westinghouse and Babcock & Wilcox (B&W) baffle/ former bolts	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.3)	Consistent with NUREG-1801. Aging management of the reactor vessel internals baffle/former bolts will be accomplished by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program. For further evaluation, see Section 3.1.2.2.3.
3.1.1-7	Small-bore reactor coolant system and connected systems piping	Crack initiation and growth due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), and thermal and mechanical loading	Inservice inspection; water chemistry; one-time inspection	Yes, parameters monitored/ inspected and detection of aging effects are to be further evaluated (see NUREG-1800, Subsection 3.1.2.2.4)	Consistent with NUREG-1801. CNP will rely on the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program and the Water Chemistry Control Program to manage cracking due to SCC. The Small Bore Piping Program will include a one-time inspection to confirm that cracking is not occurring. For further evaluation, see Section 3.1.2.2.4.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-8	BWR only				
3.1.1-9	BWR only				
3.1.1-10	Vessel shell	Crack growth due to cyclic loading	TLAA	Yes, TLAA (see NUREG-1800, Subsection 3.1.2.2.5)	NUREG-1801, Item IV.A2.5-b addresses underclad cracking of vessels with ASME SA-508, Class 2 forgings due to cyclic loadings. The CNP reactor vessel items fabricated of the subject material include the primary nozzles and the vessel and closure head flanges. The TLAA associated with underclad cracking is addressed in Section 4.7.4.
3.1.1-11	Reactor internals	Changes in dimension due to void swelling	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.6)	Consistent with NUREG-1801. The aging effect will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program. For further evaluation, see Section 3.1.2.2.6.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-12	PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains	Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.7.1)	Consistent with NUREG-1801. This grouping includes reactor vessel core support lugs, in-core instrumentation nozzles, and pressurizer spray heads. Refer to Item 3.1.1-44 of this table for primary side steam generator items. The Water Chemistry Control Program will manage cracking due to SCC/IGA. The Alloy 600 Aging Management Program will manage PWSCC of nickel-based alloys as a supplement to the Water Chemistry Control Program. Furthermore, the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will supplement the Water Chemistry Control Program to manage cracking at welded connections. The Pressurizer Examinations Program will supplement the Water Chemistry Control Program to manage cracking of the pressurizer spray head.
3.1.1-13	Cast austenitic stainless steel (CASS) reactor coolant system piping	Crack initiation and growth due to SCC	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.1.2.2.7.2)	Consistent with NUREG-1801. The Water Chemistry Control Program and the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will manage the aging effects.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-14	Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry	Yes, AMP for PWSCC of Inconel 182 weld is to be evaluated (see NUREG-1800 Subsection 3.1.2.2.7.3)	This grouping includes the nickel-based alloy weld materials for the pressurizer nozzles and thermal sleeves. The instrumentation penetrations and heater sheaths are formed from different materials and are not included in this grouping. Aging management will be accomplished by a combination of the Water Chemistry Control Program and the Alloy 600 Aging Management Program, and will be supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for components within the scope of the Inservice Inspection Program (nozzles only).
3.1.1-15	Westinghouse and B&W baffle former bolts	Crack initiation and growth due to SCC and irradiation-assisted stress corrosion cracking (IASCC)	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.8)	Consistent with NUREG-1801. Aging management of the reactor vessel internals baffle/former bolts will be accomplished by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program and the Water Chemistry Control Program.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-16	Westinghouse and B&W baffle former bolts	Loss of preload due to stress relaxation	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.9)	Consistent with NUREG-1801. Aging management of the reactor vessel internals baffle/former bolts will be accomplished by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program, supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program. The corresponding aging effect in Table 3.1.2-2 below is loss of mechanical closure integrity.
3.1.1-17	Steam generator feedwater impingement plate and support	Loss of section thickness due to erosion	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.10)	Not applicable. CNP steam generators do not include feedwater impingement plates.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-18	(Alloy 600) Steam generator tubes, repair sleeves, and plugs	Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/ or intergranular attack (IGA); or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry	Yes, effectiveness of a proposed AMP is to be evaluated (see NUREG-1800, Subsection 3.1.2.2.11)	Consistent with NUREG-1801. The Steam Generator Integrity Program based on NEI 97-06, in conjunction with the Water Chemistry Control Program, will manage the identified aging effects. For further evaluation, see Section 3.1.2.2.11.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-19	Tube support lattice bars made of carbon steel	Loss of section thickness due to flow-accelerated corrosion (FAC)	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.12)	Not applicable. The CNP tube support lattice bars are stainless steel and are therefore not susceptible to FAC.
3.1.1-20	Carbon steel tube support plate	Ligament cracking due to corrosion	Plant specific	Yes, effectiveness of a proposed AMP is to be evaluated (see NUREG-1800, Subsection 3.1.2.2.13	Not applicable. The CNP steam generators do not have carbon steel tube support plates.
3.1.1-21	Steam generator feedwater inlet ring and supports	Loss of material due to flow accelerated corrosion	Combustion Engineering (CE) steam generator feedwater ring inspection	Yes, plant specific (see NUREG-1800, Subsection 3.1.2.2.14)	Not applicable. This NUREG-1801 grouping is applicable to Combustion Engineering (CE) System 80 steam generators only. CNP has Babcock and Wilcox Model 51R and Westinghouse Model 51 steam generators.
3.1.1-22	Reactor vessel closure studs and stud assembly	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	No	The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will manage cracking of the reactor vessel closure bolting.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-23	CASS pump casing and valve body	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	No	Consistent with NUREG-1801. This grouping includes valve bodies and the reactor coolant pump main flanges that are formed of CASS material. As described in Section 3.1.2.1.3, the reactor coolant pump casing material is not susceptible to reduction in fracture toughness due to thermal embrittlement. No weld repairs of RCP casings have been required. The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will manage this aging effect.
3.1.1-24	CASS piping	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	No	Consistent with NUREG-1801 for the CASS piping. The Cast Austenitic Stainless Steel Evaluation Program, supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program, will manage this aging effect for CASS piping. This grouping also includes the CASS pressurizer spray heads. The Pressurizer Examinations Program will manage this aging effect for the spray heads.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-25	BWR piping and fittings; steam generator components	Wall thinning due to flow accelerated corrosion	Flow accelerated corrosion	No	Consistent with NUREG-1801. The main steam nozzles and the Unit 2 feedwater elbow thermal liners are included in this grouping. The steam generator feedwater nozzles are protected from flow-accelerated corrosion by nickel-based alloy thermal sleeves (Unit 1) and carbon steel thermal liners (Unit 2) listed in Table 3.1.2-5. The Flow-Accelerated Corrosion Program supplemented by the Water Chemistry Control Program will manage this aging effect for the susceptible items.
3.1.1-26	Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high-pressure and high-temperature systems	Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	No	Reactor vessel closure bolting is addressed in Items 3.1.1-22 and 3.1.1-47 of this table. For primary side Class 1 closures, cracking (SCC) of bolts will be managed by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program. Loss of mechanical closure integrity will be managed by the combination of the Bolting and Torquing Activities Program, Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program, and Boric Acid Corrosion Prevention Program for both reactor coolant pressure boundary Class 1 closures and secondary side steam generator closures.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-27	BWR only				
3.1.1-28	BWR only				
3.1.1-29	BWR only				
3.1.1-30	BWR only				
3.1.1-31	BWR only				
3.1.1-32	BWR only				
3.1.1-33	BWR only				
3.1.1-34	BWR only				
3.1.1-35	CRD nozzle	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry	No	Consistent with NUREG-1801. The combination of the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program, Water Chemistry Control Program and the Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program will manage cracking of the nickel-based CRDM nozzles and welds. The vessel vent line nozzle and elbow are also included in this grouping.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-36	Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting)	Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC	Inservice inspection; water chemistry	No	This grouping includes stainless steel and nickel-based alloy portions (including cladding) of the pressurizer, reactor vessel, reactor coolant pumps, and piping and valves for each unit. NUREG-1801 excludes CASS material from this grouping. However, the grouping includes NUREG-1801, Volume 2 item numbers specific to CASS valve bodies and pump casings. CNP includes CASS valve bodies, pump casings, and closure flanges in this group. The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will supplement the Water Chemistry Control Program for management of cracking (SSC/IGA) for those components in this grouping that are included in the inservice inspection program. In addition to the NUREG-1801 identified programs, the Alloy 600 Aging Management Program will manage PWSCC of nickel alloys, supplemented by the water chemistry control program, for the reactor vessel shell cladding and nozzle/safe end welds. (continued below)

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-36 (cont)	Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting)	Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC	Inservice Inspection; Water Chemistry	No	Similarly, the Water Chemistry Control Program and Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will be further supplemented by the Pressurizer Examinations Program for managing cracking of the pressurizer head and shell cladding. The Water Chemistry Control Program and the Pressurizer Examinations Program will manage cracking of the pressurizer nozzle cladding.
3.1.1-37	Reactor vessel internals CASS components	Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling	Thermal Aging and Neutron Irradiation Embrittlement	No	Consistent with NUREG-1801. The Reactor Vessel Internals Cast Austenitic Stainless Steel Program will manage the aging effects for the CASS portions of the internals. The Reactor Vessel Internals Cast Austenitic Stainless Steel Program will include provisions for CASS items consistent with the NUREG-1801 Thermal Aging and Neutron Irradiation Embrittlement Program.
3.1.1-38	External surfaces of carbon steel components in reactor coolant system pressure boundary	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801. The Boric Acid Corrosion Prevention Program will manage loss of material due to boric acid corrosion.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-39	Steam generator secondary manways and handholds (carbon steel)	Loss of material due to erosion	Inservice inspection	No	Not applicable. CNP has recirculating steam generators; therefore, this NUREG-1801 grouping, which addresses erosion concerns in once-through steam generators, is not applicable.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-40	Reactor internals, reactor vessel closure studs, and core support pads	Loss of material due to wear	Inservice inspection	No	Consistent with NUREG-1801. Wear of reactor internals components (clevis insert block, control rod guide tube pin, fuel assembly guide pin), the reactor vessel closure flanges, and the internal core support lugs (nickel alloy) will be managed by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program. Wear of other reactor internals components (upper core plate alignment pins, radial keys, and radial support clevis) will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program supplemented by the Inservice Inspection Program. Wear of BMI thimble tubes and bullet plugs is included in this grouping and will be managed by the Bottom-Mounted Instrumentation Thimble Tube Inspection Program. Reactor vessel closure stud aging effects / mechanisms are addressed in Items 3.1.1-22 and 3.1.1-47 of this Table.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-41	Pressurizer integral support	Crack initiation and growth due to cyclic loading	Inservice inspection	No	Consistent with NUREG-1801. CNP will credit the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for management of cracking due to flaw growth (e.g. cyclic loading) at the interface between the pressurizer shell and integral support flange for each unit. The pressurizer seismic lugs and valve support bracket lugs are also included in this grouping and will be managed by the Inservice Inspection Program.
3.1.1-42	Upper and lower internals assembly (Westinghouse)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring	No	Loss of preload of the reactor vessel internals will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program, supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for components within the scope of the Inservice Inspection Program. In the component-specific tables, loss of mechanical closure integrity is equivalent to loss of preload.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-43	Reactor vessel internals in fuel zone region (except Westinghouse and B&W baffle former bolts)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	PWR vessel internals; water chemistry	No	For Westinghouse design reactor vessel internals, NUREG-1801 recommends only the PWR Vessel Internals Program for management of this aging effect. Loss of fracture toughness of the reactor vessel internals will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program.
3.1.1-44	Steam generator upper and lower heads, tubesheets, and primary nozzles and safe ends	Crack initiation and growth due to SCC, PWSCC, and/or IASCC	Inservice inspection; water chemistry	No	The Water Chemistry Control Program will manage cracking due to SCC. In the primary water environment, the Alloy 600 Aging Management Program, supplemented by the Water Chemistry Control Program, will manage PWSCC of nickel alloys. The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will also supplement the Water Chemistry Control Program for components in this group. Tubesheets are not listed in NUREG-1801, Volume 2.
3.1.1-45	Vessel internals (except Westinghouse and B&W baffle former bolts)	Crack initiation and growth due to SCC and IASCC	PWR vessel internals; water chemistry	No	Consistent with NUREG-1801. Crack initiation and growth in the reactor vessel internals will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program and the Water Chemistry Control Program, supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-46	Reactor internals (B&W screws and bolts)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	No	Not applicable. CNP utilizes Westinghouse design reactor vessel internals.
3.1.1-47	Reactor vessel closure studs and stud assembly	Loss of material due to wear	Reactor head closure studs	No	The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will manage loss of material due to wear of the reactor vessel closure bolting.
3.1.1-48	Reactor internals (Westinghouse upper and lower internal assemblies, CE bolts and tie rods)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	No	Loss of preload of the reactor vessel internals will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program.

Table 3.1.2-1
Reactor Vessel and CRDM Pressure Boundary
Summary of Aging Management Evaluation

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bottom head Shell – nozzle course Upper head Inlet nozzles Outlet nozzles	Pressure boundary	Low alloy steel clad with stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-c	3.1.1-36	C
					TLAA - underclad cracking (nozzles only)	IV.A2.5-b	3.1.1-10	C
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.A2.1-a IV.A2.5-e	3.1.1-38	A

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Shell rings	Pressure boundary	Low alloy steel clad with stainless steel and nickel based alloy	Treated (borated) water	Cracking	Water Chemistry Control Alloy 600 Aging Management Inservice Inspection	IV.C2.5-c	3.1.1-36	C, 1, 8
				Loss of material	Water Chemistry Control			H
				Reduction in fracture toughness (beltline only)	Reactor Vessel Integrity	IV.A2.5-c	3.1.1-5	A, 2
					TLAA - RV neutron embrittlement	IV.A2.5-a	3.1.1-4	A
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.A2.5-e	3.1.1-38	A
Weld buildup support pads (external attachment)	Component support	Low alloy steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.A2.8-b	3.1.1-38	A
				Cracking	Inservice Inspection			H

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Inlet nozzle safe ends Outlet nozzle safe ends	Pressure boundary	Stainless steel (Unit 1 nickel based alloy welds)	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Inservice Inspection Alloy 600 Aging Management (Unit 1 Welds Only) Water Chemistry Control	IV.A2.4-b	3.1.1-36	A, 1, 8
Vessel flange Closure head flange	Pressure boundary RV internals support	Low alloy steel clad with stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Loss of material	Inservice Inspection	IV.A2.5-f	3.1.1-40	A
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-c	3.1.1-36	C
					TLAA - underclad cracking	IV.A2.5-b	3.1.1-10	C
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.A2.5-e IV.A2.1-a	3.1.1-38 3.1.1-38	A A

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Closure studs Closure nuts Washers	Pressure boundary	Low alloy steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.A2.1-a	3.1.1-38	A
				Loss of material	Inservice Inspection	IV.A2.1-d	3.1.1-47	E
				Cracking	Inservice Inspection	IV.A2.1-c	3.1.1-22	E
				Loss of mechanical closure integrity	Inservice Inspection Boric Acid Corrosion Prevention			H

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
CRDM nozzles	Pressure boundary	Nickel-based alloy	Treated (borated) water	Cracking	Inservice Inspection Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Water Chemistry Control	IV.A2.2-a	3.1.1-35	A, 12
				Loss of material	Water Chemistry Control			H
CRDM housing adapter	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.A2.2-b	3.1.1-36	A

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
In-core instrumentation nozzles	Pressure boundary	Nickel based alloy	Treated (borated) water	Cracking	Inservice Inspection Alloy 600 Aging Management Water Chemistry Control	IV.A2.7-a	3.1.1-12	A
				Loss of material	Water Chemistry Control			H
In-core instrumentation nozzle safe ends	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.A2.4-b	3.1.1-36	C
BMI thimble guide tubes	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.A2.4-b	3.1.1-36	C

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
BMI thimble tubes and bullet plugs	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Loss of material	Bottom-Mounted Instrumentation Thimble Tube Inspection	IV.B2.6-c	3.1.1-40	A
				Cracking	Water Chemistry Control Inservice Inspection	IV.A2.4-b	3.1.1-36	C
Thimble seal table	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.A2.4-b	3.1.1-36	C

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Core support lugs	RV internals support	Nickel-based alloy	Treated (borated) water	Cracking	Inservice Inspection Alloy 600 Aging Management Water Chemistry Control	IV.A2.6-a	3.1.1-12	A
				Loss of material	Water Chemistry Control			H
				Loss of material	Inservice Inspection	IV.B2.1-l	3.1.1-40	C
Vent line (nozzle and elbow)	Pressure boundary	Nickel based alloy	Treated (borated) water	Cracking	Inservice Inspection Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Water Chemistry Control	IV.A2.7-b	3.1.1-35	A, 12
				Loss of material	Water Chemistry Control			H

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Vent line safe end	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.A2.4-b	3.1.1-36	C
CRDM housing Core exit thermocouple nozzle assembly, holddown nut, compression collar and lockwasher	Pressure boundary	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection	IV.A2.2-b	3.1.1-36	A
				Loss of material	Water Chemistry Control			H
CRDM housing cap	Pressure boundary	Stainless Steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection	IV.A2.2-b	3.1.1-36	A
				Loss of material	Water Chemistry Control			H

Table 3.1.2-1:Reactor Vessel and CRDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Lifting lugs	None, included for complete-ness	Low alloy steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.A2.8-b	3.1.1-38	C
Ventilation shroud support ring	Component support	Carbon steel	External-ambient	Cracking	Inservice Inspection			14
				Loss of material	Boric Acid Corrosion Prevention	IV.A2.8-b	3.1.1-38	C
Flange leak tubes	Pressure boundary	Unit 1: nickel-based alloy Unit 2: stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Alloy 600 Aging Management (Unit 1 Only)	IV.A2.7-a (Unit 1) IV.A2.1-f (Unit 2)	3.1.1-12 3.1.1-12	A A
				Loss of material	Water Chemistry Control			H

Table 3.1.2-2
Reactor Vessel Internals (Westinghouse)
Summary of Aging Management Evaluation

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Lower Core Support Structure								
Core barrel (barrel, flange, outlet nozzle, and fasteners)	Core support Flow distribution Shielding	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.3-a	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.3-b	3.1.1-11	A
				Loss of mechanical closure integrity (bolted fasteners)	Reactor Vessel Internals Inservice Inspection	IV.B2.1-k	3.1.1-48	E

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core barrel (barrel, flange, outlet nozzle, and fasteners) (continued)	Core support Flow distribution Shielding	Stainless steel	Treated (borated) water	Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.3-c	3.1.1-43	A
Core former plates Core baffle plates	Core support Flow distribution Shielding	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.4-a	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.4-b	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.4-e	3.1.1-43	A

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Core baffle bolts Core former bolts	Core support	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.4-c	3.1.1-15	A
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.4-d	3.1.1-11	A
				Loss of mechanical closure integrity	Reactor Vessel Internals Inservice Inspection	IV.B2.4-h	3.1.1-16	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.4-f	3.1.1-6	A

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Lower core plate Lower support columns	Core support Flow distribution	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.5-a IV.B2.5-k	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.5-b IV.B2.5-l	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-c IV.B2.5-n	3.1.1-43	A
Diffuser plate	Flow distribution	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.5-a	3.1.1-45	C, 11

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Diffuser plate (continued)	Flow distribution	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Distortion	Reactor Vessel Internals	IV.B2.5-b	3.1.1-11	C
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-c	3.1.1-43	C
Lower support plate Lower core plate support column cap	Core support Flow distribution	CASS	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals (CASS)	IV.B2.5-k	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Lower support plate Lower core plate support column cap (continued)	Core support Flow distribution	CASS	Treated (borated) water	Distortion	Reactor Vessel Internals (CASS)	IV.B2.5-l	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals (CASS)	IV.B2.5-m	3.1.1-37	A
Secondary core support assembly (energy absorbers)	Secondary core support	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.5-a	3.1.1-45	C, 11
				Loss of material	Water Chemistry Control			14
				Distortion	Reactor Vessel Internals	IV.B2.5-b	3.1.1-11	C
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-c	3.1.1-43	C

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Clevis insert block and fasteners	Core support	Nickel-based alloy	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.5-e	3.1.1-45	A, 11
				Loss of material (insert block only)	Inservice Inspection	IV.B2.1-l	3.1.1-40	C
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.5-f	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-g	3.1.1-43	A
				Loss of mechanical closure integrity (bolted fasteners)	Reactor Vessel Internals Inservice Inspection	IV.B2.5-i	3.1.1-42	E

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermal shield	Shielding	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.3-a	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.3-b	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.3-c	3.1.1-43	A

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Upper Core Support Structure								
Upper support plate (Unit 1) Deep beam sections Upper support columns (mixing device and orifice base are CASS - see next item) Support column bolts (upper and lower)	Core support Control rod support Flow distribution Incore support	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.1-a IV.B2.1-e IV.B2.1-i IV.B2.5-e IV.B2.5-k	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.1-b IV.B2.1-f IV.B2.1-j IV.B2.5-f	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-g	3.1.1-43	C
				Loss of mechanical closure integrity (bolted fasteners)	Reactor Vessel Internals Inservice Inspection	IV.B2.5-h IV.B2.1-k	3.1.1-48	E

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Upper core support column mixing device Upper core support column orifice base Upper support plate (Unit 2 only)	Core support (All) Flow distribution (All) Control rod support (Unit 2 upper support plate only) Incore support (Unit 2 upper support plate only	CASS	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals (CASS)	IV.B2.1-e	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals (CASS)	IV.B2.1-f	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals (CASS)	IV.B2.1-g	3.1.1-37	A

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Upper core plate Upper core plate alignment pins Lower support plate radial keys	Core support Control rod support Flow distribution Incore support	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.1-a IV.B2.1-i IV.B2.5-a	3.1.1-45	A, 11
				Loss of material (alignment pins and radial keys only)	Inservice Inspection Reactor Vessel Internals	IV.B2.1-l IV.B2.5-o	3.1.1-40	A, 6
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.1-b IV.B2.1-j IV.B2.5-b	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-g	3.1.1-43	C

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Holddown spring	Core support	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.1-a	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.1-b	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-c	3.1.1-43	C
				Loss of preload	Reactor Vessel Internals	IV.B2.1-d	3.1.1-42	E

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Control rod guide tube pin Fuel assembly guide pin	Core support Control rod support	Nickel-based alloy	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.1-i IV.B2.2-d IV.B2.5-e	3.1.1-45	A, 11
				Loss of material	Inservice Inspection	IV.B2.1-l	3.1.1-40	C
					Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.1-j IV.B2.2-e IV.B2.5-f	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-g	3.1.1-43	C

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Guide tube assemblies	Control rod support Flow distribution	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.2-a	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.2-b	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-c	3.1.1-43	C

Table 3.1.2-2:Reactor Vessel Internals (Westinghouse) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
In-Core Instrumentation Support Structure								
Upper system (thermo-couples) Lower system (flux thimbles)	Incore support	Stainless steel	Treated (borated) water	Cracking	Water Chemistry Control Inservice Inspection Reactor Vessel Internals	IV.B2.6-a	3.1.1-45	A, 11
				Loss of material	Water Chemistry Control			H
				Distortion	Reactor Vessel Internals	IV.B2.6-b	3.1.1-11	A
				Reduction in fracture toughness	Reactor Vessel Internals	IV.B2.5-c	3.1.1-43	C

Table 3.1.2-3
Class 1 Piping, Valves, and Reactor Coolant Pumps
Summary of Aging Management Evaluation

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping								
Hot leg pipe and fittings Cold leg pipe and fittings Crossover leg pipe and fittings	Pressure boundary	CASS	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.1-e	3.1.1-13	A, 3
					TLAA - Leak-Before-Break			H
				Reduction in fracture toughness	Inservice Inspection Cast Austenitic Stainless Steel Evaluation	IV.C2.1-f	3.1.1-24	A, 7

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pressurizer surge line	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.1-c	3.1.1-36	A
					TLAA - Leak-Before-Break			H
Pipe and fittings (including blind flanges) NPS ≥ 4”	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.2-f	3.1.1-36	A

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pipe and fittings (including blind flanges) NPS < 4”	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Small Bore Piping Inservice Inspection	IV.C2.1-g IV.C2.2-h	3.1.1-7	A
Branch nozzles NPS ≥ 4”	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.1-c IV.C2.2-f	3.1.1-36	A

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Branch nozzles NPS < 4” (Includes sample and spray scoops, thermowells, and immersion RTDs) Note: Connections 2” and smaller may be socket welded.	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Small Bore Piping Inservice Inspection	IV.C2.1-g IV.C2.2-h	3.1.1-7	A
Thermal sleeves	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.2-f	3.1.1-36	A

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Orifices	Throttling Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.2-f	3.1.1-36	C
Class 1 Valves								
Class 1 valve bodies and bonnets ≥ 2½”	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.1-c	3.1.1-36	C

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 valve bodies and bonnets ≥ 2½" (continued)	Pressure boundary	CASS	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.4-b	3.1.1-36	A, 3
				Reduction in fracture toughness	Inservice Inspection	IV.C2.4-c	3.1.1-23	A
		Low alloy steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.1-d	3.1.1-38	C
Class 1 valve bodies and/or bonnets ≤ 2"	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.1-c	3.1.1-36	C

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Class 1 valve bodies and/or bonnets ≤ 2" (continued)	Pressure boundary	CASS	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.4-b	3.1.1-36	A, 3
				Reduction in fracture toughness	Inservice Inspection	IV.C2.4-c	3.1.1-23	A
Bolting material (for valves and blind flanges)	Pressure boundary	Low alloy and stainless steel	External-ambient	Cracking	Inservice Inspection	IV.C2.4-e	3.1.1-26	E
				Loss of mechanical closure integrity	Inservice Inspection Bolting and Torquing Activities Boric Acid Corrosion Prevention	IV.C2.4-g	3.1.1-26	E

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting material (for valves and blind flanges) (continued)	Pressure boundary	Low alloy and stainless steel	External-ambient	Loss of material (for alloy steel only)	Boric Acid Corrosion Prevention	IV.C2.4-f	3.1.1-38	A
Reactor Coolant Pumps								
Casing	Pressure boundary	CASS	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.3-b	3.1.1-36	A, 3, 4
					TLAA - Code Case N-481 Evaluation			H

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Main closure flange	Pressure boundary	CASS	Treated (borated) water	Loss of material	Water Chemistry Control Inservice Inspection			14
				Reduction of fracture toughness	Inservice Inspection	IV.C2.3-c	3.1.1-23	C
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.3-b	3.1.1-36	C, 3
Main flange bolts	Pressure boundary	Low alloy steel	External-ambient	Cracking	Inservice Inspection	IV.C2.3-e	3.1.1-26	E
				Loss of material	Boric Acid Corrosion Prevention	IV.C2.3-f	3.1.1-38	A
				Loss of mechanical closure integrity	Inservice Inspection Bolting and Torquing Activities Boric Acid Corrosion Prevention	IV.C2.3-g	3.1.1-26	E

Table 3.1.2-3:Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermal barrier heat exchanger	Pressure boundary	Stainless steel	Treated water	Loss of material	Water Chemistry Control			14
				Fouling	Water Chemistry Control			14
			Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.2-f	3.1.1-36	C

Table 3.1.2-4
Pressurizer
Summary of Aging Management Evaluation

Table 3.1.2-4: Pressurizer								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Lower head Shell Upper head	Pressure boundary	Low alloy steel clad with stainless steel	Treated (borated) water	Loss of material (cladding)	Water Chemistry Control			H
				Cracking	Water Chemistry Control Pressurizer Examinations Inservice Inspection	IV.C2.5-c	3.1.1-36	A, 13
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-b	3.1.1-38	A

Table 3.1.2-4: Pressurizer (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Surge nozzle Spray nozzle Relief nozzle Safety nozzle	Pressure boundary Pressure control (spray nozzle only)	Low alloy steel clad with stainless steel Nickel-based alloy (weld buttering)	Treated (borated) water	Loss of material (cladding)	Water Chemistry Control			H
				Cracking (cladding)	Water Chemistry Control Pressurizer Examinations	IV.C2.5-g	3.1.1-36	E
				Cracking (PWSCC of nickel-based alloy welds)	Alloy 600 Aging Management Inservice Inspection Water Chemistry Control	IV.C2.5-k	3.1.1-14	C, 1
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-b	3.1.1-38	A

Table 3.1.2-4: Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Surge nozzle safe end Spray nozzle safe end Relief nozzle safe end Safety nozzle safe end	Pressure boundary Pressure control (spray nozzle safe end only)	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-h	3.1.1-36	A
Surge and spray nozzle thermal sleeve	Pressure boundary Pressure control (spray nozzle thermal sleeve only)	Stainless steel (nickel-based alloy weld called out in WCAP-14574-A)	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control	IV.C2.5-h	3.1.1-36	E
				Cracking (PWSCC of nickel-based alloy weld)	Water Chemistry Control Alloy 600 Aging Management	IV.C2.5-k	3.1.1-14	E, 1

Table 3.1.2-4: Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heater well nozzles and coupling	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-r	3.1.1-36	C
Immersion heater sheaths	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-r	3.1.1-36	A
Heater support plates Heater support plate brackets Heater support plate bracket bolts	Pressure control	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control	IV.C2.5-r	3.1.1-36	E

Table 3.1.2-4: Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Spray head	Pressure control	CASS	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Pressurizer Examinations	IV.C2.5-j	3.1.1-12	A
				Reduction in fracture toughness	Pressurizer Examinations	IV.C2.5-l	3.1.1-24	E
Spray head locking bar Spray head coupling	Pressure control	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Pressurizer Examinations	IV.C2.5-j	3.1.1-12	C
Support skirt and flange	Component support	Carbon steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-u	3.1.1-38	A
				Cracking	Inservice Inspection	IV.C2.5-v	3.1.1-41	A

Table 3.1.2-4: Pressurizer (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Seismic lugs	Component support	Low alloy steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-o	3.1.1-38	C
				Cracking	Inservice Inspection	IV.C2.5-v	3.1.1-41	C
Valve support bracket lugs	Component support	Carbon steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-u	3.1.1-38	C
				Cracking	Inservice Inspection	IV.C2.5-v	3.1.1-41	C
Instrument nozzles and couplings	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-g	3.1.1-36	A
Manway insert	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-r	3.1.1-36	C

Table 3.1.2-4: Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manway forging	Pressure boundary	Low alloy steel clad with stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.C2.5-m	3.1.1-36	A
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-o	3.1.1-38	A
Manway cover	Pressure boundary	Low alloy steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-o	3.1.1-38	A

Table 3.1.2-4: Pressurizer (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Manway cover bolts/studs	Pressure boundary	Low alloy steel	External-ambient	Cracking	Inservice Inspection	IV.C2.5-n	3.1.1-26	E
				Loss of material	Boric Acid Corrosion Prevention	IV.C2.5-o	3.1.1-38	A
				Loss of mechanical closure integrity	Bolting and Torquing Activities Inservice Inspection Boric Acid Corrosion Prevention	IV.C2.5-p	3.1.1-26	E

Table 3.1.2-5
Steam Generators
Summary of Aging Management Evaluation

Table 3.1.2-5:Steam Generators								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Primary Side								
Primary head	Pressure boundary	Low alloy steel clad with stainless steel	Treated (borated) water	Loss of material (cladding)	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.D1.1-i	3.1.1-44	C
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	A

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Primary nozzles	Pressure boundary	Low alloy steel clad with stainless steel	Treated (borated) water	Loss of material (cladding)	Water Chemistry Control			H
				Cracking	Water Chemistry Control Alloy 600 Aging Management Inservice Inspection	IV.D1.1-i	3.1.1-44	A, 1, 8
			External-Ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	A
Primary nozzle safe ends	Pressure boundary	Stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Cracking	Water Chemistry Control Inservice Inspection	IV.D1.1-i	3.1.1-44	A

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Partition plates Nozzle dam retention rings	Pressure boundary	Nickel-based alloy	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Alloy 600 Aging Management Inservice Inspection	IV.D1.1-j	3.1.1-44	C
Primary manway insert plate	Pressure boundary	Unit 1: Nickel-based alloy Unit 2: stainless steel	Treated (borated) water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Alloy 600 Aging Management (Unit 1)	IV.D1.1-j	3.1.1-44	C
Primary manway cover	Pressure boundary	Low alloy steel	External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-k	3.1.1-38	A

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Primary manway closure bolting	Pressure boundary	Low alloy steel	External-ambient	Cracking	Inservice Inspection	IV.D1.1-l	3.1.1-26	E
				Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-k	3.1.1-38	A
				Loss of mechanical closure integrity	Bolting and Torquing Activities Inservice Inspection Boric Acid Corrosion Prevention	IV.D1.1-f	3.1.1-26	E
Tubes/plugs	Pressure boundary Heat transfer	Nickel-based alloy	Treated (borated) water	Loss of material	Water Chemistry Control			H
				Fouling	Water Chemistry Control Steam Generator Integrity			H

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubes/plugs (continued)	Pressure boundary Heat transfer	Nickel-based alloy	Treated (borated) water	Cracking	Water Chemistry Control Steam Generator Integrity	IV.D1.2-a, IV.D1.2-j	3.1.1-18	A
			Treated water	Loss of material	Water Chemistry Control Steam Generator Integrity	IV.D1.2-e IV.D1.2-f	3.1.1-18	A
					TLAA - Flow Induced Vibration			H
				Fouling	Water Chemistry Control Steam Generator Integrity			H
				Cracking	Water Chemistry Control Steam Generator Integrity	IV.D1.2-b IV.D1.2-c	3.1.1-18	A

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubesheet	Pressure boundary	Low alloy steel clad with nickel-based alloy	Treated (borated) water	Loss of material (cladding)	Water Chemistry Control			14
				Cracking	Water Chemistry Control Alloy 600 Aging Management Inservice Inspection	IV.D1.1-i	3.1.1-44	C, 8
			Treated water	Loss of material	Water Chemistry Control	IV.D1.1-c	3.1.1-2	E
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Secondary side externals								
Lower shell Upper shell Transition cone Steam drum Elliptical upper head	Pressure boundary	Low alloy steel	Treated water	Loss of material	Water Chemistry Control Inservice Inspection	IV.D1.1-c	3.1.1-2	A
				Cracking	Inservice Inspection			H
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C
Feedwater nozzles	Pressure boundary	Low alloy steel	Treated water	Loss of material	Water Chemistry Control	IV.D1.1-c	3.1.1-2	E
				Cracking	Inservice Inspection			H
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Feedwater nozzle thermal sleeve (Unit 1 only)	Pressure boundary	Nickel-based alloy	Treated water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection			H
Main steam nozzles	Pressure boundary	Low alloy steel	Treated water	Loss of material	Water Chemistry Control Flow-Accelerated Corrosion	IV.D1.1-d	3.1.1-25	A, 9
				Cracking	Inservice Inspection			H
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Feedwater safe ends (Unit 1 only)	Pressure boundary	Nickel-based alloy	Treated water	Loss of material	Water Chemistry Control			F
				Cracking	Water Chemistry Control Inservice Inspection			F
Secondary blowdown and instrumentation connections Recirculation connections (Unit 1 only) Secondary shell drain connections (Unit 2 only)	Pressure boundary	Low alloy steel	Treated water	Loss of material	Water Chemistry Control	IV.D1.1-c	3.1.1-2	E
				Cracking	Inservice Inspection			14
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Secondary handhole ports Inspection ports	Pressure boundary	Low alloy steel	Treated water	Loss of material	Water Chemistry Control Inservice Inspection	IV.D1.1-c	3.1.1-2	C
				Cracking	Inservice Inspection			14
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C
Secondary handhole port covers Inspection port covers Recirculation port covers (Unit 1 only)	Pressure boundary	Low alloy steel	Treated water	Loss of material	Water Chemistry Control	IV.D1.1-c	3.1.1-2	E
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Secondary manways	Pressure boundary	Carbon steel	Treated water	Loss of material	Water Chemistry Control Inservice Inspection	IV.D1.1-c	3.1.1-2	C
				Cracking	Inservice Inspection			14
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C
Secondary manway covers	Pressure boundary	Carbon steel	Treated water	Loss of material	Water Chemistry Control Inservice Inspection	IV.D1.1-c	3.1.1-2	C
			External-ambient	Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-g	3.1.1-38	C

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Secondary manway, handhole, recirculation (Unit 1 only), and inspection port closure bolting	Pressure boundary	Carbon steel	External-ambient	Cracking	Inservice Inspection			H
				Loss of material	Boric Acid Corrosion Prevention	IV.D1.1-k	3.1.1-38	A
				Loss of mechanical closure integrity	Bolting and Torquing Activities Inservice Inspection Boric Acid Corrosion Prevention	IV.D1.1-f	3.1.1-26	E
Steam flow restrictors (Unit 1 only)	Throttling	Stainless steel	Treated water	Loss of material	Water Chemistry Control			14
				Cracking	Water Chemistry Control Inservice Inspection			14

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Feedwater elbow thermal liners (Unit 2 only) Feedwater liner piston rings (Unit 2 only)	Pressure boundary	Liners: carbon steel Rings: Nickel-based alloy	Treated water	Loss of material	Flow-Accelerated Corrosion Water Chemistry Control (elbow thermal liners only)	IV.D1.1-d	3.1.1-25	C, 9
					Water Chemistry Control (piston rings only)			14
				Cracking	Inservice Inspection Water Chemistry Control (piston rings only)			14

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Secondary side internals								
Tube wrappers (shroud)	Pressure boundary Note These components perform the intended function of providing structural and/ or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Carbon steel	Treated water	Loss of material	Water Chemistry Control Steam Generator Integrity	IV.D1.1-c	3.1.1-2	E
				Cracking	Water Chemistry Control Steam Generator Integrity			14

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tube support plates Anti-vibration bar (AVB) (Unit 2 only)	Pressure boundary Note These components perform the intended function of providing structural and/ or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Stainless steel	Treated water	Loss of material	Water Chemistry Control Steam Generator Integrity			F
				Cracking	Water Chemistry Control Steam Generator Integrity			F

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tube support plate stayrods Tube support plate spacers (Unit 2 only)	Pressure boundary Note These components perform the intended function of providing structural and/or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Carbon steel	Treated water	Loss of material	Water Chemistry Control Steam Generator Integrity	IV.D1.1-c	3.1.1-2	E

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tube support plate stayrod nuts (Unit 2 only)	Pressure boundary Note These components perform the intended function of providing structural and/ or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Carbon steel	Treated water	Loss of material	Water Chemistry Control	IV.D1.1-c	3.1.1-2	E
				Cracking	Water Chemistry Control Steam Generator Integrity			14
				Loss of mechanical closure integrity	Steam Generator Integrity			14

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tube support plate stayrod washers AVB retaining rings (Unit 2 only)	Pressure boundary Note These components perform the intended function of providing structural and/ or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Nickel-based alloy	Treated water	Loss of material	Water Chemistry Control Steam Generator Integrity			14
				Cracking	Water Chemistry Control Steam Generator Integrity			14

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Lattice grid ring U-bend arch bars (Unit 1 only)	Pressure boundary Note These components perform the intended function of providing structural and/ or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Carbon steel	Treated water	Loss of material	Water Chemistry Control Steam Generator Integrity	IV.D1.1-c	3.1.1-2	E

Table 3.1.2-5:Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Lattice grid ring studs (Unit 1 only)	Pressure boundary Note These components perform the intended function of providing structural and/ or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Carbon steel	Treated water	Loss of material	Water Chemistry Control	IV.D1.1-c	3.1.1-2	E
				Cracking	Water Chemistry Control Steam Generator Integrity			14
				Loss of mechanical closure integrity	Steam Generator Integrity			14

Table 3.1.2-5:Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Lattice grid bars U-bend flat bars J-tabs (Unit 1 only)	Pressure boundary Note These components perform the intended function of providing structural and/ or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.	Stainless steel	Treated water	Loss of material	Water Chemistry Control Steam Generator Integrity			14
				Cracking	Water Chemistry Control Steam Generator Integrity			14

Notes for Tables 3.1.2-1 through 3.1.2-5

Generic notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes

1. Certain welds are fabricated of nickel-based weld material (Alloy 82/182, 52/152). PWSCC is a concern for these welds.
2. The reactor vessel beltline region definition does not need to be expanded for license renewal to include the nozzle belt region for either unit.

3. Material is identified as CASS (SA351 Grade CF-8 or CF-8M). The NUREG-1801 AMP discussion credits either primary water chemistry or material selection according to NUREG-0313, Rev. 2, guidelines for carbon and ferrite limits to manage SCC. CNP will credit the Water Chemistry Control Program for managing cracking due to SCC and IGA. The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program will supplement the Water Chemistry Control Program for management of cracking and flaw growth.
4. Evaluation of the reactor coolant pump casing determined that the casings are not susceptible to reduction in fracture toughness.
5. Not used.
6. The Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program will be supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for the management of loss of material due to wear of this component.
7. The Cast Austenitic Stainless Steel Evaluation Program will be supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for the management of reduction of fracture toughness of this component. The CASS Evaluation Program, as supplemented by portions of the Inservice Inspection Program, will meet the requirements of the GALL Thermal Aging Embrittlement of CASS Program.
8. The Water Chemistry Control and Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Programs will be supplemented by the Alloy 600 Aging Management Program for the management of cracking of this component. The Alloy 600 Aging Management Program will manage PWSCC of nickel-based alloys in the primary water environment.
9. The Flow-Accelerated Corrosion Program will be supplemented by the Water Chemistry Control Program for the management of loss of material of this component. CNP will explicitly credit both programs to meet the attributes of the recommended GALL Program.
10. These components perform the intended function of providing structural and/or functional support for in-scope equipment (namely, the steam generator tubes); and are therefore within the scope of license renewal requiring aging management review.
11. The Reactor Vessel Internals Plates, Forgings, Welds, and Bolting (or the Reactor Vessel Internals Cast Austenitic Stainless Steel) Program and the Water Chemistry Control Program will be supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for the management of cracking of this component. The combination of the

Reactor Vessel Internals Program and the Water Chemistry Control Program meet the requirements of the recommended GALL XI.M16 and XI.M2 Programs.

12. The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program and the Water Chemistry Control Program will be supplemented by the Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program for the management of cracking of this component. The combination of the CRDM and Other VHP Inspection Program and the Water Chemistry Control Program meet the requirements of the recommended GALL XI.M11 and XI.M2 Programs.

13. The Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD Program and the Water Chemistry Control Program will be supplemented by the Pressurizer Examinations Program for the management of cracking of this component. The combination of the Inservice Inspection Program and the Water Chemistry Control Program meet the requirements of the recommended GALL XI.M1 and XI.M2 Programs.

14. The component is not evaluated in NUREG-1801 and one or more attributes (material, environment, or aging effect) of reasonable substitute components are inconsistent; so Notes C, D, and E do not apply.

3.2 ENGINEERED SAFETY FEATURES

3.2.1 Introduction

This section provides the aging management review results for components in the engineered safety features (ESF) systems. The following systems are addressed below in Subsections 3.2.2.1.1 through 3.2.2.1.4:

- Containment spray system (Section 2.3.2.1)
- Containment isolation system (Section 2.3.2.2)
- Emergency core cooling system (Section 2.3.2.3)
- Containment equalization / hydrogen skimmer system (Section 2.3.2.4)

Table 3.2.1, Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the ESF component group. Hyperlinks to the program evaluations in Appendix B are provided in the CD-ROM version of this application.

3.2.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for systems in the ESF systems group:

- Table 3.2.2-1 Containment Spray System — Summary of Aging Management Evaluation
- Table 3.2.2-2 Containment Isolation System — Summary of Aging Management Evaluation
- Table 3.2.2-3 Emergency Core Cooling System — Summary of Aging Management Evaluation
- Table 3.2.2-4 Containment Equalization / Hydrogen Skimmer System — Summary of Aging Management Evaluation

3.2.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the ESF systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.2.2.1.1 Containment Spray System

Materials

Containment spray system components are constructed of the following materials:

- Carbon steel
- Stainless steel

Environment

Containment spray system components are exposed to the following environments:

- Air
- Concrete
- Nitrogen
- Raw water (fresh)
- Sodium hydroxide
- Treated water (borated)
- Treated water
- Untreated water with boron

The external air environment can also include leaking borated water.

Evaporation of the water in the spray header supplied by the residual heat removal pumps and the subsequent concentration of contaminants in the water is possible for the low points in the lower containment header, since operating history has determined that this portion of the header may be wetted. This environment is identified as untreated water with boron to reflect the potential for concentration of contaminants.

The refueling water storage tank is considered part of the containment spray system. The bottom of this tank is exposed to concrete.

Aging Effects Requiring Management

The following aging effects associated with the containment spray system require management:

- Cracking
- Fouling
- Loss of material
- Loss of material - wear
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the containment spray system components:

- Boric Acid Corrosion Prevention
- Heat Exchanger Monitoring
- Inservice Inspection – ASME Section XI, Augmented Inspections
- Service Water System Reliability
- System Walkdown
- Water Chemistry Control

3.2.2.1.2 Containment Isolation System

Materials

Containment isolation system components are constructed of the following materials:

- Carbon steel
- Stainless steel

Environment

Containment isolation system components are exposed to the following environments:

- Air
- Condensation
- Nitrogen
- Raw water (fresh)
- Treated water (borated)
- Treated water (borated) >270°F
- Treated water
- Untreated water with boron

The external air environment can also include leaking borated water.

Certain containment penetrations (for example, sample lines and drains) were conservatively evaluated for untreated water that may contain boron. This environment is identified as untreated water with boron.

Aging Effects Requiring Management

The following aging effects associated with the containment isolation system require management:

- Cracking
- Cracking - fatigue
- Loss of material
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the containment isolation system components:

- Bolting and Torquing Activities
- Boric Acid Corrosion Prevention
- Containment Leakage Rate Testing
- System Walkdown

- Wall Thinning Monitoring
- Water Chemistry Control

3.2.2.1.3 Emergency Core Cooling System

Materials

Emergency core cooling system components are constructed of the following materials:

- Brass
- Carbon steel
- Carbon steel with stainless steel cladding
- Cast iron
- Copper alloy
- Glass
- Stainless steel

Environment

Emergency core cooling system components are exposed to the following environments:

- Air
- Concrete
- Lube oil
- Nitrogen
- Treated water (borated)
- Treated water (borated) >270°F
- Treated water

The external air environment can also include leaking borated water.

Aging Effects Requiring Management

The following aging effects associated with the emergency core cooling system require management:

- Cracking
- Cracking - fatigue
- Fouling
- Loss of material
- Loss of material - erosion
- Loss of material - wear
- Loss of mechanical closure integrity

Cladding cracking from casing stress concentrations was identified as a component-specific aging effect for charging pump casings in NRC Information Notice 80-38. The charging pump casings are carbon steel clad internally with stainless steel. This cracking is an aging effect requiring management for the charging pump casings.

Aging Management Programs

The following aging management programs will manage the aging effects for the emergency core cooling system components:

- Boric Acid Corrosion Prevention
- Heat Exchanger Monitoring
- Oil Analysis
- Preventive Maintenance
- System Testing
- System Walkdown
- Water Chemistry Control

3.2.2.1.4 Containment Equalization / Hydrogen Skimmer System

Materials

Containment equalization / hydrogen skimmer system components are constructed of the following materials:

- Carbon steel
- Copper alloy
- Stainless steel

Environment

Containment equalization / hydrogen skimmer system components are exposed to the following environments:

- Air
- Treated water

The external air environment can also include leaking borated water.

Aging Effects Requiring Management

The following aging effects associated with the containment equalization / hydrogen skimmer system require management:

- Fouling
- Loss of material
- Loss of material - erosion
- Loss of material - wear
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the containment equalization / hydrogen skimmer system components:

- Boric Acid Corrosion Prevention
- Heat Exchanger Monitoring

- System Walkdown
- Water Chemistry Control

3.2.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation by the NRC reviewer is necessary for certain aging effects, particularly those that require plant-specific programs or that involve TLAAs. Section 3.2.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain I&M's approach to addressing the areas requiring further evaluation. Programs are described in Appendix B of this application.

3.2.2.2.1 Cumulative Fatigue Damage

The NUREG-1801, Volume 2, Chapter V, Table D1 line items for fatigue list an environment of borated water at temperature less than 93°C (200°F). I&M's aging management reviews do not consider cumulative fatigue damage a concern for stainless steel unless the system temperature exceeds 270°F. Where identified as an aging effect requiring management by the CNP review, the analysis of fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed in Section 4.3 of this application.

3.2.2.2.2 Loss of Material due to General Corrosion

1) Paragraph 1 of this section of NUREG-1800 is applicable to BWRs only.

2) With respect to paragraph 2 of this section of NUREG-1800, loss of material due to general corrosion of carbon steel in air will be managed by the System Walkdown Program for the affected plant components.

3.2.2.2.3 Local Loss of Material due to Pitting and Crevice Corrosion

1) Paragraph 1 of this section of NUREG-1800 is applicable to BWRs only.

2) With respect to paragraph 2 of this section of NUREG-1800, for the components relevant to this discussion, the Water Chemistry Control, Wall Thinning Monitoring, and Containment Leakage Rate Testing Programs will manage the "local loss of material from pitting and crevice corrosion" aging effect for the affected plant components.

3.2.2.2.4 Local Loss of Material due to Microbiologically Influenced Corrosion

For containment isolation system piping and valves, the Containment Leakage Rate Testing, Wall Thinning Monitoring, and Water Chemistry Control Programs will manage the "local loss of material due to microbiologically induced corrosion" aging effect.

3.2.2.2.5 Changes in Properties due to Elastomer Degradation

The discussion in this paragraph of NUREG-1800 applies only to degradation of seals associated with the standby gas treatment system, which is applicable to BWRs only.

3.2.2.2.6 Local Loss of Material due to Erosion

The discussion in NUREG-1800 pertains to an aging mechanism/effect that could occur to the high pressure safety injection pump miniflow orifice at some plants. This specific issue is applicable to CNP's charging pumps that are used for RCS makeup. The System Testing Program will manage this aging effect for the charging pump miniflow recirculation line flow orifice. This aging effect is not applicable to the safety injection pumps, which are not normally used for charging.

3.2.2.2.7 Buildup of Deposits due to Corrosion

The discussion in this NUREG-1800 section is applicable to BWRs only.

3.2.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The CNP Corrective Action Program applies to both safety-related and nonsafety-related structures and components. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing CNP Document Control Program in accordance with the Quality Assurance Program Description (QAPD). See Section B.0.3 of this application for further discussion.

3.2.2.3 Time-Limited Aging Analysis

The only TLAA identified for the ESF mechanical systems components is metal fatigue. This is evaluated in Section 4.3.

3.2.3 Conclusion

The ESF piping, fittings, and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). The aging management programs selected to manage aging effects for the ESF components are identified in the following tables and Section 3.2.2.1. A description of these aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the ESF components will be adequately managed, so there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.2.1
Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-1	Piping, fittings, and valves in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800, Subsection 3.2.2.2.1)	The system temperatures assumed in the line items in NUREG-1801, Volume 2, Chapter V that refer to this item are inconsistent with the temperature threshold for cumulative fatigue damage used in the aging management reviews. See Section 3.2.2.2.1 of this application for further discussion. This line item is not referenced in Tables 3.2.2-1 through 3.2.2-4.
3.2.1-2	BWR only				

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-3	Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to general corrosion	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.2.2.2.2.2)	Consistent with NUREG-1801 for containment isolation. The System Walkdown Program, as described in Appendix B of this application, will manage this aging effect. NUREG-1801 line items for containment spray and ECCS are not applicable as the associated components in these systems at CNP are not carbon steel.
3.2.1-4	BWR only				
3.2.1-5	Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to pitting and crevice corrosion	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.2.2.2.3.2)	Consistent with NUREG-1801. Water Chemistry Control, Wall Thinning Monitoring, and Containment Leakage Rate Testing Programs, as described in Appendix B of this application, will manage this aging effect.

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-6	Containment isolation valves and associated piping	Loss of material due to microbiologically influenced corrosion (MIC)	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.2.2.2.4)	Consistent with NUREG-1801. Water Chemistry Control, Wall Thinning Monitoring, and Containment Leakage Rate Testing Programs, as described in Appendix B of this application, will manage this aging effect.
3.2.1-7	BWR only				
3.2.1-8	High pressure safety injection (charging) pump miniflow orifice	Loss of material due to erosion	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.2.2.2.6)	Consistent with NUREG-1801 for charging pump miniflow orifice. Safety injection pumps are not normally used for charging. The System Testing Program, as described in Appendix B of this application, will manage the aging effect.
3.2.1-9	BWR only				
3.2.1-10 (NUREG-1801 only)	External surface of carbon steel components	Loss of material due to general corrosion	Plant specific	Yes, plant specific	Consistent with NUREG-1801. The System Walkdown Program, described in Appendix B of this application, will manage this aging effect.
3.2.1-11	Piping and fittings of CASS in emergency core cooling systems	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	No	Not applicable, as CASS is not used in these systems at CNP.

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-12	Components serviced by open-cycle cooling system	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	No	Consistent with NUREG-1801. The Service Water System Reliability Program is comparable to the NUREG-1801 Open-Cycle Cooling Water System Program. As described in Appendix B of this application and as supplemented by the Heat Exchanger Monitoring Program, this program will manage loss of material and fouling. Although biofouling is not in itself an aging effect, these programs will manage effects which may result from biofouling.
3.2.1-13	Components serviced by closed-cycle cooling system	Loss of material due to general, pitting, and crevice corrosion	Closed-cycle cooling water system	No	Consistent with NUREG-1801. The closed-cycle cooling system subsection of the Water Chemistry Control Program is comparable to the NUREG-1801 closed-cycle cooling water system program. The Water Chemistry Control Program, as described in Appendix B of this application and as supplemented by the Heat Exchanger Monitoring Program, will manage loss of material for the system.
3.2.1-14	BWR only				

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-15	Pumps, valves, piping, and fittings, and tanks in containment spray and emergency core cooling system	Crack initiation and growth due to SCC	Water chemistry	No	The line items in NUREG-1801 Volume 2 that refer to this row number specify a temperature less than 93°C (200°F). The aging management reviews for CNP consider a threshold of 140°F for SCC. Environments for these systems are either less than 140°F (such that cracking is not an aging effect requiring management) or greater than 270°F (which is outside the range of the NUREG-1801 listed environment). Therefore, Tables 3.2.2-1 through 3.2.2-4 of this section do not have any references to this item number (i.e., Table 1 Item 3.2.1-15). The Water Chemistry Control Program, as described in Appendix B of this application, will manage SCC for stainless steel in borated water at temperatures above the 140°F threshold for SCC.
3.2.1-16	BWR only				
3.2.1-17	Carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801. The Boric Acid Corrosion Prevention Program, as described in Appendix B of this application, will manage the aging effect.

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-18	Closure bolting in high–pressure or high-temperature systems	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	No	This item is not referenced in Tables 3.2.2-1 through 3.2.2-4, since it was not considered to match the CNP AMR results. For these components, the aging effect identified by the CNP AMR is loss of mechanical closure integrity, which is the result of a broader range of aging mechanisms than those identified in this line item. The Bolting and Torquing Activities, Boric Acid Corrosion Prevention, and System Walkdown Programs, as described in Appendix B of this application, will manage loss of mechanical closure integrity.

Table 3.2.2-1
Containment Spray System
Summary of Aging Management Evaluation

Table 3.2.2-1 Containment Spray System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.A.1-b V.A.3-b V.A.4-b V.A.5-b V.A.6-d V.D1.3-a V.D1.8-b	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
				Loss of mechanical closure integrity	Boric Acid Corrosion Prevention			H
					System Walkdown			H
		Stainless steel	Air (external)	None	None			F
Eductor	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-1 Containment Spray System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.A.6-d	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Raw water (fresh) (internal)	Loss of material	Heat Exchanger Monitoring	V.A.6-a	3.2.1-12	E
					Service Water System Reliability	V.A.6-a	3.2.1-12	B
			Treated water (internal)	Loss of material	Water Chemistry Control	V.A.6-c	3.2.1-13	B
Heat exchanger (tubes)	Heat transfer	Stainless steel	Raw water (fresh) (external)	Fouling	Service Water System Reliability	V.A.6-b	3.2.1-12	B, 2
			Treated water (external)	Fouling	Water Chemistry Control			H
			Treated water (borated) (internal)	Fouling	Water Chemistry Control			H

Table 3.2.2-1 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Stainless steel	Raw water (fresh) (external)	Loss of material	Service Water System Reliability	V.A.6-a	3.2.1-12	B
				Loss of material – wear	Heat Exchanger Monitoring			H
			Treated water (external)	Loss of material	Water Chemistry Control	V.A.6-c	3.2.1-13	B
				Loss of material - wear	Heat Exchanger Monitoring			H
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H
Heater housing (RWST electric heater)	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			6
Manifold (piping)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-1 Containment Spray System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Orifice	Flow control Pressure boundary	Stainless steel	Air (external)	None	None			G
			Air (internal)	None	None			G
	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Air (internal)	None	None			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-1 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Air (internal)	None	None			G
			Nitrogen (internal)	None	None			G
			Sodium hydroxide (internal)	Cracking	Inservice Inspection (Aug)			G
				Loss of material	Inservice Inspection (Aug)			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1
			Untreated water with boron (internal)	Cracking	Inservice Inspection (Aug)			G
				Loss of material	Inservice Inspection (Aug)			G
Pump casing	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-1 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Spray nozzle	Flow control Pressure boundary	Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
Tank	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Concrete (external)	None	None			G
			Sodium hydroxide (internal)	Cracking	Inservice Inspection (Aug)			J
				Loss of material	Inservice Inspection (Aug)			J
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-1 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Sodium hydroxide	Cracking	Inservice Inspection (Aug)			G
				Loss of material	Inservice Inspection (Aug)			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1
Tubing (instrument piping)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-1 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Air (internal)	None	None			G
			Nitrogen (internal)	None	None			G
			Sodium hydroxide	Cracking	Inservice Inspection (Aug)			G
				Loss of material	Inservice Inspection (Aug)			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			G

Table 3.2.2-2
Containment Isolation System
Summary of Aging Management Evaluation

Table 3.2.2-2: Containment Isolation System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A
					Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
				Loss of mechanical closure integrity	Bolting and Torquing Activities			H
					Boric Acid Corrosion Prevention			H
					System Walkdown			H
			Condensation (external)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F
				None	None			F
			Condensation (external)	None	None			F

Table 3.2.2-2: Containment Isolation System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	V.C.1-a	3.2.1-3	A
			Air (internal)	Loss of material	Containment Leakage Rate Testing			G
			Condensation (external)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A
			Nitrogen (internal)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Wall Thinning Monitoring	V.C.1-a	3.2.1-5 3.2.1-6	A
			Treated water (internal)	Loss of material	Water Chemistry Control	V.C.1-a	3.2.1-5 3.2.1-6	A

Table 3.2.2-2: Containment Isolation System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			I, 3
			Air (internal)	None	None			G
			Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Containment Leakage Rate Testing	V.C.1-b	3.2.1-5 3.2.1-6	A
			Treated water (borated) >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			H
				Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control	V.C.1-b	3.2.1-5 3.2.1-6	A
			Treated water (internal)	Loss of material	Water Chemistry Control	V.C.1-b	3.2.1-5 3.2.1-6	A

Table 3.2.2-2: Containment Isolation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Stainless steel	Treated water (borated) (external)	Loss of material	Water Chemistry Control			G
			Treated water (borated) (internal)	Cracking	Water Chemistry Control			H
				Loss of material	Containment Leakage Rate Testing	V.C.1-b	3.2.1-5 3.2.1-6	A
				Loss of material	Water Chemistry Control	V.C.1-b	3.2.1-5 3.2.1-6	A
			Untreated water with boron (internal)	Loss of material	Containment Leakage Rate Testing			G
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	V.C.1-a	3.2.1-3	A
			Air (internal)	Loss of material	Containment Leakage Rate Testing			G
			Condensation (external)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A
			Nitrogen (internal)	None	None			G

Table 3.2.2-2: Containment Isolation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Carbon steel	Raw water (fresh) (internal)	Loss of material	Containment Leakage Rate Testing	V.C.1-a	3.2.1-5 3.2.1-6	A
					Wall Thinning Monitoring	V.C.1-a	3.2.1-5 3.2.1-6	A
			Treated water (internal)	Loss of material	Water Chemistry Control	V.C.1-a	3.2.1-5 3.2.1-6	A
		Stainless steel	Air (external)	None	None			I, 3
			Air (internal)	None	None			G
			Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Containment Leakage Rate Testing	V.C.1-b	3.2.1-5 3.2.1-6	A
			Treated water (borated) >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			H
				Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control	V.C.1-b	3.2.1-5 3.2.1-6	A

Table 3.2.2-2: Containment Isolation System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	Water Chemistry Control	V.C.1-b	3.2.1-5 3.2.1-6	A
			Treated water (borated) (external)	Loss of material	Water Chemistry Control			G
			Treated water (borated) (internal)	Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control	V.C.1-b	3.2.1-5 3.2.1-6	A
			Untreated water with boron (internal)	Loss of material	Containment Leakage Rate Testing			G

Table 3.2.2-3
Emergency Core Cooling System
Summary of Aging Management Evaluation

Table 3.2.2-3: Emergency Core Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.D1.1-d V.D1.2-b V.D1.4-c V.D1.5-b	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
				Loss of mechanical closure integrity	Boric Acid Corrosion Prevention			H
					System Walkdown			H
		Stainless steel	Air (external)	None	None			F
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Lube oil (internal)	Loss of material	Oil Analysis			6

Table 3.2.2-3: Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flex hose	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1
Heat exchanger (bonnet)	Pressure boundary	Brass	Air (external)	None	None			J
			Lube oil (internal)	Loss of material	Oil Analysis			6
			Treated water (internal)	Loss of material	Water Chemistry Control			6
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.D1.5-b	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Lube oil (internal)	Loss of material	Oil Analysis			6
			Treated water (internal)	Loss of material	Heat Exchanger Monitoring	V.D1.5-a	3.2.1-13	E
					Water Chemistry Control	V.D1.5-a	3.2.1-13	B

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell) (continued)	Pressure boundary	Cast iron	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.D1.5-b	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Treated water (internal)	Loss of material	Heat Exchanger Monitoring	V.D1.5-a	3.2.1-13	E
					Water Chemistry Control	V.D1.5-a	3.2.1-13	B
		Copper alloy	Air (external)	None	None			6
			Lube oil (internal)	Loss of material	Oil Analysis			6
Heat exchanger (tubes)	Heat transfer	Copper alloy	Lube oil (external)	Fouling	Oil Analysis			6
			Treated water (internal)	Fouling	Water Chemistry Control			6
		Stainless steel	Treated water (borated) >270°F (internal)	Fouling	Water Chemistry Control			H
			Treated water (external)	Fouling	Water Chemistry Control			H

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes) (continued)	Heat transfer	Stainless steel	Treated water (borated) (internal)	Fouling	Water Chemistry Control			H
	Pressure boundary	Copper alloy	Lube oil (external)	Loss of material – wear	Heat Exchanger Monitoring			6
				Loss of material	Oil Analysis			6
			Treated water (internal)	Loss of material - erosion	Heat Exchanger Monitoring			6
				Loss of material	Water Chemistry Control			6
		Stainless steel	Treated water (borated) >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			G
				Cracking	Water Chemistry Control			G
				Loss of material	Water Chemistry Control			G

Table 3.2.2-3: Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Stainless steel	Treated water (external)	Cracking	Heat Exchanger Monitoring			H
				Loss of material - wear	Heat Exchanger Monitoring			H
				Loss of material	Water Chemistry Control	V.D1.5-a	3.2.1-13	B
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control	V.D1.5-a	3.2.1-13	B
Heater housing	Pressure boundary	Stainless steel	Air (external)	None	None			6
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			6

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Manifold (piping)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			G
				Cracking	Water Chemistry Control			G
				Loss of material	Water Chemistry Control			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1
Orifice	Flow control Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) (internal)	Loss of material – erosion	System Testing	V.D1.2-c	3.2.1-8	A, 4
				Loss of material	Water Chemistry Control			H
	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	Boric Acid Corrosion Prevention			G
			Concrete (external)	None	None			G
			Lube oil (internal)	Loss of material	Oil Analysis			G
			Nitrogen (internal)	None	None			G
		Copper alloy	Air (external)	None	None			F
			Lube oil (internal)	Loss of material	Oil Analysis			F
		Glass	Air (external)	None	None			F
			Lube oil (internal)	None	None			F

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Lube oil (internal)	Loss of material	Oil Analysis			G
			Nitrogen (internal)	None	None			G
			Treated water (borated) >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			G
				Cracking	Water Chemistry Control			G
				Loss of material	Water Chemistry Control			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Lube oil (internal)	Loss of material	Oil Analysis			6
		Carbon steel with stainless steel cladding	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.D1.2-b	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Treated water (borated) (internal)	Cracking	Preventive Maintenance			H, 5
				Loss of material	Water Chemistry Control			H

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing (continued)	Pressure boundary	Cast iron	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Lube oil (internal)	Loss of material	Oil Analysis			6
		Stainless steel	Air (external)	None	None			G
			Treated water (borated) >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			G
				Cracking	Water Chemistry Control			G
				Loss of material	Water Chemistry Control			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing	Pressure boundary	Stainless steel	Air (external)	None	None			6
			Treated water (borated) >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			6
				Cracking	Water Chemistry Control			6
				Loss of material	Water Chemistry Control			6
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			6
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	Boric Acid Corrosion Prevention			6
			Lube oil (internal)	Loss of material	Oil Analysis			6

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tank (continued)	Pressure boundary	Carbon steel with stainless steel cladding	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.D1.7-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1
		Stainless steel	Air (external)	None	None			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			6
			Treated water (borated) >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			6
				Cracking	Water Chemistry Control			6
				Loss of material	Water Chemistry Control			6

Table 3.2.2-3: Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated water (borated) >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			G
				Cracking	Water Chemistry Control			G
				Loss of material	Water Chemistry Control			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.D1.4-c	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	Boric Acid Corrosion Prevention			G
			Nitrogen (internal)	None	None			G

Table 3.2.2-3: Emergency Core Cooling System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Lube oil (internal)	Loss of material	Oil Analysis			F
		Stainless steel	Air (external)	None	None			G
			Nitrogen (internal)	None	None			G
			Treated water (borated) >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			G
				Cracking	Water Chemistry Control			G
				Loss of material	Water Chemistry Control			G
			Treated water (borated) (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.2.2-4
Containment Equalization / Hydrogen Skimmer System
Summary of Aging Management Evaluation

Table 3.2.2-4: Containment Equalization / Hydrogen Skimmer System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
				Loss of mechanical closure integrity	Boric Acid Corrosion Prevention			H
					System Walkdown			H
		Stainless steel	Air (external)	None	None			F
Damper housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A
Ductwork	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A

Table 3.2.2-4: Containment Equalization / Hydrogen Skimmer System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fan housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A
Heat exchanger	Heat transfer	Copper alloy	Air (external)	None	None			6
			Treated water (internal)	Fouling	Water Chemistry Control			6
	Pressure boundary	Copper alloy	Air (external)	Loss of material – wear	Heat Exchanger Monitoring			6
			Treated water (internal)	Loss of material – erosion	Heat Exchanger Monitoring			6
				Loss of material	Water Chemistry Control			6
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A

Table 3.2.2-4: Containment Equalization / Hydrogen Skimmer System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	V.E.1-a	3.2.1-17	A
					System Walkdown	V.E.1-b	3.2.1-10	A
			Air (internal)	Loss of material	System Walkdown	V.E.1-b	3.2.1-10	A

Notes for Tables 3.2.2-1 through 3.2.2-4

Generic notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes

1. The temperature in this portion of the system is below the threshold for cracking, both for fatigue and stress corrosion cracking.
2. NUREG-1801 discusses only biofouling. As used in the table, fouling is not restricted to biofouling, but includes other causes of fouling.

3. NUREG-1801, Item V.C.1-b identifies an aging effect applicable to the internal environment only.
4. NUREG-1801, Item V.D1.2-c evaluates a high pressure safety injection (HPSI) and low pressure safety injection (LPSI) miniflow recirculation line flow orifice that would be subject to extended operation for normal plant charging. At CNP, the charging pumps (not the safety injection pumps) are used for the normal charging function. The miniflow recirculation line flow orifice associated with the charging pumps is subject to the “loss of material – erosion” aging effect identified by Item V.D1.2-c and was evaluated as part of ECCS.
5. I&M identified “cladding cracking from casing stress concentrations” as a component-specific aging effect for the centrifugal charging pump casings (part of the ECCS). This effect is different than the “stress corrosion cracking” aging effect identified in NUREG-1801, Item V.D1.2-a.
6. NUREG-1801 has neither the component nor a reasonable substitute (Notes C, D, and E do not apply).

3.3 AUXILIARY SYSTEMS

3.3.1 Introduction

This section provides the aging management review results for components in the auxiliary systems. The security diesel and associated ventilation is the only subsystem of the security system that is required to be in scope for license renewal. For clarity, the term security has been replaced with security diesel throughout this section. The following systems are addressed below in Subsections 3.3.2.1.1 through 3.3.2.1.11:

- Spent fuel pool system (Section 2.3.3.1)
- Essential service water system (Section 2.3.3.2)
- Component cooling water system (Section 2.3.3.3)
- Compressed air systems (Section 2.3.3.4)
- Chemical and volume control system (Section 2.3.3.5)
- Heating, ventilation and air conditioning systems (Section 2.3.3.6)
- Fire protection system (Section 2.3.3.7)
- Emergency diesel generator (Section 2.3.3.8)
- Security diesel (Section 2.3.3.9)
- Post-accident containment hydrogen monitoring system (Section 2.3.3.10)
- Miscellaneous systems in scope for 10 CFR 54.4(a)(2) (Section 2.3.3.11)

Table 3.3.1, Summary of Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the auxiliary systems component group. Hyperlinks to the program evaluations in Appendix B are provided in the CD-ROM version of this application.

3.3.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for systems in the auxiliary systems group:

- Table 3.3.2-1 Spent Fuel System — Summary of Aging Management Evaluation
- Table 3.3.2-2 Essential Service Water System — Summary of Aging Management Evaluation

- Table 3.3.2-3 Component Cooling Water System — Summary of Aging Management Evaluation
- Table 3.3.2-4 Compressed Air Systems — Summary of Aging Management Evaluation
- Table 3.3.2-5 Chemical and Volume Control System — Summary of Aging Management Evaluation
- Table 3.3.2-6 Heating, Ventilation and Air Conditioning Systems — Summary of Aging Management Evaluation
- Table 3.3.2-7 Fire Protection System — Summary of Aging Management Evaluation
- Table 3.3.2-8 Emergency Diesel Generator — Summary of Aging Management Evaluation
- Table 3.3.2-9 Security Diesel — Summary of Aging Management Evaluation
- Table 3.3.2-10 Post-Accident Containment Hydrogen Monitoring System — Summary of Aging Management Evaluation
- Table 3.3.2-11 Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) — Summary of Aging Management Evaluation

3.3.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the auxiliary systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.3.2.1.1 Spent Fuel Pool System

Materials

Spent fuel pool system components are constructed of the following materials:

- Aluminum
- Boron carbide

Environment

Spent fuel pool system components are exposed to the following environment:

- Treated (borated) water

Aging Effects Requiring Management

The following aging effects associated with the spent fuel pool system require management:

- Change in material properties
- Cracking
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the spent fuel pool system components:

- Boral Surveillance
- Water Chemistry Control

3.3.2.1.2 Essential Service Water System

Materials

Essential service water system components are constructed of the following materials:

- Carbon steel
- Cast iron
- Copper alloy
- Elastomer
- Stainless steel

Environment

Essential service water system components are exposed to the following environments:

- Condensation
- Raw water (fresh)

Condensation is the term used for the environment of the external surfaces of cooling system components exposed to air, since the condensation of atmospheric moisture is the predominant environmental factor. This environment is considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the essential service water system require management:

- Change in material properties
- Cracking
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the essential service water system components:

- Service Water System Reliability
- System Walkdown

3.3.2.1.3 Component Cooling Water System

Materials

Component cooling water system components are constructed of the following materials:

- Carbon steel
- Copper alloy
- Stainless steel

Environment

Component cooling water system components are exposed to the following environments:

- Condensation

- Lube oil
- Raw water (fresh)
- Treated water

Condensation is the term used for the environment of the external surfaces of cooling system components exposed to air, since the condensation of atmospheric moisture is the predominant environmental factor. For the auxiliary systems comparison tables, this environment is considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the component cooling water system require management:

- Cracking
- Fouling
- Loss of material
- Loss of material – wear

Aging Management Programs

The following aging management programs will manage the aging effects for the component cooling water system components:

- Heat Exchanger Monitoring
- Oil Analysis
- Service Water System Reliability
- System Walkdown
- Water Chemistry Control

3.3.2.1.4 Compressed Air System

Materials

Compressed air system components are constructed of the following materials:

- Brass
- Carbon steel
- Copper alloy
- Elastomer
- Stainless steel

Environment

Compressed air system components are exposed to the following environments:

- Air
- Nitrogen
- Treated air
- Untreated air

The internal environments of most compressed air systems components subject to aging management review, is treated air which is air downstream of the dryers and filters. The environment of untreated air, applicable to a small number of components, is comparable to saturated air and similar environments from NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the compressed air system require management:

- Change in material properties
- Cracking
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the compressed air system components:

- Containment Leakage Rate Testing
- Instrument Air Quality

- Preventive Maintenance
- System Walkdown

3.3.2.1.5 Chemical and Volume Control System

Materials

Chemical and volume control system components are constructed of the following materials:

- Carbon steel
- Glass
- Stainless steel

Environment

Chemical and volume control system components are exposed to the following environments:

- Air
- Hydrogen
- Nitrogen
- Treated water
- Treated (borated) water
- Treated borated water > 270°F.

Aging Effects Requiring Management

The following aging effects associated with the chemical and volume control system require management:

- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of material – erosion

- Loss of material – wear
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the chemical and volume control system components:

- Boric Acid Corrosion Prevention
- Heat Exchanger Monitoring
- System Testing
- System Walkdown
- Water Chemistry Control

3.3.2.1.6 Heating, Ventilation and Air Conditioning Systems

Materials

Heating, ventilation and air conditioning system components are constructed of the following materials:

- Carbon steel
- Cast iron
- Copper alloy
- Elastomer
- Glass
- Stainless steel

Environment

Heating, ventilation and air conditioning system components are exposed to the following environments:

- Air
- Condensation
- Freon

- Outdoor air
- Raw water (fresh)
- Treated water

For the comparison tables, the environments of air, condensation, and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the heating, ventilation and air conditioning system require management:

- Change in material properties
- Cracking
- Fouling
- Loss of material
- Loss of material – wear

Aging Management Programs

The following aging management programs will manage the aging effects for the heating, ventilation and air conditioning system components:

- Heat Exchanger Monitoring
- Preventive Maintenance
- Service Water System Reliability
- System Testing
- System Walkdown
- Water Chemistry Control

3.3.2.1.7 Fire Protection System

Materials

Fire protection system components are constructed of the following materials:

- Aluminum
- Carbon steel
- Cast iron
- Copper alloy
- Elastomer
- Glass
- Stainless steel

Environment

Fire protection system components are exposed to the following environments:

- Air
- Carbon dioxide
- Exhaust gas
- Freon
- Fuel oil
- Halon
- Lube oil
- Lube oil and borated water leakage
- Outdoor air
- Soil
- Treated water

The environments of air and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the fire protection system require management:

- Change in material properties

- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of material – wear
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the fire protection system components:

- Bolting and Torquing Activities
- Boric Acid Corrosion Prevention
- Diesel Fuel Monitoring
- Fire Protection
- Oil Analysis
- Preventive Maintenance
- System Walkdown

3.3.2.1.8 Emergency Diesel Generator

Materials

Emergency diesel generator components are constructed of the following materials:

- Carbon steel
- Copper alloy
- Elastomer
- Glass
- Stainless steel

Environment

Emergency diesel generator components are exposed to the following environments:

- Air
- Condensation
- Exhaust gas
- Fuel oil
- Lube oil
- Outdoor air
- Raw water (fresh)
- Soil
- Treated water

The environments of air, condensation and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the emergency diesel generator require management:

- Change in material properties
- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of material – erosion
- Loss of material – wear
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the emergency diesel generator components:

- Bolting and Torquing Activities
- Buried Piping Inspection
- Diesel Fuel Monitoring
- Heat Exchanger Monitoring
- Oil Analysis
- Preventive Maintenance
- Service Water System Reliability
- System Walkdown
- Water Chemistry Control

3.3.2.1.9 Security Diesel

Materials

Security diesel components are constructed of the following materials:

- Carbon steel
- Copper alloy
- Elastomer
- Stainless steel

Environment

Security diesel components are exposed to the following environments:

- Air
- Exhaust gas
- Fuel oil
- Lube oil
- Outdoor air

- Soil
- Treated water

The environments of air and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the security diesel require management:

- Change in material properties
- Cracking
- Cracking – fatigue
- Fouling
- Loss of material
- Loss of material – wear
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the security diesel components:

- Bolting and Torquing Activities
- Diesel Fuel Monitoring
- Oil Analysis
- Preventive Maintenance
- System Testing
- System Walkdown
- Water Chemistry Control

3.3.2.1.10 Post-Accident Containment Hydrogen Monitoring System

Materials

Post-accident containment hydrogen monitoring system components are constructed of the following materials:

- Brass
- Carbon steel
- Elastomer
- Stainless steel

Environment

Post-accident containment hydrogen monitoring system components are exposed to the following environments:

- Air
- Hydrogen and nitrogen
- Oxygen

Aging Effects Requiring Management

The following aging effects associated with the post-accident containment hydrogen monitoring system require management:

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the post-accident containment hydrogen monitoring system components:

- Preventive Maintenance
- System Walkdown

3.3.2.1.11 Nonsafety-Related Systems and Components Affecting Safety-Related Systems

Materials

The nonsafety-related systems and components affecting safety-related systems are constructed of the following materials:

- Carbon steel
- Carbon steel (coated)
- Cast iron
- Copper alloy
- Glass
- Molded plastic
- Stainless steel

Environment

The nonsafety-related systems and components affecting safety-related systems are exposed to the following environments:

- Air
- Raw water (fresh)
- Steam > 270°F
- Treated water
- Treated water > 270°F
- Treated (borated) water
- Treated borated water > 270°F
- Untreated water
- Untreated water > 270°F
- Untreated water with boron

Aging Effects Requiring Management

The following aging effects associated with nonsafety-related systems and components affecting safety-related systems require management:

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of material
- Loss of material – erosion
- Loss of mechanical closure integrity

Aging Management Programs

The following aging management programs will manage the aging effects for the nonsafety-related systems and components affecting safety-related systems:

- Bolting and Torquing Activities
- Boric Acid Corrosion Prevention
- Flow-Accelerated Corrosion
- System Walkdown
- Water Chemistry Control

3.3.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation by the NRC reviewer is necessary for certain aging effects, particularly those that require plant-specific programs or that involve TLAAs. Section 3.3.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain I&M's approach to addressing the areas requiring further evaluation. Programs are described in Appendix B of this application.

3.3.2.2.1 Loss of Material due to General, Pitting, and Crevice Corrosion

Both subsections of this paragraph of NUREG-1800 discuss loss of material in components of the spent fuel pool cooling and cleanup system. The CNP spent fuel pool cooling components do not provide any intended functions. The maintenance of pool inventory, which assures cooling, is provided by the spent fuel pool. The spent fuel pool is evaluated as part of the auxiliary building.

3.3.2.2.2 Hardening and Cracking or Loss of Strength due to Elastomer Degradation or Loss of Material due to Wear

This paragraph of NUREG-1800 describes the potential for degradation of elastomer in linings, collars, and seals in spent fuel cooling systems and ventilation systems. As described in Section 3.3.2.2.1, the spent fuel pool cooling components do not provide an intended function. For the CNP ventilation systems, the Preventive Maintenance Program will manage degradation of elastomers. Elastomers are used in other systems. For these other systems, management of elastomer degradation will be provided by the Preventive Maintenance Program, the Service Water System Reliability Program, or the Fire Protection Program.

3.3.2.2.3 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed in Section 4.3.

3.3.2.2.4 Crack Initiation and Growth due to Cracking or Stress Corrosion Cracking

The potential for cracking in the high pressure pumps of the chemical and volume control system (charging pumps) is discussed in this paragraph of NUREG-1800. The charging pumps are evaluated as part of the emergency core cooling system. As described in Section 3.2.2.1.3, the Preventive Maintenance Program will manage this aging effect.

3.3.2.2.5 Loss of Material due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

This paragraph of NUREG-1800 discusses the loss of material from corrosion that could occur on the internal and external surfaces of components exposed to air and the associated range of atmospheric conditions. Specifically included in the paragraph are the ventilation systems; diesel fuel oil, air, and exhaust systems; and the external carbon steel surfaces of all auxiliary systems. The System Walkdown

Program, System Testing Program, Service Water System Reliability Program and Preventive Maintenance Program will manage loss of material. The Fire Protection Program will manage loss of material for internal surfaces of the fire protection system.

3.3.2.2.6 Loss of Material due to General, Galvanic, Pitting, and Crevice Corrosion

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation of programs to manage loss of material in the reactor coolant pump oil collection system to verify the effectiveness of the fire protection program. For CNP, the Preventive Maintenance Program will be adequate to manage the aging effects for the interior surface of the tank without reliance on a one-time inspection.

3.3.2.2.7 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation of programs to manage loss of material in the diesel fuel oil system to verify the effectiveness of the Diesel Fuel Monitoring Program. The Diesel Fuel Monitoring Program will manage loss of material for the system. The program provides for the periodic inspection of the fuel oil tanks, which addresses the one time inspection recommendation in NUREG-1801.

3.3.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The CNP Corrective Action Program applies to both safety-related and nonsafety-related structures and components. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing CNP Document Control Program in accordance with the Quality Assurance Program Description (QAPD). See Section B.0.3 of this application for further discussion.

3.3.2.2.9 Crack Initiation and Growth due to Stress Corrosion Cracking and Cyclic Loading

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation of programs to manage cracking in the chemical and volume control system to verify the effectiveness of the Water Chemistry Control Program. The Water Chemistry Program supplemented, for some components, by the Heat Exchanger Monitoring Program will manage cracking in the heat exchangers. The Water Chemistry Control – Chemistry One-Time Inspection will be performed to verify program effectiveness. This addresses the Verification Program recommendation in NUREG-1801.

3.3.2.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material due to General Corrosion

Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. The Boral Surveillance Program and Water Chemistry Control Program will manage neutron absorbing capacity and loss of material.

3.3.2.2.11 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

This paragraph of NUREG-1800 discusses the potential for loss of material in buried piping of the service water and diesel fuel oil systems. There are no buried components in the CNP essential service water system. The Buried Piping Inspection Program will manage loss of material for buried components of the diesel fuel oil system. For buried components of the security diesel, the System Testing Program will manage loss of material.

3.3.2.3 Time-Limited Aging Analysis

The only TLAA identified for the auxiliary system components is metal fatigue. This is evaluated in Section 4.3.

3.3.3 Conclusion

The auxiliary system piping, fittings, and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). The aging management programs selected to manage aging effects for the auxiliary system components are identified in the following tables and Section 3.3.2.1. A description of these aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the auxiliary system components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.3.1
Summary of Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801

Table 3.3.1 Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-1	Components in spent fuel pool cooling and cleanup	Loss of material due to general, pitting, and crevice corrosion	Water chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800 subsections 3.3.2.2.1.1 and 3.3.2.2.1.2).	Not applicable. The components of the spent fuel pool cooling system provide no intended functions. The maintenance of pool inventory, which assures cooling, is provided by the spent fuel pool. The pool components are included in the auxiliary building structural component evaluation in Section 3.5.
3.3.1-2	Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant specific	Yes, plant specific (see NUREG-1800 subsection 3.3.2.2.2)	Consistent with NUREG-1801 for ventilation systems. Not applicable to the spent fuel cooling system for the reason stated in Item 3.3.1-1. The Preventive Maintenance Program will manage degradation of ventilation system elastomers.

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-3	Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800, Subsection 3.3.2.2.3)	Consistent with NUREG-1801. This TLAA is further evaluated in Section 4.3.
3.3.1-4	Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR)	Crack initiation and growth due to SCC or cracking	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.3.2.2.4)	High-pressure pumps in the CVCS are addressed as part of the ECCS in the ESF evaluation. See Section 3.2, Table 3.2.2-3.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-5	Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.3.2.2.5)	Consistent with NUREG-1801. The System Walkdown Program, Service Water System Reliability Program, and Preventive Maintenance Program will manage loss of material. The Fire Protection Program and Preventive Maintenance Program will manage loss of material for internal surfaces of the fire protection system.
3.3.1-6	Components in reactor coolant pump oil collect system of fire protection	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800, Subsection 3.3.2.2.6)	The Boric Acid Corrosion Prevention Program and Preventive Maintenance Program will manage loss of material without reliance on a one-time inspection.
3.3.1-7	Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800, Subsection 3.3.2.2.7)	Consistent with NUREG-1801. The Diesel Fuel Monitoring Program will manage loss of material. The program provides for the periodic inspection of the fuel oil tanks which addresses the one-time inspection recommendation in NUREG-1801.
3.3.1-8	BWR only				

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-9	Heat exchangers in chemical and volume control system	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and a plant-specific verification program	Yes, plant specific (see NUREG-1800, Subsection 3.3.2.2.9)	The Water Chemistry Control Program supplemented, for some components, by the Heat Exchanger Monitoring Program will manage cracking in the heat exchangers.
3.3.1-10	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant specific	Yes, plant specific (see NUREG-1800, Subsection 3.3.2.2.10)	Consistent with NUREG-1801. The Boral Surveillance Program and Water Chemistry Control Program, as described in Appendix B of this application, will manage reduction of neutron absorbing capacity and loss of material.
3.3.1-11	New fuel rack assembly	Loss of material due to general, pitting, and crevice corrosion	Structures monitoring	No	Not applicable. The new fuel racks are made of stainless steel and are not subject to loss of material in an air environment.
3.3.1-12	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring	No	Not applicable. Boraflex is not used.

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-13	Spent fuel storage racks and valves in spent fuel pool cooling and cleanup	Crack initiation and growth due to stress corrosion cracking	Water chemistry	No	Not applicable for the components of the spent fuel pool cooling system, which provide no intended functions. The maintenance of pool inventory, which assures cooling, is provided by the spent fuel pool. The pool components, including the spent fuel storage racks, are included in the auxiliary building structural component evaluation in Section 3.5.
3.3.1-14	Closure bolting and external surfaces of carbon steel and low-alloy steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801. The Boric Acid Corrosion Prevention Program will manage loss of material due to boric acid corrosion.
3.3.1-15	Components in or serviced by closed-cycle cooling water system	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	No	Consistent with NUREG-1801. The closed-cycle cooling system subsection of the Water Chemistry Control Program is comparable to the NUREG-1801 closed-cycle cooling water system program. The program will manage loss of material in these components.

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-16	Cranes including bridge and trolleys and rail system in load handling system	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling systems	No	Consistent with NUREG-1801. The crane inspection subsection of the Structures Monitoring – Crane Inspection Program will manage loss of material. Cranes and other lifting devices are evaluated as part of the structures that house them, as described in Section 3.5.
3.3.1-17	Components in or serviced by open-cycle cooling water systems	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	No	The Service Water System Reliability Program is comparable to the open cycle cooling system program described in NUREG-1801. The program, together with the System Testing Program and Water Chemistry Control Programs applicable to some components, will manage loss of material and fouling. Although biofouling is not, in itself, an aging effect, the programs will manage effects which may result from biofouling.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-18	Buried piping and fittings	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	No Yes, detection of aging effects and operating experience are to be further evaluated (see NUREG-1800, Subsection 3.3.2.2.11)	Consistent with NUREG-1801; for the emergency diesel generators, the Buried Piping Inspection Program will manage loss of material for buried components. For the security diesel, the System Testing Program will manage loss of material for buried components.
3.3.1-19	Components in compressed air system	Loss of material due to general and pitting corrosion	Compressed air monitoring	No	Not applicable for most components. With few exceptions, the air in the compressed air system components subject to aging management review is treated air rather than saturated air, as identified in NUREG-1801. For compressed air system components in the containment penetrations, where the environment is considered untreated air, a different program, the Containment Leakage Rate Testing Program will manage the loss of material.

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-20	Components (doors and barrier penetration seals) and concrete structures in fire protection	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	No	Consistent with NUREG-1801 for fire doors and fire barrier seals. The Fire Protection Program will manage loss of material, cracking, and changes in material properties. Fire barriers are evaluated as part of the associated structures as described in Section 3.5.
3.3.1-21	Components in water-based fire protection	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	No	Not applicable. The fire water system uses treated water rather than raw water as evaluated in NUREG-1801.
3.3.1-22	Components in diesel fire system	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	No	The Diesel Fuel Monitoring Program will manage loss of material.
3.3.1-23	Tanks in diesel fuel oil system	Loss of material due to general, pitting, and crevice corrosion	Above ground carbon steel tanks	No	The diesel fuel oil tanks are buried. The System Walkdown Program will manage the loss of material for the diesel fuel oil day tanks, which are housed indoors.

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-24	Closure bolting	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	No	Different programs are used. The Bolting and Torquing Activities Program and System Walkdown Program will manage the loss of material and loss of closure integrity caused by cracking.
3.3.1-25	BWR only				
3.3.1-26	BWR only				
3.3.1-27	BWR only				
3.3.1-28	BWR only				
3.3.1-29	Components (aluminum bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink	Loss of material due to selective leaching	Selective leaching of materials	No	Different programs will be used to manage selective leaching for the component cooling water system and some components cooled by the essential service water system. Copper alloy components of the essential service water system contain less than 15% zinc and are not subject to selective leaching. The Service Water System Reliability Program and Water Chemistry Control Program will manage loss of material due to selective leaching of materials.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-30	Fire barriers, walls, ceilings, and floors in fire protection	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel	Fire protection and structures monitoring	No	Not applicable. Walls, ceilings, and floors as fire barriers are evaluated as part of the associated structures.

Table 3.3.2-1
Spent Fuel Pool System
Summary of Aging Management Evaluation

Table 3.3.2-1: Spent Fuel Pool System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
SFP poison	Neutron absorption	Aluminum	Treated (borated) water (external)	Change in material properties	Boral Surveillance	VII.A2.1-b	3.3.1-10	A
				Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control	VII.A2.1-b	3.3.1-10	A
			Treated (borated) water (internal)	Change in material properties	Boral Surveillance	VII.A2.1-b	3.3.1-10	A
				Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control	VII.A2.1-b	3.3.1-10	A
		Boron carbide	Treated (borated) water (internal)	Change in material properties	Boral Surveillance	VII.A2.1-b	3.3.1-10	A

Table 3.3.2-2
Essential Service Water System
Summary of Aging Management Evaluation

Table 3.3.2-2: Essential Service Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
		Stainless steel	Condensation (external)	None	None			F
Detector well	Pressure boundary	Stainless steel	Condensation (external)	None	None			3
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	D

Table 3.3.2-2: Essential Service Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Expansion joint	Pressure boundary	Elastomer	Condensation (external)	Change in material properties	Service Water System Reliability			F
				Cracking	Service Water System Reliability			F
			Raw water (fresh) (internal)	Change in material properties	Service Water System Reliability			F
				Cracking	Service Water System Reliability			F
				Loss of material	Service Water System Reliability			F
Fittings	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B

Table 3.3.2-2: Essential Service Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fittings (continued)	Pressure boundary	Copper alloy	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B
		Stainless steel	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B
Flex hose	Pressure boundary	Stainless steel	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B
Manifold (piping)	Pressure boundary	Copper alloy	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B

Table 3.3.2-2: Essential Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice	Flow control and pressure boundary	Stainless steel	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.4-a	3.3.1-17	B
	Pressure boundary	Stainless steel	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.4-a	3.3.1-17	B
Piping	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B
		Copper alloy	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B
		Stainless steel	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B

Table 3.3.2-2: Essential Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel Stainless steel	Raw water (fresh) (external)	Loss of material	Service Water System Reliability	VII.C1.5-a	3.3.1-17	B
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.5-a	3.3.1-17	B
Strainer	Filtration	Stainless steel	Raw water (fresh) (external)	Loss of material	Service Water System Reliability	VII.C1.6-a	3.3.1-17	B
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.6-a	3.3.1-17	B
Strainer housing	Pressure boundary	Cast iron	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.6-a	3.3.1-17	B
Thermowell	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	D
		Stainless steel	Condensation (external)	None	None			3
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	D

Table 3.3.2-2: Essential Service Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B
		Copper alloy	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B
		Stainless steel	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	B

Table 3.3.2-2: Essential Service Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.2-a	3.3.1-17	B
		Copper alloy	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.2-a	3.3.1-17	B
		Stainless steel	Condensation (external)	None	None			G
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.2-a	3.3.1-17	B

Table 3.3.2-3
Component Cooling Water System
Summary of Aging Management Evaluation

Table 3.3.2-3: Component Cooling Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
		Stainless steel	Condensation (external)	None	None			F
Detector well	Pressure boundary	Stainless steel	Condensation (external)	None	None			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Expansion joint	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.1-a	3.3.1-15	B
Fittings	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.1-a	3.3.1-15	B

Table 3.3.2-3: Component Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fittings (continued)	Pressure boundary	Copper alloy	Condensation (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Condensation (external)	None	None			F
			Treated water (internal)	Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
Heat exchanger	Pressure boundary	Stainless steel	Condensation (external)	None	None			3
			Lube oil (external)	Loss of material	Oil Analysis			J
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.1-a	3.3.1-15	D

Table 3.3.2-3: Component Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell)	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.1-a	3.3.1-15	D
		Stainless steel	Condensation (external)	None	None			3
			Lube oil (internal)	Loss of material	Oil Analysis			J
Heat exchanger (tubes)	Heat transfer	Copper alloy	Raw water (fresh) (internal)	Fouling	Service Water System Reliability	VII.C1.3-b	3.3.1-17	B
			Treated water (external)	Fouling	Water Chemistry Control	VII.C1.3-b	3.3.1-17	E
	Pressure boundary	Copper alloy	Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.3-a	3.3.1-17 3.3.1-29	B E
			Treated water (external)	Loss of material – wear	Heat Exchanger Monitoring			H

Table 3.3.2-3: Component Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Copper alloy	Treated water (external)	Loss of material	Water Chemistry Control	VII.C1.3-a	3.3.1-17 3.3.1-29	E E
		Stainless steel	Lube oil (external)	Loss of material	Oil Analysis			J
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Manifold (piping)	Pressure boundary	Copper alloy	Condensation (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Condensation (external)	None	None			F
			Treated water (internal)	Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.3.2-3: Component Cooling Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Orifice	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.5-a	3.3.1-15	B
Piping	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.1-a	3.3.1-15	B
		Copper alloy	Condensation (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Condensation (external)	None	None			F
			Treated water (internal)	Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.3.2-3: Component Cooling Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.3-a	3.3.1-15	B
Strainer - tee	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.1-a	3.3.1-15	D
Tank	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.4-a	3.3.1-15	B
Thermowell	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.1-a	3.3.1-15	D

Table 3.3.2-3: Component Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell (continued)	Pressure boundary	Stainless steel	Condensation (external)	None	None			3
			Treated water (internal)	Cracking	Water Chemistry Control			3
				Loss of material	Water Chemistry Control			3
Tubing	Pressure boundary	Copper alloy	Condensation (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Condensation (external)	None	None			F
			Treated water (internal)	Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
Valve	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.C2.2-a	3.3.1-15	B

Table 3.3.2-3: Component Cooling Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Copper alloy	Condensation (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Condensation (external)	None	None			G
			Treated water (internal)	Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control	VII.C2.2-a	3.3.1-15	B

Table 3.3.2-4
Compressed Air Systems
Summary of Aging Management Evaluation

Table 3.3.2-4: Compressed Air Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
Fittings	Pressure boundary	Brass	Air (external)	None	None			F
			Nitrogen (internal)	None	None			F
			Treated air (internal)	Loss of material	Instrument Air Quality			F
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Preventive Maintenance			F
				Cracking	Preventive Maintenance			F

Table 3.3.2-4: Compressed Air Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flex hose (continued)	Pressure boundary	Elastomer	Treated air (internal)	Change in material properties	Preventive Maintenance			F
				Cracking	Preventive Maintenance			F
		Stainless steel	Air (external)	None	None			F
			Treated air (internal)	Loss of material	Instrument Air Quality			F
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Nitrogen (internal)	None	None			G
			Treated air (internal)	Loss of material	Instrument Air Quality			G
			Untreated air (internal)	Loss of material	Containment Leakage Rate Testing	VII.D.1-a	3.3.1-19	E
		Copper alloy	Air (external)	None	None			F
			Treated air (internal)	Loss of material	Instrument Air Quality			F

Table 3.3.2-4: Compressed Air Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Nitrogen (internal)	None	None			F
			Treated air (internal)	Loss of material	Instrument Air Quality			F
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Nitrogen (internal)	None	None			G
			Treated air (internal)	Loss of material	Instrument Air Quality			G
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Nitrogen (internal)	None	None			G
			Treated air (internal)	Loss of material	Instrument Air Quality			G

Table 3.3.2-4: Compressed Air Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing (continued)	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Treated air (internal)	Loss of material	Instrument Air Quality			F
		Stainless steel	Air (external)	None	None			F
			Nitrogen (internal)	None	None			F
			Treated air (internal)	Loss of material	Instrument Air Quality			F
Valve	Pressure boundary	Brass	Air (external)	None	None			F
			Nitrogen (internal)	None	None			F

Table 3.3.2-4: Compressed Air Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Nitrogen (internal)	None	None			G
			Treated air (internal)	Loss of material	Instrument Air Quality			G
			Untreated air (internal)	Loss of material	Containment Leakage Rate Testing	VII.D.2-a	3.3.1-19	E
		Copper alloy	Air (external)	None	None			F
			Treated air (internal)	Loss of material	Instrument Air Quality			F
		Stainless Steel	Air (external)	None	None			F
			Nitrogen (internal)	None	None			F
			Treated Air (internal)	Loss of material	Instrument Air Quality			F

Table 3.3.2-5
Chemical and Volume Control System
Summary of Aging Management Evaluation

Table 3.3.2-5: Chemical And Volume Control System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	VII.E1.1-b, VII.E1.2-a, VII.E1.3-b, VII.E1.4-a, VII.E1.5-b, VII.E1.6-a, VII.E1.7-b, VII.E1.8-d, VII.E1.9-a, VII.E1.10-a,	3.3.1-14	A
					System Walkdown	VII.I.1-b	3.3.1-5	A
				Loss of mechanical closure integrity	Boric Acid Corrosion Prevention			H
					System Walkdown			H

Table 3.3.2-5: Chemical And Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			F
Filter housing	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			3
Flow element body	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-5: Chemical And Volume Control System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (bonnet)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water > 270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VII.E1.8-a	3.3.1-3	A
				Cracking	Water Chemistry Control	VII.E1.8-b	3.3.1-9	A
				Loss of material	Water Chemistry Control			H
			Treated (borated) water (internal)	Cracking	Water Chemistry Control	VII.E1.8-b	3.3.1-9	A
				Loss of material	Water Chemistry Control			H

Table 3.3.2-5: Chemical And Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	VII.I.1-a	3.3.1-14	A
					System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.E1.8-c	3.3.1-15	B
		Stainless steel	Air (external)	None	None			G
			Treated borated water > 270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VII.E1.7-a	3.3.1-3	A
				Cracking	Water Chemistry Control	VII.E1.7-c	3.3.1-9	A
				Loss of material	Water Chemistry Control			H
Heat exchanger (tubes)	Heat transfer	Stainless steel	Treated borated water > 270°F (internal)	Fouling	Water Chemistry Control			H

Table 3.3.2-5: Chemical And Volume Control System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes) (continued)	Pressure boundary	Stainless steel	Treated borated water > 270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VII.E1.7-a VII.E1.8-a	3.3.1-3	A
				Cracking	Water Chemistry Control	VII.E1.7-c VII.E1.8-b	3.3.1-9	A
				Loss of material	Water Chemistry Control			H
			Treated borated water > 270°F (external)	Cracking - fatigue	TLAA - Metal Fatigue	VII.E1.7-a	3.3.1-3	A
				Cracking	Water Chemistry Control	VII.E1.7-c	3.3.1-9	A
				Loss of material – wear	Heat Exchanger Monitoring			H
				Loss of material	Water Chemistry Control			H

Table 3.3.2-5: Chemical And Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Stainless steel	Treated water (external)	Cracking	Heat Exchanger Monitoring	VII.E1.8-b	3.3.1-9	E
				Loss of material - wear	Heat Exchanger Monitoring			H
				Loss of material	Water Chemistry Control			H
			Treated (borated) water (internal)	Cracking	Water Chemistry Control	VII.E1.8-b	3.3.1-9	E
				Loss of material	Water Chemistry Control			H
Heater housing	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			3
Level glass gauge	Pressure boundary	Glass	Air (external)	None	None			J
			Treated (borated) water (internal)	None	None			J

Table 3.3.2-5: Chemical And Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manifold (piping)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			H
Orifice	Flow control and pressure boundary	Stainless steel	Air (external)	None	None			3
			Treated borated water > 270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VII.E1.1-a	3.3.1-3	C
				Cracking	Water Chemistry Control			3
				Loss of material – erosion	System Testing			3
				Loss of material	Water Chemistry Control			3
			Treated (borated) water (internal	Loss of material	Water Chemistry Control			3
	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Treated (borated) water (internal	Loss of material	Water Chemistry Control			3

Table 3.3.2-5: Chemical And Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Hydrogen (internal)	None	None			G
			Nitrogen (internal)	None	None			G
			Treated borated water > 270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VII.E1.1-a	3.3.1-3	A
				Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control			H
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.3.2-5: Chemical And Volume Control System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping-spool assembly	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			H
Pulsation dampener	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			3
Pump casing	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			H, I, 1
Strainer – tee	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-5: Chemical And Volume Control System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention	VII.I.1-a	3.3.1-14	A
					System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Boric Acid Corrosion Prevention			3
		Stainless steel	Air (external)	None	None			3
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-5: Chemical And Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Treated borated water > 270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VII.E1.1-a	3.3.1-3	C
				Cracking	Water Chemistry Control			3
				Loss of material	Water Chemistry Control			3
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			3
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water > 270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VII.E1.1-a	3.3.1-3	A
				Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control			H
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			H

Table 3.3.2-5: Chemical And Volume Control System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Hydrogen (internal)	None	None			G
			Nitrogen (internal)	None	None			G
			Treated borated water > 270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VII.E1.3-a	3.3.1-3	A
				Cracking	Water Chemistry Control			H
				Loss of material	Water Chemistry Control			H
			Treated (borated) water (internal)	Loss of material	Water Chemistry Control			H, I, 1

Table 3.3.2-6
Heating, Ventilation, and Air Conditioning Systems
Summary of Aging Management Evaluation

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F3.1-a VII.F4.1-a	3.3.1-5	A
			Condensation (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F3.1-a VII.F4.1-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F4.1-a	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
			Condensation (external)	None	None			F
			Outdoor air (external)	None	None			F

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Compressor casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Freon (internal)	None	None			J
Damper housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F3.1-a VII.F4.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F3.1-a VII.F4.1-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F4.1-a	3.3.1-5	A

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Dryer	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Freon (internal)	None	None			G
		Copper alloy	Condensation (external)	Loss of material	Preventive Maintenance	VII.F1.2-a	3.3.1-5	A
			Freon (internal)	None	None			G

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Ductwork	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F3.1-a VII.F4.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F3.1-a VII.F4.1-a	3.3.1-5	A
			Condensation (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F3.1-a VII.F4.1-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F4.1-a	3.3.1-5	A

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fan housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F4.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a VII.F4.1-a	3.3.1-5	A
			Condensation (external)	Loss of material	System Walkdown	VII.F1.1-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VII.F2.1-a	3.3.1-5	C
		Elastomer	Air (external)	Change in material properties	Preventive Maintenance	VII.F4.1-b	3.3.1-2	A
				Cracking	Preventive Maintenance	VII.F4.1-b	3.3.1-2	A
			Air (internal)	Change in material properties	Preventive Maintenance	VII.F4.1-b	3.3.1-2	A
				Cracking	Preventive Maintenance	VII.F4.1-b	3.3.1-2	A

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.F4.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.F4.1-a	3.3.1-5	A
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Condensation (internal)	Loss of material	Heat Exchanger Monitoring			3
			Freon (internal)	None	None			J
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17	D
			Treated water (internal)	Loss of material	Water Chemistry Control	VII.F1.3-a	3.3.1-15	D

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Heat transfer	Copper alloy	Condensation (external)	Fouling	Preventive Maintenance			H
					Service Water System Reliability			H
			Freon (external)	None	None			G
			Freon (internal)	None	None			G
			Raw water (fresh) (external)	Fouling	Service Water System Reliability	VII.C1.1-a	3.3.1-17	D
			Raw water (fresh) (internal)	Fouling	Service Water System Reliability	VII.C1.3-a	3.3.1-17	B
			Treated water (external)	Fouling	Water Chemistry Control			G
		Stainless steel	Condensation (external)	Fouling	Preventive Maintenance			F
			Treated water (internal)	Fouling	Water Chemistry Control			F

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes) (continued)	Pressure boundary	Copper alloy	Condensation (external)	Loss of material	Preventive Maintenance	VII.F1.2-a	3.3.1-5	A
					Service Water System Reliability	VII.F1.2-a	3.3.1-5	A
				Loss of material – wear	Heat Exchanger Monitoring			H
			Freon (external)	Loss of material – wear	Heat Exchanger Monitoring			G
			Freon (internal)	None	None			G
			Raw water (fresh) (external)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17 3.3.1-29	D E
				Loss of material – wear	Heat Exchanger Monitoring			H
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.C1.1-a	3.3.1-17 3.3.1-29	D E

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes) (continued)	Pressure boundary	Copper alloy	Treated water (external)	Loss of material – wear	Heat Exchanger Monitoring			G
				Loss of material	Water Chemistry Control			G
		Stainless steel	Condensation (external)	Loss of material	Preventive Maintenance			F
				Loss of material – wear	Heat Exchanger Monitoring			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
Heater housing	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.F1.1-a	3.3.1-5	C
			Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Carbon steel	Freon (internal)	None	None			G
			Raw water (fresh) (internal)	Loss of material	System Testing	VII.C1.1-a	3.3.1-17	E
		Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
			Condensation (external)	None	None			F
			Freon (internal)	None	None			F
		Stainless steel	Air (external)	None	None			F
			Condensation (external)	None	None			F
			Raw water (fresh) (internal)	Loss of material	System Testing	VII.C1.1-a	3.3.1-17	E
			Treated water (internal)	Loss of material	Water Chemistry Control			F

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Cast iron	Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Sight glass	Pressure boundary	Glass	Condensation (external)	None	None			J
			Freon (internal)	None	None			J
			Treated water (internal)	None	None			J
Sight glass housing	Pressure boundary	Copper alloy	Condensation (external)	None	None			3
			Freon (internal)	None	None			J
		Stainless steel	Condensation (external)	None	None			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tank	Pressure boundary	Stainless steel	Condensation (external)	None	None			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Test canister housing	Pressure boundary	Copper alloy	Air (external)	None	None			3
			Air (internal)	None	None			3
Thermowell	Pressure boundary	Stainless steel	Condensation (external)	None	None			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Tubing	Pressure boundary	Copper alloy	Condensation (external)	Loss of material	Preventive Maintenance	VII.F2.2-a	3.3.1-5	C
			Freon (internal)	None	None			G
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown			G
			Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Carbon steel	Freon (internal)	None	None			G
			Raw water (fresh) (internal)	Loss of material	System Testing	VII.C1.2-a	3.3.1-17	E
		Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
			Condensation (external)	Loss of material	Preventive Maintenance			F
				None	None			F
			Freon (internal)	None	None			G

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
			Condensation (external)	None	None			F
			Raw water (fresh) (internal)	Loss of material	System Testing	VII.C1.2-a	3.3.1-17	E
			Treated water (internal)	Loss of material	Water Chemistry Control			F
Ventilation unit housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.F1.1-a VII.F2.1-a	3.3.1-5	A
			Condensation (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-6: Heating, Ventilation, And Air Conditioning Systems (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Ventilation unit housing (continued)	Pressure boundary	Elastomer	Air (internal)	Change in material properties	Preventive Maintenance	VII.F1.1-b	3.3.1-2	A
				Cracking	Preventive Maintenance	VII.F1.1-b	3.3.1-2	A
			Condensation (external)	Change in material properties	Preventive Maintenance	VII.F1.1-b	3.3.1-2	A
				Cracking	Preventive Maintenance	VII.F1.1-b	3.3.1-2	A
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F

Table 3.3.2-7
Fire Protection System
Summary of Aging Management Evaluation

Table 3.3.2-7: Fire Protection System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
				Loss of mechanical closure integrity	Bolting and Torquing Activities			H
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F
				None	None			F
Expansion joint	Pressure boundary	Elastomer	Air (external)	Change in material properties	Fire Protection			F
				Cracking	Fire Protection			F
			Treated water (internal)	Change in material properties	Fire Protection			F
				Cracking	Fire Protection			F

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Fire Protection	VII.H2.3-a	3.3.1-5	C
		Copper alloy	Air (internal)	None	None			G
Fittings	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Fire Protection			G
			Carbon dioxide (internal)	None	None			G
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.G.8-a	3.3.1-22	E
			Lube oil and borated water leakage (external)	Loss of material	Boric Acid Corrosion Prevention	VII.I.1-a	3.3.1-14	A
					System Walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil and borated water leakage (internal)	Loss of material	Boric Acid Corrosion Prevention	VII.G.7-b	3.3.1-6	E
					Preventive Maintenance	VII.G.7-b	3.3.1-6	E

Table 3.3.2-7: Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fittings (continued)	Pressure boundary	Carbon steel	Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G
		Cast iron	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Fire Protection			G
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G
		Copper alloy	Air (external)	None	None			G
			Air (internal)	None	None			G
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			G
			Treated water (internal)	Loss of material	Fire Protection			G

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flange	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			H
				Loss of material	Fire Protection	VII.H2.4-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G
		Cast iron	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G
Flex hose	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			H
				Loss of material	Fire Protection	VII.H2.4-a	3.3.1-5	A

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flex hose (continued)	Pressure boundary	Elastomer	Air (external)	Change in material properties	Fire Protection			F
				Cracking	Fire Protection			F
			Air (internal)	Change in material properties	Fire Protection			F
				Cracking	Fire Protection			F
			Fuel oil (internal)	Change in material properties	Fire Protection			F
				Cracking	Fire Protection			F
			Lube oil (internal)	Change in material properties	Fire Protection			F
				Cracking	Fire Protection			F
			Treated water (internal)	Change in material properties	Fire Protection			F
				Cracking	Fire Protection			F
		Stainless steel	Air (external)	None	None			G
			Air (internal)	None	None			G

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			3
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	Fire Protection			3
		Cast iron	Lube oil (internal)	Loss of material	Oil Analysis			3

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes)	Heat transfer	Copper alloy	Lube oil (external)	Fouling	Oil Analysis			3
			Treated water (external)	Fouling	Fire Protection			3
			Treated water (internal)	Fouling	Fire Protection			3
	Pressure boundary	Copper alloy	Lube oil (external)	Loss of material – wear	Fire Protection			3
				Loss of material	Oil Analysis			3
			Treated water (external)	Loss of material – wear	Fire Protection			3
				Loss of material	Fire Protection			3
			Treated water (internal)	Loss of material	Fire Protection			3
Heater housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			3

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Hydrant	Pressure boundary	Cast iron	Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G
Level glass gauge	Pressure boundary	Glass	Air (external)	None	None			J
			Fuel oil (internal)	None	None			J
Orifice	Flow control and pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			3
	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			3
Piping	Pressure boundary	Aluminum	Air (external)	None	None			F
			Air (internal)	None	None			F

Table 3.3.2-7: Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Fire Protection	VII.H2.2-a	3.3.1-5	C
			Carbon dioxide (internal)	None	None			G
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			H
				Loss of material	Fire Protection	VII.H2.4-a	3.3.1-5	C
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.G.8-a	3.3.1-22	E
			Lube oil (external)	Loss of material	Oil Analysis			G
			Lube oil (internal)	Cracking – fatigue	TLAA - Metal Fatigue			G
				Loss of material	Oil Analysis			G
			Lube oil and borated water leakage (external)	Loss of material	Boric Acid Corrosion Prevention	VII.I.1-a	3.3.1-14	A
					System Walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-7: Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Carbon steel	Lube oil and borated water leakage (internal)	Loss of material	Boric Acid Corrosion Prevention	VII.G.7-b	3.3.1-6	E
					Preventive Maintenance	VII.G.7-b	3.3.1-6	E
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G
		Cast iron	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Fire Protection	VII.H2.2-a	3.3.1-5	C
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Soil (external)	Loss of material	Fire Protection			G
			Treated water (internal)	Loss of material	Fire Protection			G
		Copper alloy	Air (external)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.G.8-a	3.3.1-22	E
			Lube oil (external)	Loss of material	Oil Analysis			G
			Lube oil (internal)	Loss of material	Oil Analysis			G
			Treated water (internal)	Loss of material	Fire Protection			G
Silencer	Pressure boundary	Carbon steel	Air (external)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking - fatigue	TLAA - Metal Fatigue			3
				Loss of material	Fire Protection	VII.H2.4-a	3.3.1-5	C
Spray nozzles	Pressure boundary	Aluminum	Air (external)	None	None			F
			Air (internal)	None	None			F

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Spray nozzles (continued)	Pressure boundary	Aluminum	Treated water (internal)	Loss of material	Fire Protection			F
		Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown			G
			Treated water (internal)	Loss of material	Fire Protection			G
		Copper alloy	Air (external)	None	None			G
			Air (internal)	None	None			G
			Treated water (internal)	Loss of material	Fire Protection			G
Strainer	Filtration	Stainless steel	Treated water (internal)	Loss of material	Fire Protection			G
Strainer housing	Pressure boundary	Cast iron	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G

Table 3.3.2-7: Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Fire Protection	VII.H2.2-a	3.3.1-5	C
					Preventive Maintenance	VII.H2.2-a	3.3.1-5	C
			Carbon dioxide (internal)	None	None			J
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H1.4-a	3.3.1-7	D
			Halon (internal)	None	None			J
			Lube oil and borated water leakage (internal)	Loss of material	Boric Acid Corrosion Prevention	VII.G.7-a	3.3.1-6	E
					Preventive Maintenance	VII.G.7-a	3.3.1-6	E
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Soil (external)	Loss of material	Fire Protection			3
			Treated water (internal)	Loss of material	Fire Protection			3

Table 3.3.2-7: Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Fire Protection	VII.H2.2-a	3.3.1-5	C
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.G.8-a	3.3.1-22	E
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire Protection			G
		Copper alloy	Air (external)	None	None			G
			Carbon dioxide (external)	None	None			G
			Freon (internal)	None	None			G
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			G
			Treated water (internal)	Loss of material	Fire Protection			G
Valve	Pressure boundary	Cast iron	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-7: Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Cast iron	Treated water (internal)	Loss of material	Fire Protection			G
		Copper alloy	Air (external)	None	None			G
			Air (internal)	None	None			G
			Carbon dioxide (internal)	None	None			G
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			G
			Lube oil and borated water leakage (external)	Loss of material	Boric Acid Corrosion Prevention	VII.G.7-b	3.3.1-6	E
					System Walkdown	VII.G.7-b	3.3.1-6	E
			Lube oil and borated water leakage (internal)	Loss of material	Boric Acid Corrosion Prevention	VII.G.7-b	3.3.1-6	E
					Preventive Maintenance	VII.G.7-b	3.3.1-6	E
			Treated water (internal)	Loss of material	Fire Protection			G

Table 3.3.2-8
Emergency Diesel Generator
Summary of Aging Management Evaluation

Table 3.3.2-8: Emergency Diesel Generator

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.H1.2-a VII.H1.3-a VII.I.1-b	3.3.1-5	A
						VII.I.2-a	3.3.1-24	E
				Loss of mechanical closure integrity	Bolting and Torquing Activities	VII.I.2-b	3.3.1-24	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F
				None	None			F
Compressor	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.3-a	3.3.1-5	C
				Loss of material - wear	Preventive Maintenance			H

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Compressor (continued)	Pressure boundary	Carbon steel	Exhaust gas (internal)	Cracking - fatigue	TLAA - Metal Fatigue			H
				Loss of material	Preventive Maintenance	VII.H2.4-a	3.3.1-5	C
			Lube oil (internal)	Loss of material	Preventive Maintenance			G
Dryer	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a	3.3.1-5	C
			Condensation (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a	3.3.1-5	C
Expansion joint	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking - fatigue	TLAA - Metal Fatigue			H
				Loss of material	Preventive Maintenance	VII.H2.4-a	3.3.1-5	A

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.3-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			3
		Copper alloy	Air (external)	None	None			3
			Air (internal)	None	None			3
Fittings	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a VII.H2.3-a	3.3.1-5	A
			Exhaust gas (internal)	Loss of material	Preventive Maintenance	VII.H2.4-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fittings (continued)	Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Oil Analysis			G
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability	VII.H2.1-b	3.3.1-17	B
			Soil (external)	Loss of material	Buried Piping Inspection	VII.H1.1-b	3.3.1-18	B
			Treated water (internal)	Loss of material	Water Chemistry Control			G

Table 3.3.2-8: Emergency Diesel Generator (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fittings (continued)	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F
			Lube oil (internal)	Loss of material	Oil Analysis			F
			Raw water (fresh) (internal)	Loss of material	Service Water System Reliability			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F
			Lube oil (internal)	Cracking	Oil Analysis			F
				Loss of material	Oil Analysis			F

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fittings (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Cracking	Preventive Maintenance			F
				Loss of material	Water Chemistry Control			F
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Preventive Maintenance			F
				Cracking	Preventive Maintenance			F
			Air (internal)	Change in material properties	Preventive Maintenance			F
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.3-a	3.3.1-5	C
			Condensation (internal)	Loss of material	Preventive Maintenance	VII.H2.3-a	3.3.1-5	C
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air (external)	Fouling	Preventive Maintenance			3
			Lube oil (external)	Fouling	Oil Analysis			3
			Raw water (fresh) (internal)	Fouling	Service Water System Reliability			3
			Treated water (external)	Fouling	Water Chemistry Control			3

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes) (continued)	Heat transfer	Copper alloy	Treated water (internal)	Fouling	Water Chemistry Control			3
	Pressure boundary	Copper alloy	Air (external)	Loss of material – wear	Heat Exchanger Monitoring			3
			Lube oil (external)	Loss of material – wear	Heat Exchanger Monitoring			3
				Loss of material	Oil Analysis			3
			Raw water (fresh) (internal)	Loss of material – erosion	Service Water System Reliability			3
				Loss of material	Service Water System Reliability			3
			Treated water (external)	Loss of material – wear	Heat Exchanger Monitoring			3
				Loss of material	Water Chemistry Control			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heater housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Level glass gauge	Pressure boundary	Glass	Air (external)	None	None			J
			Treated water (internal)	None	None			J
Manifold (piping)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control			G
		Copper alloy	Air (external)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F

Table 3.3.2-8: Emergency Diesel Generator (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice	Flow control and pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance			3
	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a VII.H2.3-a	3.3.1-5	A
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			H
				Loss of material	Preventive Maintenance	VII.H2.4-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D

Table 3.3.2-8: Emergency Diesel Generator (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Oil Analysis			G
			Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Soil (external)	Loss of material	Buried Piping Inspection	VII.H1.1-b	3.3.1-18	B
			Treated water (internal)	Loss of material	Water Chemistry Control			G
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F
			Lube oil (internal)	Cracking	Oil Analysis			F
				Loss of material	Oil Analysis			F
			Treated water (internal)	Cracking	Preventive Maintenance			F
				Loss of material	Water Chemistry Control			F

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pneumatic cylinder	Pressure boundary	Copper alloy	Air (external)	None	None			3
			Air (internal)	None	None			3
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.H1.3-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Sight flow indicator	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Preventive Maintenance			3
Silencer	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.3-a	3.3.1-5	A

Table 3.3.2-8: Emergency Diesel Generator (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filtration	Stainless steel	Air (internal)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
			Lube oil (internal)	Cracking	Oil Analysis			J
				Loss of material	Oil Analysis			J
	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a VII.H2.3-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer (continued)	Pressure boundary	Stainless steel	Lube oil (internal)	Cracking	Oil Analysis			J
			Treated water (internal)	Cracking	Preventive Maintenance			3
				Loss of material	Water Chemistry Control			3
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.H1.4-b	3.3.1-23	E
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H1.4-a VII.H2.5-a	3.3.1-7	B
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Soil (external)	Loss of material	Buried Piping Inspection	VII.H1.1-b	3.3.1-18	B
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a VII.H2.3-a	3.3.1-5	A
		Stainless steel	Air (external)	None	None			3
			Lube oil (internal)	Cracking	Oil Analysis			J
				Loss of material	Oil Analysis			J
			Treated water (internal)	Cracking	Preventive Maintenance			3
				Loss of material	Water Chemistry Control			3
Trap	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a	3.3.1-5	A
Tubing	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing (continued)	Pressure boundary	Copper alloy	Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F
			Lube oil (internal)	Loss of material	Oil Analysis			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F
			Lube oil (internal)	Cracking	Oil Analysis			F
				Loss of material	Oil Analysis			F
			Treated water (internal)	Cracking	Preventive Maintenance			F
				Loss of material	Water Chemistry Control			F

Table 3.3.2-8: Emergency Diesel Generator (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.H1.2-a	3.3.1-5	A
			Air (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a VII.H2.3-a	3.3.1-5	A
			Condensation (internal)	Loss of material	Preventive Maintenance	VII.H2.2-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			G
			Treated water (internal)	Loss of material	Preventive Maintenance			G
					Water Chemistry Control			G
		Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F

Table 3.3.2-8: Emergency Diesel Generator (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Copper alloy	Lube oil (internal)	Loss of material	Oil Analysis			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			F
			Lube oil (internal)	Loss of material	Oil Analysis			F
			Treated water (internal)	Cracking	Preventive Maintenance			F
				Loss of material	Water Chemistry Control			F

Table 3.3.2-9
Security Diesel
Summary of Aging Management Evaluation

Table 3.3.2-9: Security Diesel								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b VII.I.2-a	3.3.1-5 3.3.1-24	A E
				Loss of mechanical closure integrity	Bolting and Torquing Activities	VII.I.2-b	3.3.1-24	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F
Compressor casing	Pressure boundary	Carbon steel	Air (external)	Cracking - fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Testing	VII.H2.4-a	3.3.1-5	C

Table 3.3.2-9: Security Diesel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Expansion joint	Pressure boundary	Carbon steel	Air (external)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Testing	VII.H2.4-a	3.3.1-5	C
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.H2.3-a	3.3.1-5	C
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			3
		Copper alloy	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fittings	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Testing	VII.H2.3-a	3.3.1-5	C
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Soil (external)	Loss of material	System Testing	VII.H1.1-b	3.3.1-18	E
			Treated water (internal)	Loss of material	Water Chemistry Control			3
		Copper alloy	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
			Soil (external)	Loss of material	System Testing			J
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fittings (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
			Soil (external)	Loss of material	System Testing			J
Flange	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Preventive Maintenance			3
				Cracking	Preventive Maintenance			3
			Fuel oil (internal)	Change in material properties	Preventive Maintenance			J
				Cracking	Preventive Maintenance			J
			Treated water (internal)	Change in material properties	Preventive Maintenance			J
				Cracking	Preventive Maintenance			J
		Stainless steel	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil Analysis			3
		Copper alloy	Air (external)	None	None			3
			Treated water (internal)	Loss of material	System Testing			3
Heat exchanger (tubes)	Heat transfer	Copper alloy	Lube oil (external)	Fouling	System Testing			3
			Treated water (external)	Fouling	System Testing			3
			Treated water (internal)	Fouling	System Testing			3
	Pressure boundary	Copper alloy	Lube oil (external)	Loss of material - wear	System Testing			3
				Loss of material	Oil Analysis			3

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (tubes) (continued)	Pressure boundary	Copper alloy	Treated water (external)	Loss of material - wear	System Testing			3
				Loss of material				
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Heater housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Piping	Pressure boundary	Carbon steel	Air (external)	Cracking - fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.H2.3-a	3.3.1-5	C
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Testing	VII.H2.4-a	3.3.1-5	C
			Lube oil (internal)	Loss of material	Oil Analysis			3

Table 3.3.2-9: Security Diesel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Carbon steel	Outdoor air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Soil (external)	Loss of material	System Testing	VII.H1.1-b	3.3.1-18	E
			Treated water (internal)	Loss of material	Water Chemistry Control			3
		Stainless steel	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
			Soil (external)	Loss of material	System Testing			J
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (external)	Loss of material	Oil Analysis			3
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing (continued)	Pressure boundary	Copper alloy	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
Silencer	Pressure boundary	Carbon steel	Air (external)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Testing	VII.H2.4-a	3.3.1-5	C
Strainer	Filtration	Stainless steel	Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
				Cracking				
			Lube oil (internal)	Loss of material	Oil Analysis			J
				Cracking				

Table 3.3.2-9: Security Diesel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			3
		Copper alloy	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.H1.4-b	3.3.1-23	E
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a VII.H1.4-a	3.3.1-7	D
			Soil (external)	Loss of material	System Testing	VII.H1.1-b	3.3.1-18	E
			Treated water (internal)	Loss of material	Water Chemistry Control			3
Thermowell	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Carbon steel	Air (external)	Cracking – fatigue	TLAA - Metal Fatigue			3
				Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System Walkdown	VII.H2.3-a	3.3.1-5	C
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (internal)	Loss of material	Oil Analysis			3
			Soil (external)	Loss of material	System Testing	VII.H1.1-b	3.3.1-18	E
			Treated water (internal)	Loss of material	Water Chemistry Control			3
		Copper alloy	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J
			Treated water (internal)	Loss of material	Water Chemistry Control			3

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing (continued)	Pressure boundary	Elastomer	Air (external)	Change in material properties	Preventive Maintenance			3
				Cracking	Preventive Maintenance			3
			Fuel oil (internal)	Change in material properties	Preventive Maintenance			J
				Cracking	Preventive Maintenance			J
		Stainless steel	Air (external)	None	None			3
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J

Table 3.3.2-9: Security Diesel (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (external)	Loss of material	Oil Analysis			3
			Lube oil (internal)	Loss of material	Oil Analysis			3
		Stainless steel	Air (external)	None	None			3
			Fuel oil (external)	Loss of material	Diesel Fuel Monitoring			J
			Fuel oil (internal)	Loss of material	Diesel Fuel Monitoring			J

Table 3.3.2-10
Post-Accident Containment Hydrogen Monitoring System
Summary of Aging Management Evaluation

Table 3.3.2-10: Post-Accident Containment Hydrogen Monitoring System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Analyzer body	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Air (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
		Stainless steel	Air (external)	None	None			3
Filter	Filtration	Stainless steel	Air (external)	None	None			3
			Air (internal)	None	None			3
Fittings	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VII.I.1-b	3.3.1-5	A
			Oxygen (internal)	None	None			J

Table 3.3.2-10: Post-Accident Containment Hydrogen Monitoring System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Preventive Maintenance			3
				Cracking	Preventive Maintenance			3
			Oxygen (internal)	Change in material properties	Preventive Maintenance			J
				Cracking	Preventive Maintenance			J
Heat exchanger	Heat transfer	Stainless steel	Air (external)	None	None			3
			Air (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
				None	None			3
	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Air (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
				None	None			3

Table 3.3.2-10: Post-Accident Containment Hydrogen Monitoring System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Moisture separator	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Air (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
Orifice	Flow control pressure boundary	Stainless steel	Air (external)	None	None			3
			Air (internal)	Cracking – fatigue	TLAA - Metal Fatigue			3
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Air (internal)	None	None			3
			Hydrogen and nitrogen (internal)	None	None			J
			Oxygen (internal)	None	None			J
Pump casing	Pressure boundary	Stainless steel	Air (external)	None	None			3
			Air (internal)	None	None			3

Table 3.3.2-10: Post-Accident Containment Hydrogen Monitoring System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Brass	Air (external)	None	None			J
			Oxygen (internal)	None	None			J
		Stainless steel	Air (external)	None	None			3
			Air (internal)	Cracking - fatigue	TLAA - Metal Fatigue			3
				None	None			3
			Hydrogen and nitrogen (internal)	None	None			J
			Oxygen (internal)	None	None			J

Table 3.3.2-11
Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)
Summary of Aging Management Evaluation

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric Acid Corrosion Prevention			2
					System Walkdown			2
				Loss of mechanical closure integrity	Bolting and Torquing Activities			2
					Boric Acid Corrosion Prevention			2
					System Walkdown			2
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			2
				None	None			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Condenser shell	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
Evaporator housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
Filter housing	Pressure boundary	Stainless steel	Air (external)	None	None			2
		Stainless steel	Untreated water with boron (internal)	Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flex hose	Pressure boundary	Stainless steel	Air (external)	None	None			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2
Heat exchanger (shell)	Pressure boundary	Copper alloy	Air (external)	None	None			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
Heater coil	Pressure boundary	Copper alloy	Air (external)	None	None			2
			Steam >270°F (internal)	Cracking – fatigue	System Walkdown			2
				Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heater housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
Level glass gauge	Pressure boundary	Glass	Air (external)	None	None			2
			Treated water (internal)	None	None			2
			Untreated water (internal)	None	None			2
			Untreated water with boron (internal)	None	None			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Manifold (piping)	Pressure boundary	Copper alloy	Air (external)	None	None			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
		Stainless steel	Air (external)	None	None			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Manifold (piping) (continued)	Pressure boundary	Stainless steel	Treated (borated) water (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2
Orifice	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice (continued)	Pressure boundary	Carbon steel	Untreated water (internal)	Loss of material	System Walkdown			2
		Stainless steel	Air (external)	None	None			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Steam >270°F (internal)	Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
				Loss of material - erosion	Flow-Accelerated Corrosion			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Copper alloy	Air (external)	None	None			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
		Stainless steel	Air (external)	None	None			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Steam >270°F (internal)	Cracking – fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
				Loss of material – erosion	Flow-Accelerated Corrosion			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Stainless steel	Treated (borated) water (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
			Untreated water with boron (internal)	Cracking	System Walkdown			2
				Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
		Cast iron	Air (external)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
		Stainless steel	Air (external)	None	None			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Treated (borated) water (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing (continued)	Pressure boundary	Stainless steel	Treated (borated) water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2
Strainer housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
		Cast iron	Air (external)	Loss of material	System Walkdown			2
			Steam >270°F (internal)	Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Strainer housing (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			2
			Untreated water (internal)	Loss of material	System Walkdown			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tank (continued)	Pressure boundary	Carbon steel (coated)	Air (external)	Loss of material	System Walkdown			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2
		Molded plastic	Air (external)	Change in material properties	System Walkdown			2
				Cracking	System Walkdown			2
			Treated water (internal)	Change in material properties	System Walkdown			2
				Cracking	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tank (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Treated (borated) water (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermowell	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
		Stainless steel	Air (external)	None	None			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell (continued)	Pressure boundary	Stainless steel	Treated (borated) water (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
Trap	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Steam >270°F (internal)	Cracking – fatigue	System Walkdown			2
				Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Copper alloy	Air (external)	None	None			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
		Stainless steel	Air (external)	None	None			2
			Treated borated water > 270°F (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Treated (borated) water (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Treated water >270°F (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing (continued)	Pressure boundary	Stainless steel	Untreated water > 270°F (internal)	Cracking	System Walkdown			2
				Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
			Untreated water with boron (internal)	Cracking	System Walkdown			2
				Loss of material	System Walkdown			2
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Steam >270°F (internal)	Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
				Loss of material - erosion	Flow-Accelerated Corrosion			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
		Copper alloy	Air (external)	None	None			2
			Raw water (fresh) (internal)	Loss of material	System Walkdown			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			2
			Treated borated water > 270°F (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Treated water (internal)	Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Treated (borated) water (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2

Table 3.3.2-11: Miscellaneous Systems in Scope for 10 CFR 54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Treated water >270°F (internal)	Cracking	System Walkdown			2
					Water Chemistry Control			2
				Cracking – fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
					Water Chemistry Control			2
			Untreated water (internal)	Loss of material	System Walkdown			2
			Untreated water > 270°F (internal)	Cracking	System Walkdown			2
				Cracking - fatigue	System Walkdown			2
				Loss of material	System Walkdown			2
			Untreated water with boron (internal)	Loss of material	System Walkdown			2
Ventilation unit housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown			2
			Air (internal)	Loss of material	System Walkdown			2

Notes for Tables 3.3.2-1 through 3.3.2-11

Generic notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with material, environment, and aging effect for NUREG-1801 line item but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes

1. The temperature is below the threshold for both fatigue and cracking. However, loss of material due to pitting, crevice corrosion, and MIC is an aging effect requiring management.

2. These are nonsafety-related components with the potential to impact a safety function. Comparisons between these aging management review results and those of NUREG-1801 have not been made.
3. The component is not evaluated in NUREG-1801 and one or more attributes (material, environment, or aging effect) of reasonable substitute components are inconsistent, so Notes C, D, and E do not apply

3.4 STEAM AND POWER CONVERSION SYSTEMS

3.4.1 Introduction

This section provides the AMR results for components in the steam and power conversion systems. The following systems are addressed below in Subsections 3.4.2.1.1 through 3.4.2.1.4:

- Main feedwater system (Section 2.3.4.1)
- Main steam system (Section 2.3.4.2)
- Auxiliary feedwater system (Section 2.3.4.3)
- Blowdown system (Section 2.3.4.4)

Table 3.4.1, Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the steam and power conversion system component group. Hyperlinks to the program evaluations in Appendix B are provided in the CD-ROM version of this application.

3.4.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for systems in the steam and power conversion system group:

- Table 3.4.2-1 Main Feedwater System — Summary of Aging Management Evaluation
- Table 3.4.2-2 Main Steam System — Summary of Aging Management Evaluation
- Table 3.4.2-3 Auxiliary Feedwater System — Summary of Aging Management Evaluation
- Table 3.4.2-4 Blowdown System — Summary of Aging Management Evaluation

3.4.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the steam and power conversion systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.4.2.1.1 Main Feedwater System

Materials

Main feedwater system components are constructed of the following materials:

- Carbon steel
- Stainless steel

Environment

Main feedwater system components are exposed to the following environments:

- Air
- Treated water >270°F

Aging Effects Requiring Management

The following aging effects associated with the main feedwater system require management:

- Cracking
- Cracking - fatigue
- Loss of material
- Loss of mechanical closure integrity

Aging Management Programs

The following programs will manage the aging effects for the main feedwater system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- System Walkdown
- Water Chemistry Control

3.4.2.1.2 Main Steam System

Materials

Main steam system components are constructed of the following materials:

- Carbon steel
- Inconel
- Stainless steel

Environment

Main steam system components are exposed to the following environments:

- Air
- Steam >270°F
- Treated water >270°F

Aging Effects Requiring Management

The following aging effects associated with the main steam system require management:

- Cracking
- Cracking - fatigue
- Loss of material
- Loss of mechanical closure integrity

Aging Management Programs

The following programs will manage the aging effects for the main steam system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- System Testing

- System Walkdown
- Water Chemistry Control

3.4.2.1.3 Auxiliary Feedwater System

Materials

Auxiliary feedwater system components are constructed of the following materials:

- Carbon steel
- Cast iron
- Copper alloy
- Elastomer
- Glass
- Stainless steel

Environment

Auxiliary feedwater system components are exposed to the following environments:

- Air
- Concrete
- Lube oil
- Steam >270°F
- Treated water
- Treated water >270°F

A small number of auxiliary feedwater system components are exposed to outdoor environments. Indoor air and outdoor air have been identified separately but have been treated the same.

The condensate storage tank is evaluated as part of the auxiliary feedwater system. The tank is located outdoors and the bottom of this tank is exposed to concrete.

Aging Effects Requiring Management

The following aging effects associated with the auxiliary feedwater system require management:

- Change in material properties
- Cracking
- Cracking - fatigue
- Fouling
- Loss of material
- Loss of material - wear
- Loss of mechanical closure integrity

Aging Management Programs

The following programs will manage the aging effects for the auxiliary feedwater system components:

- Bolting and Torquing Activities
- Heat Exchanger Monitoring
- Oil Analysis
- Preventive Maintenance
- System Walkdown
- Wall Thinning Monitoring
- Water Chemistry Control

3.4.2.1.4 Blowdown System

Materials

Blowdown system components are constructed of the following materials:

- Carbon steel
- Stainless steel

Environment

Blowdown system components are exposed to the following environments:

- Air
- Treated water >270°F

Aging Effects Requiring Management

The following aging effects associated with the blowdown system require management:

- Cracking
- Cracking - fatigue
- Loss of material
- Loss of material - erosion
- Loss of mechanical closure integrity

Aging Management Programs

The following programs will manage the aging effects for the blowdown system components:

- Bolting and Torquing Activities
- Flow-Accelerated Corrosion
- System Walkdown
- System Testing
- Water Chemistry Control

3.4.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation by the NRC reviewer is necessary for certain aging effects, particularly those that require plant-specific programs or those that involve TLAAs. Section 3.4.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain I&M's approach to addressing the areas requiring further evaluation. Programs are described in Appendix B to this application.

3.4.2.2.1 Cumulative Fatigue Damage

The analysis of fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed in Section 4.3 of this application.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation of managing loss of material due to general, pitting, and crevice corrosion. For the components for which this evaluation is required, the Water Chemistry Control Program will minimize loss of material. The Wall Thinning Monitoring Program will supplement chemistry control for the auxiliary feedwater system. The Water Chemistry Control – Chemistry One-Time Inspection Program will address the one-time inspection recommendation of NUREG-1801.

3.4.2.2.3 Loss of Material due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

This paragraph of NUREG-1800 discusses the loss of material in carbon steel piping and fittings for untreated water from the backup water supply in the PWR auxiliary feedwater system. The portion of the lines from the essential service water (ESW) system to the auxiliary feedwater system that are exposed to untreated water are addressed as part of the ESW system. See Item Number 3.3.1-17 in Table 3.3.1 of this application.

3.4.2.2.4 General Corrosion

Loss of material due to general corrosion could occur on the external surfaces of all carbon steel structures and components, including closure bolting. This aging effect will be managed by the System Walkdown Program for carbon steel components and bolting exposed to indoor and outdoor environments.

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

1) Loss of material due to general corrosion, pitting and crevice corrosion, and MIC could occur in carbon steel components exposed to lubricating oil in the

auxiliary feedwater system. The Oil Analysis Program will manage loss of material.

2) This paragraph of NUREG-1800, which discusses the loss of material in underground piping and fittings and storage tanks, is not applicable. There are no buried components subject to aging management review for the steam and power conversion system.

3.4.2.2.6 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The CNP Corrective Action Program applies to both safety-related and nonsafety-related structures and components. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing CNP Document Control Program in accordance with the Quality Assurance Program Description (QAPD). See Section B.0.3 of this application for further discussion.

3.4.2.3 Time-Limited Aging Analysis

The only TLAA identified for steam and power conversion system components is metal fatigue. This is evaluated in Section 4.3.

3.4.3 Conclusion

Steam and power conversion system components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). The aging management programs selected to manage aging effects for steam and power conversion system components are identified in the following tables and in Section 3.4.2.1. A description of these aging management programs is provided in Appendix B of this application, along with the demonstration that identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with steam and power conversion system components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.4.1
Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801

Table 3.4.1 Steam and Power Conversion System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-1	Piping and fittings in main feedwater line, steam line and auxiliary feedwater (AFW) piping (PWR only)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800 Subsection 3.4.2.2.1)	Consistent with NUREG-1801. This TLAA is further evaluated in Section 4.3 of this application.
3.4.1-2	Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800 Subsection 3.4.2.2.2)	Consistent with NUREG-1801. The Water Chemistry Control Program will minimize loss of material. The Wall Thinning Monitoring Program will supplement chemistry control for the AFW system. For further evaluation, see Section 3.4.2.2.2 of this application.

Table 3.4.1 Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-3	AFW piping	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.4.2.2.3)	The portion of the lines from the ESW system to the AFW system that are exposed to untreated water are addressed as part of the ESW system.
3.4.1-4	Oil coolers in AFW system (lubricating oil side possibly contaminated with water)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.4.2.2.5.1)	Consistent with NUREG-1801. The Oil Analysis Program will manage loss of material. For further evaluation, see Section 3.4.2.2.5 of this application.
3.4.1-5	External surface of carbon steel components	Loss of material due to general corrosion	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.4.2.2.4)	Consistent with NUREG-1801. The System Walkdown Program will manage loss of material.

Table 3.4.1 Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-6	Carbon steel piping and valve bodies	Wall thinning due to Flow-Accelerated Corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801 for main feedwater, main steam, and blowdown systems. The Flow-Accelerated Corrosion Program will manage loss of material. Flow-accelerated corrosion is not an applicable aging mechanism for AFW system components because the steam generators do not include preheaters (NUREG-1801, Vol. 2, Table VIII.G, Item G.1-a) and the system is not subjected to continuous high-flow conditions.
3.4.1-7	Carbon steel piping and valve bodies in main steam system	Loss of material due to pitting and crevice corrosion	Water chemistry	No	Consistent with NUREG-1801. The Water Chemistry Control Program will minimize loss of material. The Wall Thinning Monitoring Program will supplement chemistry control for the AFW system.

Table 3.4.1 Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-8	Closure bolting in high-pressure or high-temperature systems	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC.	Bolting integrity	No	Different programs than the NUREG-1801 bolting integrity program are used. The System Walkdown Program will supplement Bolting and Torquing Activities Program to maintain bolting integrity.
3.4.1-9	Heat exchangers and coolers/ condensers serviced by open-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	No	Not applicable. The only heat exchangers subject to aging management review for the steam and power conversion system are the AFW system lube oil and hydraulic control oil coolers, which are cooled by the process fluid (condensate).
3.4.1-10	Heat exchangers and coolers/ condensers serviced by closed-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-cycle cooling water system	No	Not applicable. The only heat exchangers subject to aging management review for the steam and power conversion system are the AFW system lube oil and hydraulic control oil coolers, which are cooled by the process fluid (condensate).

Table 3.4.1 Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-11	External surface of aboveground condensate storage tank	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Aboveground carbon steel tanks	No	Not applicable. The condensate storage tanks are stainless steel.
3.4.1-12	External surface of buried condensate storage tank and AFW piping	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	No Yes, detection of aging effects and operating experience are to be further evaluated (see NUREG-1800 Subsection 3.4.2.2.5.2)	Not applicable. There are no buried components subject to aging management review for the steam and power conversion system.
3.4.1-13	External surface of carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Not applicable. Components subject to aging management review for the steam and power conversion system are not exposed to leakage from systems containing boric acid.

Table 3.4.2-1
Main Feedwater System
Summary of Aging Management Evaluation

Table 3.4.2-1 Main Feedwater System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.2-a	3.4.1-8	E
				Loss of mechanical closure integrity	Bolting and Torquing Activities	VIII.H.2-b	3.4.1-8	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F

Table 3.4.2-1 Main Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.D1.1-b	3.4.1-1	A
				Loss of material	Flow-Accelerated Corrosion Water Chemistry Control	VIII.D1.1-a VIII.D1.1-c	3.4.1-6 3.4.1-2	A
		Stainless steel	Air (external)	None	None			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.4.2-1 Main Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.D1.1-b	3.4.1-1	C
				Loss of material	Flow-Accelerated Corrosion	VIII.D1.2-a	3.4.1-6	A
					Water Chemistry Control	VIII.D1.2-b	3.4.1-2	

Table 3.4.2-1 Main Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

**Table 3.4.2-2
Main Steam System
Summary of Aging Management Evaluation**

Table 3.4.2-2 Main Steam System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.2-a	3.4.1-8	E
				Loss of mechanical closure integrity	Bolting and Torquing Activities	VIII.H.2-b	3.4.1-8	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F
Manifold (piping)	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.4.2-2 Main Steam System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Orifice	Flow control Pressure boundary	Inconel insert with carbon steel safe ends in carbon steel pipe	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Steam >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			1
				Cracking	Water Chemistry Control			1
				Loss of material	System Testing			1
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Steam >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.B1.1-b	3.4.1-1	A
				Loss of material	Flow-Accelerated Corrosion Water Chemistry Control	VIII.B1.1-c VIII.B1.1-a	3.4.1-6 3.4.1-7	A
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.D1.1-b	3.4.1-1	C
				Loss of material	Water Chemistry Control	VIII.D1.1-c	3.4.1-2	C

Table 3.4.2-2 Main Steam System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Steam >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.4.2-2 Main Steam System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Steam >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.4.2-2 Main Steam System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Steam >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.B1.1-b	3.4.1-1	C
				Loss of material	Water Chemistry Control	VIII.B1.2-a	3.4.1-7	A
					Flow-Accelerated Corrosion	VIII.B1.2-b	3.4.1-6	
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.D1.1-b	3.4.1-1	C
				Loss of material	Water Chemistry Control	VIII.D1.2-b	3.4.1-2	C
					Flow-Accelerated Corrosion	VIII.D1.2-a	3.4.1-6	

Table 3.4.2-2 Main Steam System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Steam >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.4.2-3
Auxiliary Feedwater System
Summary of Aging Management Evaluation

Table 3.4.2-3: Auxiliary Feedwater System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.2-a	3.4.1-8	E
				Loss of mechanical closure integrity	Bolting and Torquing Activities	VIII.H.2-b	3.4.1-8	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F
Fittings	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Steam >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VIII.B1.1-b	3.4.1-1	C
				Loss of material	Water Chemistry Control	VIII.B1.1-a	3.4.1-7	C
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.1-c	3.4.1-2	A

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fittings (continued)	Pressure boundary	Carbon steel	Treated water >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VIII.G.1-b	3.4.1-1	A
				Loss of material	Water Chemistry Control	VIII.G.1-c	3.4.1-2	A
		Copper alloy	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
			Steam >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	C

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Governor housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil Analysis	VIII.G.5-d	3.4.1-4	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil Analysis	VIII.G.5-d	3.4.1-4	A
Heat exchanger (tubes)	Heat transfer	Copper alloy	Lube oil (external)	Fouling	Oil Analysis			F
			Treated water (internal)	Fouling	Water Chemistry Control			F
	Pressure boundary	Copper alloy	Lube oil (external)	Loss of material - wear	Heat Exchanger Monitoring			F
				Loss of material	Oil Analysis			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F

Table 3.4.2-3: Auxiliary Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manifold (piping)	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Air (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	C
Orifice	Flow control Pressure boundary	Stainless steel	Air (external)	None	None			1
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	C
	Pressure boundary	Stainless steel	Air (external)	None	None			1
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	C

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil Analysis	VIII.G.5-d	3.4.1-4	C
			Outdoor air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Steam>270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.B1.1-b	3.4.1-1	C
				Loss of material	Wall Thinning Monitoring	VIII.B1.1-a	3.4.1-7	E
					Water Chemistry Control	VIII.B1.1-a	3.4.1-7	C
		Stainless steel	Treated water (internal)	Loss of material	Wall Thinning Monitoring	VIII.G.1-c	3.4.1-2	E
					Water Chemistry Control	VIII.G.1-c	3.4.1-2	A

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Stainless steel	Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.G.1-b	3.4.1-1	A
				Loss of material	Water Chemistry Control	VIII.G.1-c	3.4.1-2	A
			Outdoor air (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	C
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil Analysis	VIII.G.5-d	3.4.1-4	C
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.2-a	3.4.1-2	A
Sight glass	Pressure boundary	Glass	Air (external)	None	None			1
			Lube oil (internal)	None	None			1
Sight glass housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil Analysis	VIII.G.5-d	3.4.1-4	C

Table 3.4.2-3: Auxiliary Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer housing	Pressure boundary	Cast iron	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.1-c	3.4.1-2	C
Tank	Pressure boundary	Elastomer	Air (external)	Change in material properties	Preventive Maintenance			F
				Cracking	Preventive Maintenance			F
			Treated water (internal)	Change in material properties	Preventive Maintenance			F
				Cracking	Preventive Maintenance			F
		Stainless steel	Concrete (external)	None	None			G
			Outdoor air (external)	None	None			G
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	A

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
			Steam >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	C

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Turbine casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Steam >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VIII.B1.1-b	3.4.1-1	C
				Loss of material	Water Chemistry Control	VIII.B1.1-a	3.4.1-7	C
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Outdoor air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Steam >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VIII.B1.1-b	3.4.1-1	C
				Loss of material	Wall Thinning Monitoring	VIII.B1.2-a	3.4.1-7	E
					Water Chemistry Control	VIII.B1.2-a	3.4.1-7	C
			Treated water (internal)	Loss of material	Wall Thinning Monitoring	VIII.G.3-a	3.4.1-2	E
					Water Chemistry Control	VIII.G.3-a	3.4.1-2	A

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Carbon steel	Treated water >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue	VIII.G.1-b	3.4.1-1	C
				Loss of material	Water Chemistry Control	VIII.G.1-c	3.4.1-2	C
		Copper alloy	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
			Treated water (internal)	Loss of material	Water Chemistry Control			F
		Stainless steel	Air (external)	None	None			F
			Outdoor air (external)	None	None			F

Table 3.4.2-3: Auxiliary Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Steam >270°F (internal)	Cracking - fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
			Treated water (internal)	Loss of material	Water Chemistry Control	VIII.G.4-b	3.4.1-2	C

Table 3.4.2-4
Blowdown System
Summary of Aging Management Evaluation

Table 3.4.2-4 Blowdown System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.2-a	3.4.1-8	E
				Loss of mechanical closure integrity	Bolting and Torquing Activities	VIII.H.2-b	3.4.1-8	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and Torquing Activities			F

Table 3.4.2-4 Blowdown System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice	Flow control Pressure boundary	Stainless steel	Air (external)	None	None			1
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			1
				Cracking	Water Chemistry Control			1
				Loss of material – erosion	System Testing			1
				Loss of material	Water Chemistry Control			1

Table 3.4.2-4 Blowdown System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.D1.1-b	3.4.1-1	C
				Loss of material	Water Chemistry Control	VIII.F.1-b	3.4.1-2	A
					Flow-Accelerated Corrosion	VIII.F.1-a	3.4.1-6	A
		Stainless steel	Air (external)	None	None			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Table 3.4.2-4 Blowdown System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System Walkdown	VIII.H.1-b	3.4.1-5	A
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue	VIII.D1.1-b	3.4.1-1	C

Table 3.4.2-4 Blowdown System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Carbon steel	Treated water >270°F (internal)	Loss of material	Flow-Accelerated Corrosion	VIII.F.2-a	3.4.1-6	A
					Water Chemistry Control	VIII.F.2-b	3.4.1-2	A
		Stainless steel	Air (external)	None	None			F
			Treated water >270°F (internal)	Cracking – fatigue	TLAA - Metal Fatigue			F
				Cracking	Water Chemistry Control			F
				Loss of material	Water Chemistry Control			F

Notes for Tables 3.4.2-1 through 3.4.2-4

Generic notes

A. Consistent with component, material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes

1. The component is not evaluated in NUREG-1801 and one or more attributes (material, environment, or aging effect) of reasonable substitute components are inconsistent so Notes C, D and E do not apply.

3.5 STRUCTURES AND COMPONENT SUPPORTS

3.5.1 Introduction

This section provides the AMR results for structural components and commodities. The following structures and commodity groups are addressed below in Subsections 3.5.2.1.1 through 3.5.2.1.5:

- Containment (Section 2.4.1)
- Auxiliary building (Section 2.4.2)
- Turbine building and screenhouse (Section 2.4.3)
- Yard structures (Section 2.4.4)
- Structural commodities (Section 2.4.5)

Table 3.5.1 provides a summary of the programs evaluated in NUREG-1801 for structures and component supports. Hyperlinks to the program evaluations in Appendix B are provided in the CD-ROM version of this application.

3.5.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for structures and component supports:

- Table 3.5.2-1 Containment – Summary of Aging Management Evaluation
- Table 3.5.2-2 Auxiliary Building – Summary of Aging Management Evaluation
- Table 3.5.2-3 Turbine Building and Screenhouse – Summary of Aging Management Evaluation
- Table 3.5.2-4 Yard Structures – Summary of Aging Management Evaluation
- Table 3.5.2-5 Structural Commodities – Summary of Aging Management Evaluation

3.5.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for structures and component supports. Programs are described in Appendix B. Further details are provided in the structure and commodities tables.

3.5.2.1.1 Containment

Materials

Containment components are constructed of the following materials:

- Cadmium-plated steel
- Carbon steel
- Concrete block
- Galvanized steel
- High-strength carbon steel
- Mylar, ventsil fabric, fiberglass
- PVC
- Reinforced concrete
- Rubber
- Stainless steel

Environment

Containment components are subject to the following environments:

- Exposed to borated water or borated ice
- Exposed to treated water
- Exposed to weather (above grade and below grade)
- Protected from weather

Aging Effects Requiring Management

The following aging effects associated with the containment require management:

- Change in material properties
- Cracking
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the containment components:

- Boric Acid Corrosion Prevention
- Containment Leakage Rate Testing
- Inservice Inspection – ASME Section XI, Subsection IWE
- Inservice Inspection – ASME Section XI, Subsection IWF
- Inservice Inspection – ASME Section XI, Subsection IWL
- Structures Monitoring
- Structures Monitoring – Crane Inspection
- Structures Monitoring – Divider Barrier Seal Inspection
- Structures Monitoring – Ice Basket Inspection
- Water Chemistry Control

3.5.2.1.2 Auxiliary Building

Materials

Auxiliary building components are constructed of the following materials:

- Block wall
- Carbon steel
- Galvanized steel
- Reinforced concrete
- Stainless steel

Environment

Auxiliary building components are subject to the following environments:

- Exposed to borated water
- Exposed to weather (includes above grade and below grade)
- Protected from weather

Aging Effects Requiring Management

The following aging effects associated with the auxiliary building require management:

- Cracking
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the auxiliary building components:

- Boric Acid Corrosion Prevention
- System Testing
- Structures Monitoring
- Structures Monitoring – Crane Inspection
- Structures Monitoring – Masonry Wall
- Water Chemistry Control

3.5.2.1.3 Turbine Building and Screenhouse

Materials

Turbine building and screenhouse components are constructed of the following materials:

- Carbon steel
- Galvanized steel
- Masonry block
- Reinforced concrete
- Sacked concrete

Environment

Turbine building and screenhouse components are subject to the following environments:

- Exposed to raw water

- Exposed to weather (above grade)
- Exposed to weather (below grade)
- Protected from weather

Aging Effects Requiring Management

The following aging effects associated with the turbine building and screenhouse require management:

- Cracking
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the turbine building and screenhouse components:

- Structures Monitoring
- Structures Monitoring – Masonry Wall

3.5.2.1.4 Yard Structures

Materials

Yard structure components are constructed of the following materials:

- Carbon steel
- Earth
- Galvanized steel
- Reinforced concrete

Environment

Yard structure components are subject to the following environments:

- Exposed to weather
- Exposed to weather (above grade)
- Exposed to weather (below grade)
- Protected from weather

Aging Effects Requiring Management

The following aging effects associated with yard structures require management:

- Change in material properties
- Loss of form
- Loss of material

Aging Management Programs

The following aging management program will manage the aging effects for yard structure components:

- Structures Monitoring

3.5.2.1.5 Structural Commodities

Materials

Structural commodities are constructed of the following materials:

- Aluminum
- Asphalt, ballast
- Carbon steel
- Elastomer
- Fiberglass
- Galvanized steel
- Mecatiss, Darmat, Thermolag, Maranite Board, Scotch brand tape (No. 77 or 7700), or Bishop No. 43A ARC fire-proofing tape
- Plastic
- PVC
- Pyrocrete
- Reinforced concrete
- Stainless steel
- Transite

Environment

Structural commodities are subject to the following environments:

- Exposed to weather (includes above grade and below grade)
- Exposed to borated water
- Protected from weather

Aging Effects Requiring Management

The following aging effects associated with structural commodities require management:

- Change in material properties
- Cracking
- Loss of material

Aging Management Programs

The following aging management programs will manage the aging effects for the structural commodities:

- Boric Acid Corrosion Prevention
- Containment Leakage Rate Testing
- Fire Protection
- Inservice Inspection – ASME Section XI, Subsection IWE
- Inservice Inspection – ASME Section XI, Subsection IWF
- Structures Monitoring
- Structures Monitoring – Crane Inspection
- Structures Monitoring – Divider Barrier Seal Inspection
- Water Chemistry Control

3.5.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects, particularly those that require plant-specific programs or involve TLAAs. Section 3.5.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered in accordance with the corresponding discussions in NUREG-1800, explain I&M's approach to addressing the areas requiring further evaluation. Programs are described in Appendix B of this application.

3.5.2.2.1 PWR Containments

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

CNP concrete structures are designed in accordance with American Concrete Institute (ACI) specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

- High cement content
- Low water-to-cement ratio
- Proper curing
- Adequate air entrainment

CNP concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same American Society for Testing and Materials (ASTM) standards for selection, application, and testing of concrete.

The CNP below-grade environment is not aggressive (pH > 5.5, chlorides < 500 parts per million (ppm), and sulfates < 1,500 ppm). CNP concrete was provided with air content between 3 percent and 6 percent. Accessible concrete has not exhibited degradation related to freeze-thaw. Therefore, loss of material and cracking due to freeze-thaw, aggressive chemical attack, and corrosion of embedded steel are not applicable for CNP concrete in inaccessible areas. The absence of concrete aging effects at CNP is confirmed under the Structures Monitoring Program.

3.5.2.2.1.2 Cracking, Distortion, and Increase in Component Stress Level due to Settlement; Reduction of Foundation Strength due to Erosion of Porous Concrete Subfoundations, if not Covered by Structures Monitoring Program

The CNP licensing basis does not credit a dewatering system. Settlement was monitored at CNP until discontinued after confirmation that significant settlement was not occurring.

Concrete within five feet of the highest known ground water level is protected by membrane waterproofing. This membrane prevents the containment building concrete from being exposed to groundwater.

CNP was not identified in Information Notice 97-11, "Cement Erosion from Containment Subfoundations at Nuclear Power Plants," as a plant susceptible to erosion of porous concrete sub-foundations. Groundwater was not aggressive during plant construction and there is no indication that groundwater chemistry has significantly changed. No documented changes in groundwater conditions have been observed at CNP.

Cracking, distortion, and increases in component stress level due to settlement and reduction of foundation strength due to erosion of porous concrete sub-foundation are not applicable to CNP concrete structures.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

During normal operation, all areas within the containment building are below 150ºF ambient temperature except for the Unit 1 pressurizer enclosure, which is at 160ºF. Several penetrations have been exposed to temperature greater than 200ºF; however, this resulted from temporary system misalignments and the effect was negligible. Therefore, change in material properties due to elevated temperature is an aging effect requiring management for the CNP containment concrete only for the pressurizer enclosure area for Unit 1, where ambient temperature exceeds 150ºF.

The Structures Monitoring Program will manage change in material properties for CNP containment concrete. The CNP aging effect "change in material properties" is equivalent to the NUREG-1801 aging effect "reduction of strength and modulus of elasticity."

3.5.2.2.1.4 Loss of Material due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate

CNP containment concrete in contact with the liner plate is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete. CNP concrete also meets requirements of later ACI guide

ACI 201.2R-77, since both documents use the same ASTM standards for selection, application, and testing of concrete. The concrete is monitored for cracks under the Structures Monitoring Program. The liner is inspected in accordance with the Inservice Inspection – ASME Section XI, Subsection IWE Program. Uncommon spills (e.g., borated water spill) are cleaned up in timely manner. As a result, for inaccessible areas (i.e., liner plate), loss of material due to corrosion is insignificant.

3.5.2.2.1.5 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Not applicable to CNP containments. The reinforced concrete containments at CNP do not use prestressed tendons.

3.5.2.2.1.6 Cumulative Fatigue Damage

TLAAs are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4 of this application. Fatigue analysis TLAAs for the containment liner plates and penetrations are evaluated as documented in Section 4.6.

3.5.2.2.1.7 Cracking due to Cyclic Loading and SCC

TLAAs are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4 of this application. Cyclic loading analyses for containment penetrations are TLAAs that are evaluated as documented in Section 4.6.

Stress corrosion cracking (SCC) is an aging effect requiring management for stainless steel containment penetrations exposed to borated water (i.e., the fuel transfer tube penetration). At CNP, Containment Leakage Rate Testing and Inservice Inspection – ASME Section XI, Subsection IWE Programs, implemented in accordance with applicable regulations, provide adequate testing and inspection methods (i.e., VT-1, VT-3) to detect cracks and manage this aging effect.

3.5.2.2.2 Class I Structures

3.5.2.2.2.1 Aging of Structures not Covered by Structures Monitoring Program

CNP concrete structures subject to aging management review are included in the Structures Monitoring Program. This is true for concrete items even if the aging management review did not identify aging effects requiring management.

Aging effects discussed below for structural steel items are also addressed by the Structures Monitoring Program. Additional discussion of specific aging effects follows.

(1) Freeze-thaw

CNP structures are designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by requiring the following:

- High cement content
- Low water-to-cement ratio
- Proper curing
- Adequate air entrainment

CNP concrete also meets requirements of later ACI guide ACI 201.2R-77, since both documents use the same ASTM standards for selection, application, and testing of concrete.

CNP concrete was provided with air content between 3 percent and 6 percent. Accessible concrete has not exhibited degradation related to freeze-thaw. Therefore, loss of material and cracking due to freeze-thaw are not aging effects requiring management for CNP concrete.

(2) Leaching of calcium hydroxide and aggressive chemical attack

CNP concrete is not exposed to flowing water and the concrete used was constructed in accordance with the recommendations in ACI 201.2R-77 for durability. The CNP below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide are not applicable aging effects for CNP concrete structures.

(3) Reaction with aggregates

CNP concrete was provided in accordance with ACI 318 requirements, resulting in dense, well-cured, high-strength concrete with low permeability. Nonreactivity of concrete aggregates was taken into consideration during production, as described in the CNP design specification. Therefore, reaction with aggregates is not an applicable aging mechanism for CNP concrete.

(4) Corrosion of embedded steel

CNP concrete was provided in accordance with ACI 318 requirements, resulting in dense, well-cured, high-strength concrete with low permeability. The CNP below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, corrosion of embedded steel is not an applicable aging mechanism for CNP concrete.

(5) Settlement

See Section 3.5.2.2.1.2 above.

(6) Erosion of porous concrete subfoundation

See Section 3.5.2.2.1.2 above.

(7) Corrosion of structural steel components

Corrosion of structural steel components is an aging effect requiring management at CNP. This aging effect is managed by the Structures Monitoring Program.

(8) Elevated temperatures

Concrete within Class I structures is typically exposed to ambient temperatures of less than 150ºF. Therefore, change in material properties owing to elevated temperature is not an aging effect requiring management for CNP except for the Unit 1 pressurizer enclosure, as discussed in Section 3.5.2.2.1.3 above.

(9) Aging effects for stainless steel liners for tanks

No tanks with stainless steel liners are included in the structural aging management reviews. The in-scope tanks are addressed in their respective mechanical systems.

3.5.2.2.2.2 Aging Management of Inaccessible Areas

CNP concrete was provided in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which requires the following, resulting in low permeability and resistance to aggressive chemical solutions:

- High cement content
- Low water-to-cement ratio
- Proper curing
- Adequate air entrainment

CNP concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same ASTM standards for selection, application, and testing of concrete.

Inspections of accessible concrete have not revealed degradation related to corrosion of embedded steel. The CNP below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, corrosion of embedded steel is not an applicable aging mechanism for CNP concrete.

3.5.2.2.3 Component Supports

3.5.2.2.3.1 Aging of Supports not Covered by Structures Monitoring Program

NUREG-1801 does not recommend further evaluation of certain component support/aging effect combinations if they are included in the applicant's Structures Monitoring Program. Aging effects of component supports at CNP are managed by the Structures Monitoring Program for Groups B2 through B5 and Inservice Inspection – ASME Section XI, Subsection IWF Program for Group B1.

1) Reduction in concrete anchor capacity due to degradation of surrounding concrete for Groups B1 through B5 supports

Concrete anchors and surrounding concrete are included in the Structures Monitoring Program (Groups B2 through B5) and Inservice Inspection (IWF) Program (Group B1).

2) Loss of material due to environmental corrosion, for Groups B2 through B5 supports

Loss of material due to corrosion of steel support components is an aging effect requiring management at CNP. This aging effect is managed by the Structures Monitoring Program.

3) Reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports

The CNP aging management review did not identify any component support/aging effect combination corresponding to NUREG-1801, Volume 2, Item III.B4.2-a.

3.5.2.2.3.2 Cumulative Fatigue Damage due to Cyclic Loading

TLAAs are evaluated in accordance with 10 CFR 54.21(c), as documented in Section 4 of this application. During the process of identifying TLAAs in the CNP current licensing basis, no fatigue analyses were identified for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3.

3.5.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The CNP Corrective Action Program applies to both safety-related and nonsafety-related structures and components. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing CNP Document Control Program in accordance with the Quality Assurance Program Description (QAPD). See Section B.0.3 of this application for further discussion.

3.5.2.3 Time-Limited Aging Analyses

TLAAs identified for structural components and commodities are containment liner plate and penetration fatigue analyses, ice condenser lattice frame fatigue analysis, and fatigue analysis of cranes. These topics are discussed in Sections 4.6, 4.7.3, and 4.7.6, respectively.

3.5.3 Conclusion

Structural components and commodities subject to aging management review have been identified in accordance with the criteria of 10 CFR 54.21(a)(1). The aging management programs selected to manage aging effects for the structural components and commodities are identified in the following tables and Section 3.5.2.1. A description of these aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the structural components and commodities will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.5.1
Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801

Table 3.5.1: Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
Common Components of All Types of PWR and BWR Containment					
3.5.1-1	Penetration sleeves, penetration bellows, and dissimilar metal welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800, Subsection 3.5.2.2.1.6)	For further evaluation, see Section 3.5.2.2.1.6 of this application.
3.5.1-2	Penetration sleeves, bellows, and dissimilar metal welds	Cracking due to cyclic loading; crack initiation and growth due to SCC	Containment inservice inspection (ISI) and containment leak rate test	Yes, detection of aging effects is to be evaluated (see NUREG-1800, Subsection 3.5.2.2.1.7)	Consistent with NUREG-1801. For the fuel transfer tube penetration, loss of material is also an aging effect due to the borated water environment. For further evaluation, see Section 3.5.2.2.1.7 of this application.
3.5.1-3	Penetration sleeves, penetration bellows, and dissimilar metal welds	Loss of material due to corrosion	Containment ISI and containment leak rate test	No	Consistent with NUREG-1801.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-4	Personnel airlock and equipment hatch	Loss of material due to corrosion	Containment ISI and containment leak rate test	No	Consistent with NUREG-1801.
3.5.1-5	Personnel airlock and equipment hatch	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	Containment leak rate test and plant technical specifications	No	Consistent with NUREG-1801. NUREG-1801 lists Technical Specifications (TS) as an aging management program, although a specific section is not provided. CNP TS are not described as an aging management program but TS applicability will continue for the period of extended operation.
3.5.1-6	Seals, gaskets, and moisture barriers	Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers	Containment ISI and containment leak rate test	No	For CNP, the Containment Leakage Rate Testing Program will manage the aging effects. Seals and gaskets are not included in the Inservice Inspection – ASME Section XI, Subsection IWE Program at CNP.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
PWR Concrete (Reinforced and Prestressed) and Steel Containment BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment					
3.5.1-7	Concrete elements: foundation, dome, and wall	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Yes, if aging mechanism is significant for inaccessible areas (see NUREG-1800, Subsection 3.5.2.2.1.1)	Aging mechanisms are not significant for accessible and inaccessible areas. See Section 3.5.2.2.1.1 of this application. Components will be included in the Inservice Inspection – ASME Section XI, Subsection IWL Program and the Structures Monitoring Program.
3.5.1-8	Concrete elements: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800, Subsection 3.5.2.2.1.2)	Settlement is not an applicable aging mechanism for CNP. See Section 3.5.2.2.1.2 of this application. Nonetheless, components will be included in the Structures Monitoring Program.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-9	Concrete elements: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800, Subsection 3.5.2.2.1.2)	Not applicable. CNP was not identified in IN 97-11 as one of the plants susceptible to erosion of porous concrete subfoundation. See Section 3.5.2.2.1.2 of this application. Nonetheless, concrete foundation will be included in the Structures Monitoring and Inservice Inspection – ASME Section XI, Subsection IWL Programs.
3.5.1-10	Concrete elements: foundation, dome, and wall	Reduction of strength and modulus due to elevated temperature	Plant specific	Yes, for any portions of concrete containment that exceed specified temperature limits (see NUREG-1800, Subsection 3.5.2.2.1.3)	See Section 3.5.2.2.1.3 of this application. Only the Unit 1 pressurizer enclosure is subjected to elevated temperatures during normal operating conditions (see Item number 3.5.1-27).

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-11	Prestressed containment: tendons and anchorage components	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800, Subsection 3.5.2.2.1.5)	Not applicable to CNP. The reinforced concrete containments at CNP do not use prestressed tendons.
3.5.1-12	Steel elements: liner plate and containment shell	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and containment leak rate test	Yes, if corrosion is significant for inaccessible areas (see NUREG-1800, Subsection 3.5.2.2.1.4)	Consistent with NUREG-1801. Corrosion is not significant for inaccessible areas. See Section 3.5.2.2.1.4 of this application for discussion pertaining to inaccessible areas.
3.5.1-13	BWR only				
3.5.1-14	Steel elements: protected by coating	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	No	Not applicable. Protective coatings are not relied upon to manage the effects of aging at CNP.
3.5.1-15	Prestressed containment: tendons and anchorage components	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	No	Not applicable to CNP. The reinforced concrete containment structures at CNP do not use prestressed tendons.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-16	Concrete elements: foundation, dome, and wall	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	No	The listed aging effects and mechanisms are not applicable for the identified concrete components at CNP. Nonetheless, the components will be included in the Structures Monitoring and Inservice Inspection – ASME Section XI, Subsection IWL Programs. See Section 3.5.2.2.2.1 of this application.
3.5.1-17	BWR only				
3.5.1-18	BWR only				
3.5.1-19	BWR only				
Class I Structures					
3.5.1-20	All Groups except Group 6: accessible interior/exterior concrete and steel components	All types of aging effects	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800, Subsection 3.5.2.2.2.1)	Consistent with NUREG-1801. Components in Tables 3.5.2-1 through 3.5.2-5 that reference Table 1 Item 3.5.1-20 will be included in the Structures Monitoring Program.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-21	Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant specific	Yes, if an aggressive below-grade environment exists (see NUREG-1800, Subsection 3.5.2.2.2.2)	Not applicable to CNP. An aggressive below-grade environment does not exist. See discussion in Section 3.5.2.2.2.2 of this application.
3.5.1-22	Group 6: all accessible/ inaccessible concrete, steel, and earthen components	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance	No	Because CNP is not committed to Reg. Guide 1.127, the listed aging management program is not used. The Structures Monitoring Program will manage the effects of aging on Group 6 components.
3.5.1-23	Group 5: liners	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Water chemistry and monitoring of spent fuel pool water level	No	Consistent with NUREG-1801. Spent fuel pool water level monitoring is performed as part of the System Testing Program.
3.5.1-24	Groups 1-3, 5, 6: all masonry block walls	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry wall	No	Consistent with NUREG-1801. At CNP the Structures Monitoring – Masonry Wall Program is part of the Structures Monitoring Program.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-25	Groups 1-3, 5, 7-9: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800, Subsection 3.5.2.2.1.2)	Settlement is not applicable as an aging mechanism for CNP. See Section 3.5.2.2.1.2 of this application for further discussion. Nonetheless, components will be included in the Structures Monitoring Program.
3.5.1-26	Groups 1-3, 5-9: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800, Subsection 3.5.2.2.1.2)	CNP was not identified in IN 97-11 as one of the plants susceptible to erosion of porous concrete subfoundation. Nonetheless, concrete foundation will be included in the Structures Monitoring Program. See Section 3.5.2.2.1.2 of this application for further discussion.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-27	Groups 1-5: concrete	Reduction of strength and modulus due to elevated temperature	Plant specific	Yes, for any portions of concrete that exceed specified temperature limits (see NUREG-1800, Subsection 3.5.2.2.1.3)	Consistent with NUREG-1801 for the Unit 1 pressurizer enclosure. The Structures Monitoring Program will manage the aging effect.
3.5.1-28	Groups 7, 8: liners	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Plant specific	Yes [no subsection given]	Not applicable, as there are no concrete or steel tanks with stainless steel liners included in the structural aging management reviews. Tanks are evaluated with their respective mechanical systems.
Component Supports					
3.5.1-29	All Groups: support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc.	Aging of component supports	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800, Subsection 3.5.2.2.3.1)	Consistent with NUREG-1801. Components that refer to this item number in Tables 3.5.2-1 through 3.5.2-5 will be included in the Structures Monitoring Program. See Section 3.5.2.2.3.1 of this application.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-30	Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800, Subsection 3.5.2.2.3.2)	For further evaluation, see Section 3.5.2.2.3.2 of this application.
3.5.1-31	All Groups: support members: anchor bolts and welds	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801 for components in containment. Component groups in the auxiliary building may reference this item, since they are susceptible to the same aging effect and mechanism.
3.5.1-32	Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	No	Consistent with NUREG-1801. The Inservice Inspection – ASME Section XI, Subsection IWF Program will manage the identified aging effect.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-33	Group B1.1: high strength low-alloy bolts	Crack initiation and growth due to SCC	Bolting integrity	No	At CNP, the programs that will manage cracking due to SCC are Inservice Inspection – ASME Section XI, Subsection IWF and Boric Acid Corrosion Prevention Programs instead of the bolting integrity program identified in NUREG-1801. This line item is not referenced in Tables 3.5.2-1 through 3.5.2-5.

Table 3.5.2-1
Containment
Summary of Aging Management Evaluation

This table also includes the supports for the RCS components.

Table 3.5.2-1: Containment								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Air lock doors	FB, PB	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWE) Containment Leakage Rate Testing	II.A3.2-a	3.5.1-4	B A
					Structures Monitoring	III.A4.2-a	3.5.1-20	A
Air lock hinges, locks, closing mechanisms	FB, PB	Carbon steel	Protected from weather	Loss of material	Containment Leakage Rate Testing	II.A3.2-b	3.5.1-5	A
					Structures Monitoring	III.A4.2-a	3.5.1-20	A

Table 3.5.2-1: Containment (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Containment liner and associated anchorage	FD, PB, SNS, SRE SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWE) Containment Leakage Rate Testing	II.A1.2-a	3.5.1-12	B A
					Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	C
Containment penetrations (piping and electrical)	PB, SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWE) Containment Leakage Rate Testing	II.A3.1-a	3.5.1-3	B A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C
					Structures Monitoring	III.A4.2-a	3.5.1-20	A

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Containment penetrations (piping and electrical) (continued)	PB, SNS, SRE, SSR	Stainless steel	Protected from weather	Cracking	Inservice Inspection (IWE) Containment Leakage Rate Testing	II.A3.1-d	3.5.1-2	B A
CRDM support structure	SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C
Divider barrier access doors and associated framing	FC	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C

Table 3.5.2-1: Containment (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Divider barrier equipment hatches and associated framing	FC	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C
Fuel transfer tube penetration	PB	Stainless steel	Exposed to borated water	Loss of material	Inservice Inspection (IWE) Containment Leakage Rate Testing			H
			Protected from weather	Cracking	Inservice Inspection (IWE) Containment Leakage Rate Testing	II.A3.1-d	3.5.1-2	B A
Ice baskets	SSR	Galvanized steel	Exposed to borated ice	Loss of material	Structures Monitoring – Ice Basket Inspection			J

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Ice condenser bridge cranes, crane rails, and supports	SNS	Carbon steel	Protected from weather	Loss of material	Structures Monitoring – Crane Inspection	VII.B.1-b	3.3.1-16	B
Ice condenser intermediate deck door frames	FC, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C
Ice condenser lattice frame	FC, SSR	Galvanized steel	Exposed to borated ice	Loss of material	Structures Monitoring			J
Ice condenser lower deck door frames	FC, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C
Ice condenser lower support structure	SSR	Carbon steel	Exposed to borated ice	Loss of material	Structures Monitoring			J
Ice condenser turning vanes	SSR	Carbon steel	Exposed to borated ice	Loss of material	Structures Monitoring			J

Table 3.5.2-1: Containment (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Ice condenser wall duct panels	SNS	Stainless steel	Exposed to borated ice	Loss of material	Structures Monitoring			J
Polar cranes, crane rails, and supports	SNS	Carbon steel	Protected from weather	Loss of material	Structures Monitoring – Crane Inspection	VII.B.1-b	3.3.1-16	B
Pressurizer supports	SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	A
Reactor cavity missile block embedded steel and associated framing	FC, HELB, MB, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C
Reactor coolant pump supports	SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	A

Table 3.5.2-1: Containment (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor vessel supports (water-cooled)	SSR	Carbon steel	Exposed to treated water	Loss of material	Inservice Inspection (IWF) Water Chemistry Control			G
			Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	A
Removable gate (bulkhead)	FC, HELB, MB, SSR	Stainless steel	Protected from weather	None	Structures Monitoring			1
Seal table	SSR	Stainless steel	Protected from weather	None	Structures Monitoring			1
Steam generator enclosure permanent interior form plate	SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	C

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Steam generator supports	SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	A
Structural steel framing (including embedded steel)	SNS, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	C
Sump screens (coarse) and associated framing	SSR	Galvanized steel	Protected from weather	None	Structures Monitoring			J
Sump screens (fine)	SSR	Stainless steel	Protected from weather	None	Structures Monitoring			J

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Threaded fasteners, CRDM support structure	SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A4.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention	III.B1.2.1-b	3.5.1-31	C
Threaded fasteners, ice basket	SSR	Cadmium-plated steel	Exposed to borated ice	Loss of material	Structures Monitoring – Ice Basket Inspection			J
Threaded fasteners, reactor coolant system component supports (reactor vessel, steam generators, reactor coolant pumps, pressurizer)	SSR	High-strength carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	A
		Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	A

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Containment base slab foundation	SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring Inservice Inspection (IWL)			I, 1
Containment dome	SSR, SP, SNS, MB, FB	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring Inservice Inspection (IWL)			I, 1
Containment operating deck	SP, FC, HELB, MB, SNS, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Containment wall	SP, FB, FLB, MB, SNS, SSR	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring Inservice Inspection (IWL)			I, 1
Crane wall (upper) and ice condenser end walls	SP, FC, HELB, MB, SNS, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Exhaust dome and exhaust duct	SSR	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring Inservice Inspection (IWL)			I, 1
Fuel transfer canal walls and flood-up overflow structure	SP, FC, HELB, MB, SNS, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Ice condenser support slab	SSR	Reinforced concrete	Exposed to borated ice	Loss of material Cracking Change in material properties	Structures Monitoring			G, 2
Ice condenser wear slab	SSR	Reinforced concrete	Exposed to borated ice	Loss of material Cracking Change in material properties	Structures Monitoring			G, 2

Table 3.5.2-1: Containment (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Lower containment concrete walls and floor slabs	SP, FD, HELB, MB, SNS, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Pressurizer enclosure	FC, HELB, MB, SSR	Reinforced concrete	Protected from weather	Change in material properties	Structures Monitoring	III.A4.1-c	3.5.1-27	A
				Loss of material Cracking				H
Reactor cavity missile blocks	FC, MB, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Regenerative heat exchanger room wall	SP, SSR	Concrete block	Protected from weather	None	Structures Monitoring			I, 1
Steam generator enclosures	FC, HELB, MB, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Sump concrete	SSR	Reinforced concrete	Protected from weather	Loss of material Cracking Change in material properties	Structures Monitoring	III.A4.1-a	3.5.1-20	A, 2
Air lock seals	SSR	Rubber	Protected from weather	Cracking Change in material properties	Containment Leakage Rate Testing	II.A3.3-a	3.5.1-6	E
Reactor pit membrane waterproofing	SP	PVC	Protected from weather	Cracking Change in material properties	Structures Monitoring			J

Table 3.5.2-1: Containment (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Removable gate (bulkhead) seals	FC	Rubber	Protected from weather	Cracking Change in material properties	Structures Monitoring – Divider Barrier Seal Inspection			J
Ice condenser intermediate and upper deck curtains	SNS	Mylar, ventsil fabric, fiberglass	Exposed to borated ice	None	Structures Monitoring			J, 1

Table 3.5.2-2
Auxiliary Building
Summary of Aging Management Evaluation

Table 3.5.2-2: Auxiliary Building

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Block wall grating and framing	SP, FB	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention			G
Cranes, rails and supports	SNS	Carbon steel	Protected from weather	Loss of material	Structures Monitoring – Crane Inspection	VII.B.1-b	3.3.1-16	B
Elevator support steel	SNS	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
Emergency diesel generator air intake missile shield framing	SNS	Carbon steel	Exposed to weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
Emergency diesel generator air intake missile shield grating	SNS	Galvanized steel	Exposed to weather	Loss of material	Structures Monitoring			J

Table 3.5.2-2: Auxiliary Building (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Louver framing (emergency diesel generator and switch gear)	SSR, HELB	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
Missile shield	MB	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention			G
New fuel storage racks	SSR	Stainless steel	Protected from weather	None	None			F
Spent fuel pit steel (including swing gate, attachments, liner and fuel racks)	SF, SNS, SSR	Stainless steel	Exposed to borated water	Loss of material Cracking	Water Chemistry Control System Testing	III.A5.2-b	3.5.1-23	A
Superstructure framing	SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
					Boric Acid Corrosion Prevention			G

Table 3.5.2-2: Auxiliary Building (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Electrical tunnel	SP, SNS, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Elevator masonry block	SNS	Block wall	Protected from weather	Cracking	Structures Monitoring – Masonry Wall	III.A3.3-a	3.5.1-24	A
Exterior walls above grade	SP, FB, FLB, MB, SNS, SRE, SSR	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1
Exterior walls below grade	SP, FB, FLB, MB, SNS, SRE, SSR	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Floor slabs	SP, FB, HELB, MB, SNS, SRE, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Fuel transfer canal	SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Foundation	SNS, SRE, SSR	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1

Table 3.5.2-2: Auxiliary Building (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Interior walls	SP, FB, FLB, HELB, MB, SNS, SRE, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Internal flood curbs	FLB	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Main steam line enclosure	SP, HELB	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1
Masonry block	SP, SNS, FB	Block wall	Protected from weather	Cracking	Structures Monitoring – Masonry Wall	III.A3.3-a	3.5.1-24	A
Roof	SP, FB, MB, SNS, SSR	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1
Spent fuel pit walls and slab	SF, SNS, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Sump	SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1

Table 3.5.2-3
Turbine Building and Screenhouse
Summary of Aging Management Evaluation

Table 3.5.2-3: Turbine Building and Screenhouse								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Auxiliary feedwater pump room doors # 226, 227, 228, 229	FB, HELB, MB, SRE	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
Intake corrugated piping	SCW	Galvanized steel	Exposed to raw water	Loss of material	Structures Monitoring			J
Intake crib framing and plate	SCW, SNS	Carbon steel	Exposed to raw water	Loss of material	Structures Monitoring	III.A6.2-a	3.5.1-22	E
Miscellaneous steel (catwalks, handrails, ladders, platforms, stairs, and associated supports) in ESW and AFW pump rooms	SNS	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A

Table 3.5.2-3: Turbine Building and Screenhouse (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Miscellaneous steel (ladders and associated supports) in forebay	SNS	Carbon steel	Exposed to raw water	Loss of material	Structures Monitoring	III.A6.2-a	3.5.1-22	E
Screenhouse forebay bar grille and base	SP, SNS	Galvanized steel	Exposed to raw water	Loss of material	Structures Monitoring			J
Sheet piling	FLB	Carbon steel	Exposed to raw water	Loss of material	Structures Monitoring	III.A6.2-a	3.5.1-22	E
Superstructure framing	SP, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
						III.A6.2-a	3.5.1-22	E
12" concrete wall, essential MCC room walls, ESW pump room	SP, FB, FLB, MB, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1
Auxiliary feedwater pump room (walls, floor, and ceiling)	SP, FB, HELB, MB, SNS, SRE, SSR	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1

Table 3.5.2-3: Turbine Building and Screenhouse (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
De-icing tunnels	SSR	Reinforced concrete	Exposed to weather (below grade)	Loss of material	Structures Monitoring	III.A6.1-h	3.5.1-22	E, 3
Discharge tunnels and bays	SNS, SSR	Reinforced concrete	Exposed to weather (below grade)	Loss of material	Structures Monitoring	III.A6.1-h	3.5.1-22	E, 3
Foundation mat (screenhouse)	SNS, SRE	Reinforced concrete	Exposed to weather (below grade)	Loss of material	Structures Monitoring	III.A6.1-h	3.5.1-22	E, 3
Foundation mat (turbine building)	SNS, SRE	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Intake cribs (surrounding sacked concrete)	SSR	Sacked concrete	Exposed to weather (below grade)	Loss of material	Structures Monitoring	III.A6.1-h	3.5.1-22	E, 3
Masonry block (4-hour rated)	FB	Masonry block	Protected from weather	Cracking	Structures Monitoring – Masonry Wall	III.A3.3-a III.A6.3-a	3.5.1-24	A
Screenhouse exterior above grade walls	FB, FLB, SSR	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1

Table 3.5.2-3: Turbine Building and Screenhouse (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Screenhouse below grade walls, beams and slabs	FB, FLB, SSR	Reinforced concrete	Exposed to weather (below grade)	Loss of material	Structures Monitoring	III.A6.1-h	3.5.1-22	E, 3
Superstructure steel column concrete encasing	SP, SNS	Reinforced concrete	Protected from weather	None	Structures Monitoring			I, 1

Table 3.5.2-4
Yard Structures
Summary of Aging Management Evaluation

Table 3.5.2-4: Yard Structures								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fire protection pump house superstructure	SRE	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
Gas bottle storage tank rack	SRE	Carbon steel	Exposed to weather	Loss of material	Structures Monitoring	III.A3.2-a	3.5.1-20	A
Tower: Unit 2 power delivery to switchyard	SNS	Galvanized steel	Exposed to weather	Loss of material	Structures Monitoring			J
Fire protection pump house walls	SRE	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1
Fire protection pump house foundation	SRE	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Gas bottle storage tank foundation	SRE	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1

Table 3.5.2-4: Yard Structures (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Roadway	FLB	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Security diesel generator room	SRE	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1
Switchyard control house	SRE	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1
Tank area pipe tunnel (condensate storage, refueling water storage, and emergency diesel generator piping tunnel)	SP	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Tank foundations: refueling water storage tank	SSR	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1

Table 3.5.2-4: Yard Structures (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank foundations: condensate storage tank	SNS	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Tank foundations: fire protection water storage tank	SNS	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Tank foundations: primary water storage tank	SNS	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Tower: Unit 1 power delivery to switchyard	SNS	Reinforced concrete	Exposed to weather (above grade)	None	Structures Monitoring			I, 1
Transformer pedestals: start-up	SRE	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1
Trench from switchyard to start-up transformers (duct bank)	SRE	Reinforced concrete	Exposed to weather (below grade)	None	Structures Monitoring			I, 1

Table 3.5.2-4: Yard Structures (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Roadway (shoreline)	FLB	Earth	Exposed to weather	Loss of material Loss of form Change in material properties	Structures Monitoring	III.A6.4-a	3.5.1-22	E

**Table 3.5.2-5
Structural Commodities
Summary of Aging Management Evaluation**

Table 3.5.2-5: Structural Commodities								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Baseplates	SNS, SRE, SSR	Carbon steel	Protected from weather Exposed to weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a III.B1.2.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b III.B1.2.1-b	3.5.1-31	A
Baseplates, embedded unistrut	SNS, SRE, SSR	Galvanized steel	Protected from weather	Loss of material	Structures Monitoring Boric Acid Corrosion Prevention			J
			Exposed to weather	Loss of material	Structures Monitoring			J
Battery racks	SRE, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B3.1-a	3.5.1-29	A

Table 3.5.2-5: Structural Commodities (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Blowout panels	PB, SNS, SRE, SSR	Carbon steel	Protected from weather Exposed to weather	Loss of material	Structures Monitoring	III.B5.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B5.1-b	3.5.1-31	A
Cable tray and conduit supports	SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b	3.5.1-31	A

Table 3.5.2-5: Structural Commodities (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Cable trays and conduits	SNS, SRE, SSR	Galvanized steel	Protected from weather	Loss of material	Structures Monitoring Boric Acid Corrosion Prevention			J
			Exposed to weather	Loss of material	Structures Monitoring			J
		Aluminum	Protected from weather	Loss of material	Boric Acid Corrosion Prevention			J

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Component supports	SNS, SRE, SSR	Carbon steel	Protected from weather Exposed to weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a III.B1.2.1-a	3.5.1-32	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b III.B1.2.1-b III.B2.1-b III.B3.1-b III.B4.1-b III.B5.1-b	3.5.1-31	A
					Structures Monitoring	III.B2.1-a III.B3.1-a III.B4.1-a III.B5.1-a	3.5.1-29	A
Cranes, rails, and girders	SNS	Carbon steel	Protected from weather	Loss of material	Structures Monitoring - Crane Inspection	VII.B.1-b	3.3.1-16	B
Doors and framing (non-fire-rated)	SP, FB, FLB, HELB, MB, PB, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.A3.2-a III.A5.2-a	3.5.1-20	A

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Electrical instrument panels and enclosures	SP, SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B3.1-a	3.5.1-29	A
			Exposed to weather		Boric Acid Corrosion Prevention	III.B3.1-b	3.5.1-31	A
Fire damper framing (in-wall)	FB	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a	3.5.1-29	A
Fire doors	FB	Carbon steel	Protected from weather	Loss of material	Fire Protection	VII.G.1-d VII.G.2-d VII.G.3-d VII.G.4-d VII.G.5-c	3.3.1-20	B

Table 3.5.2-5: Structural Commodities (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
HVAC duct supports	SNS, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b	3.5.1-31	A
		Galvanized steel	Protected from weather	Loss of material	Structures Monitoring Boric Acid Corrosion Prevention			J

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Instrument line supports	SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b	3.5.1-31	A
		Galvanized steel	Protected from weather	Loss of material	Structures Monitoring Boric Acid Corrosion Prevention			J
Instrument racks and frames	SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a III.B3.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b III.B3.1-b	3.5.1-31	A
		Galvanized steel	Protected from weather	Loss of material	Structures Monitoring Boric Acid Corrosion Prevention			J

Table 3.5.2-5: Structural Commodities (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Miscellaneous embedments	SNS, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a III.B3.1-a III.B4.1-a III.B5.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b III.B3.1-b III.B4.1-b III.B5.1-b	3.5.1-31	A
Pipe sleeves (mechanical/ electrical, not penetrating the containment liner plate)	PB, SNS, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b	3.5.1-31	A
Piping supports	PW, SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a III.B1.2.1-a	3.5.1-32	A
					Structures Monitoring	III.B2.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b III.B1.2.1-b III.B2.1-b	3.5.1-31	A

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Roof flashing	FS	Aluminum	Exposed to weather	Loss of material	Structures Monitoring			J
Stairs, ladders, platforms, and grating (supports)	SNS, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B5.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B5.1-b	3.5.1-31	A
Tube tracks	SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B2.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b	3.5.1-31	A

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Anchor bolts (includes switchyard structures and tank anchors)	SNS, SRE, SSR	Carbon steel	Protected from weather Exposed to weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a III.B1.2.1-a	3.5.1-32	A
					Structures Monitoring	III.B2.1-a III.B3.1-a III.B4.1-a III.B5.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B1.1.1-b III.B1.2.1-b III.B2.1-b III.B3.1-b III.B4.1-b III.B5.1-b	3.5.1-31	A
Class 1 anchor bolts	SNS, SRE, SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWF)	III.B1.1.1-a	3.5.1-32	A
				Cracking	Boric Acid Corrosion Prevention	III.B1.1.1-b	3.5.1-31	A

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Equipment hatch and personnel access openings threaded fasteners	FB, SNS, SSR	Carbon steel	Protected from weather	Loss of material	Inservice Inspection (IWE) Containment Leakage Rate Testing			J
Other threaded fasteners	SNS, SSR	Carbon steel	Protected from weather Exposed to weather	Loss of material	Structures Monitoring	III.B2.1-a III.B3.1-a III.B4.1-a III.B5.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B2.1-b III.B3.1-b III.B4.1-b III.B5.1-b	3.5.1-31	A
Other threaded fasteners (spent fuel pool stainless steel fasteners)	SNS, SSR	Stainless steel	Exposed to borated water	Loss of material Cracking	Water Chemistry Control			J

Table 3.5.2-5: Structural Commodities (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor cavity missile block tie downs	SP, HELB, MB, PW, SSR	Carbon steel	Protected from weather	Loss of material	Structures Monitoring	III.B5.1-a	3.5.1-29	A
					Boric Acid Corrosion Prevention	III.B5.1-b	3.5.1-31	A
Cable trays and conduits	SNS, SRE, SSR	Transite	Exposed to weather	None	Structures Monitoring			J
Flood curbs	FS, FLB, SNS, SSR	Reinforced concrete	Protected from weather Exposed to weather	None	Structures Monitoring			I, 1
Hatches	SP, FB, FLB, HELB, MB, PB, SSR	Reinforced concrete	Protected from weather Exposed to weather	None	Structures Monitoring			I, 1
Fire proofing	FB, SRE	Pyrocrete	Protected from weather	None	Fire Protection			I, 1

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Support pedestals	SNS, SRE, SSR	Reinforced concrete	Protected from weather Exposed to weather	None	Structures Monitoring			I, 1
Trenches (pipe and cable)	SNS, SRE, SSR	Reinforced concrete	Exposed to weather	None	Structures Monitoring			I, 1
Building pressure boundary sealant	FLB, PB	Elastomer	Protected from weather	Cracking Change in material properties	Structures Monitoring			J
Cable trays and conduits	SNS, SRE, SSR	Plastic	Protected from weather	Cracking Change in material properties	Structures Monitoring			J

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Divider barrier penetration seals	SP, PB	Elastomer	Protected from weather	Cracking Change in material properties	Structures Monitoring – Divider Barrier Seal Inspection			J
Fire barrier seals	FB, FLB, HELB, PB, SNS, SRE, SSR	Elastomer	Protected from weather	Cracking Change in material properties	Fire Protection	VII.G.1-a VII.G.2-a VII.G.3-a VII.G.4-a	3.3.1-20	B
Floor plugs	SSR	Elastomer	Protected from weather	Cracking Change in material properties	Structures Monitoring			J
Joint elastomer at seismic gaps	FB, SNS, SSR	Elastomer	Protected from weather	None	Structures Monitoring			J

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Penetration seals	SP, PB	Elastomer	Protected from weather	Cracking Change in material properties	Structures Monitoring			J
Roof elastomer	SP, FLB, SNS, SSR	Elastomer	Exposed to weather	Cracking Change in material properties	Structures Monitoring			J
Water stops	FLB	PVC	Protected from weather	None	Structures Monitoring			J

Table 3.5.2-5: Structural Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fire barriers (cable trays)	FB	Mecatiss, Darmat, Thermolag, Maranite Board, Scotch brand tape (No. 77 or 7700), or Bishop No. 43A ARC fire-proofing tape	Protected from weather	None	Structures Monitoring			J, 1
Roofing above battery rooms	SSR	Asphalt, ballast	Exposed to weather	None	Structures Monitoring			J, 1
		Fiberglass	Protected from weather	None	Structures Monitoring			J, 1

Notes for Table 3.5.2-1 through 3.5.2-5

Generic notes

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes

1. There are no aging effects requiring management for this material in this environment. However, this component will conservatively be included in the listed aging management program. Additional discussion of these aging effects is provided in Section 3.5.2.2.

2. Due to exposure to borated water (or ice), the sump concrete and ice condenser walls and floor are considered susceptible to aggressive chemical attack.
3. The listed environment is equivalent to the "flowing water" environment in NUREG-1801.

3.6 ELECTRICAL AND INSTRUMENTATION AND CONTROLS

3.6.1 Introduction

This section provides the aging management review results for electrical components. Consistent with the methods described in NEI 95-10 and as discussed in Section 2.5, the electrical and I&C equipment aging management reviews focus on commodity groups rather than systems. The following electrical commodity groups are addressed in this section:

- Insulated cables and connections,
- Switchyard bus, and
- High-voltage insulators.

Table 3.6.1, Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for electrical components. Hyperlinks to the program evaluations in Appendix B are provided in the CD-ROM version of this application.

3.6.2 Results

Table 3.6.2-1, Electrical Components — Summary of Aging Management Evaluation, summarizes the results of aging management reviews and the NUREG-1801 comparison for electrical components.

3.6.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environment, aging effects requiring management, and aging management programs for electrical components subject to aging management review. Programs are described in Appendix B. Further details are provided in the system tables.

Materials

Electrical components subject to aging management review are constructed of the following materials:

- Aluminum
- Cement
- Copper

- Porcelain
- Various organic polymers
- Various galvanized metals
- Various metals

Environment

Electrical components subject to aging management review are exposed to the following environments:

- Borated water leakage
- Heat and air
- Moisture and voltage stress
- Radiation and air
- Outdoor weather

Aging Effects Requiring Management

The following aging effects associated with electrical components require management:

- Loss of circuit continuity
- Reduced insulation resistance

Loss of circuit continuity is the aging effect resulting from the mechanism of corrosion of connector contact surfaces that is listed as an aging effect in NUREG-1801.

Aging Management Programs

The following aging management programs will manage the aging effects for the electrical components:

- Boric Acid Corrosion Prevention
- Non-EQ Inaccessible Medium-Voltage Cable
- Non-EQ Instrumentation Circuits Test Review
- Non-EQ Insulated Cables and Connections

3.6.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation by the NRC reviewer is necessary for certain aging effects, particularly those that require plant-specific programs or that involve TLAAs. Section 3.6.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain I&M's approach to these areas requiring further evaluation. Programs are described in Appendix B of this application.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Environmental qualification evaluation is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed in Section 4.4 of this application.

3.6.2.2.2 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The CNP Corrective Action Program applies to both safety-related and nonsafety-related structures and components. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing CNP Document Control Program in accordance with the Quality Assurance Program Description (QAPD). See Section B.0.3 of this application for further discussion.

3.6.2.3 Time-Limited Aging Analysis

The only TLAA identified for electrical system components is environmental qualification. This TLAA is evaluated in Section 4.4.

3.6.3 Conclusion

Electrical components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). The aging management programs selected to manage aging effects for the electrical components are identified in the following tables and Section 3.6.2.1. A description of these programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with electrical components will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.6.1
Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG-1801

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-1	Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	Environmental qualification of electric components	Yes, TLAA (see NUREG-1800, Subsection 3.6.2.2.1)	EQ equipment is not subject to aging management review because it is not long-lived. EQ analyses are evaluated as TLAAs in Section 4.4.
3.6.1-2	Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/ thermoxidative degradation of organics; radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	No	Consistent with NUREG-1801. Management of aging effects will be provided by the Non-EQ Insulated Cables and Connections Program. In Table 3.6.2-1, reduced insulation resistance (IR) is considered equivalent to the aging effect listed for this item.

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-3	Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements	No	Consistent with NUREG-1801. Management of aging effects will be provided by the Non-EQ Instrumentation Circuits Test Review Program, which includes exceptions to NUREG-1801, July 2001, that are consistent with those discussed with the NRC staff during the March 13, 2003, meeting regarding NUREG-1801, Section XI.E2. In Table 3.6.2-1, reduced insulation resistance (IR) is considered equivalent to the aging effect listed for this item.

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-4	Inaccessible medium-voltage (2kV to 15kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	Formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees	Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	No	Consistent with NUREG-1801. Range of voltages included in this item extends from 4.16kV to 34.5kV. Management of aging effects will be provided by the Non-EQ Inaccessible Medium-Voltage Cable Program. In Table 3.6.2-1, reduced insulation resistance (IR) is considered equivalent to the aging effect listed for this item (breakdown of insulation).
3.6.1-5	Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric acid corrosion	No	Consistent with NUREG-1801. Management of aging effects will be provided by Boric Acid Corrosion Prevention Program. In Table 3.6.2-1, loss of circuit continuity is the aging effect resulting from corrosion of connector contact surfaces.

Table 3.6.2-1
Electrical Components
Summary of Aging Management Evaluation

Table 3.6.2-1: Electrical Components

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	CE	Insulation material – various organic polymers	Heat and/or radiation and air	Reduced insulation resistance (IR)	Non-EQ Insulated Cables and Connections	VI.A.1-a	3.6.1-2	A, 1
Electrical cables used in instrumentation required by the Technical Specifications for high-voltage, low-current circuits not subject to 10 CFR 50.49 EQ requirements	CE	Insulation material – various organic polymers	Heat and/or radiation and air	Reduced insulation resistance (IR)	Non-EQ Instrumentation Circuits Test Review	VI.A.1-b	3.6.1-3	B

Table 3.6.2-1: Electrical Components

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Inaccessible medium-voltage (4.16kV to 34.5kV) cables (e.g., installed in conduit or direct-buried) not subject to 10 CFR 50.49 EQ requirements	CE	Insulation material – various organic polymers	Moisture and voltage stress	Reduced insulation resistance (IR)	Non-EQ Inaccessible Medium-Voltage Cable	VI.A.1-c	3.6.1-4	A
Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage	CE	Connectors – various metals	Borated water leakage	Loss of circuit continuity	Boric Acid Corrosion Prevention	VI.A.2-a	3.6.1-5	A
Switchyard bus for SBO, connections	CE	Aluminum, copper	Outdoor weather	None	None			J
High voltage insulators	IN	Porcelain, galvanized metal, cement	Outdoor weather	None	None			J

<u>Notes for Table 3.6.2-1</u>

<u>Generic notes</u>

A. Consistent with component, material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and aging management program listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

<u>Plant-specific notes</u>

1. The aging management program does not include the metallic fuse clamp portion of fuse holders. The metallic fuse clamp portion of fuse holders that are in scope for ISG-5 will be evaluated prior to the end of the current license term.

4.0 TIME-LIMITED AGING ANALYSES

4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

10 CFR 54.21(c) (Reference 4.1-9) requires that an evaluation of time-limited aging analyses (TLAAs) be provided as part of the application for a renewed license.

§54.21 Contents of application -- technical information.
Each application must contain the following information:
(c) An evaluation of time-limited aging analyses.

(1) A list of time-limited aging analyses, as defined in §54.3, must be provided. The applicant shall 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.

(2) A list must be provided of plant-specific exemptions granted pursuant to 10CFR50.12 and in effect that are based on time-limited aging analyses as defined in §54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation.

TLAAs are defined in 10 CFR 54.3 (Reference 4.1-8) as those licensee calculations and analyses that meet the following six criteria.

§54.3 Definitions
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, as delineated in §54.4(a);

(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, as delineated in §54.4(b); and

(6) Are contained or incorporated by reference in the CLB.

4.1.1 Process to Identify CNP TLAAs

I&M reviewed the current licensing basis (CLB) to identify the TLAAs for CNP, including the following documents:

- Updated Final Safety Analysis Report (UFSAR) (Reference 4.1-1)
- Westinghouse Commercial Atomic Power (WCAP) topical reports referenced in the UFSAR and in licensing correspondence with the NRC
- Updated Quality Assurance Program Description (QAPD)
- Fire Hazards Analysis (FHA)
- Safe Shutdown Capability Assessment (SSCA)
- Fire Protection Program Manual (FPPM)
- NRC Safety Evaluation Reports (SERs) applicable to CNP
- I&M/NRC licensing correspondence
- Operating license issued by the NRC for CNP, including Appendix A, Technical Specifications
- Environmental qualification (EQ) binders
- Nuclear safeguards memoranda

Information developed from the review of plant-specific source documents was reviewed to determine which calculations and analyses meet all six criteria of 10 CFR 54.3).

As required by 10 CFR 54.21(c)(1) (Reference 4.1-9), an evaluation of each TLAA was performed. The results of the TLAA evaluation are presented in Sections 4.2 through 4.7 of this application and summarized in Table 4.1-1. In Table 4.1-2 of this application, the CNP TLAAs are compared to those identified in NUREG-1800, Tables 4.1-2 and 4.1-3 (Reference 4.1-10).

4.1.2 Identification of Exemptions

10 CFR 54.21(c)(2) requires that the application for a renewed license include a list of current plant-specific exemptions granted pursuant to 10 CFR 50.12 (Reference 4.1-6) that are based on TLAAs as defined in 10 CFR 54.3. The regulation further requires an evaluation justifying the continuation of any such identified exemptions for the period of extended operation. A review of the CNP docket has been performed and the results of this review identified two 10 CFR 50.12 exemptions based on a TLAA as defined in 10 CFR 54.3.

10 CFR 50, Appendix G (Reference 4.1-7) requires that pressure-temperature (P-T) limits be established for reactor pressure vessels (RPVs) during normal operating and hydrostatic or leak

rate testing conditions. Appendix G specifies that the requirements for P-T limits are based on the application of evaluation procedures given in Appendix G to ASME Section XI (Reference 4.1-12). I&M requested that the NRC staff exempt Units 1 and 2 from application of specific requirements of Appendix G to 10 CFR 50 and substitute the use of ASME Code Case N-641 (Reference 4.1-13). ASME Code Case N-641 permits the use of an alternate reference fracture toughness curve for RPV materials and permits the postulation of a circumferentially-oriented flaw for the evaluation of circumferential RPV welds when determining the P-T limits. The proposed exemption requests were granted (References 4.1-2 and 4.1-3).

These exemptions are based on analyses that involve time-limited assumptions defined by the current operating term and are therefore based on TLAAs. These exemptions are used for the calculation of the P-T limits detailed in WCAP-15878, Revision 0 (Reference 4.1-4), and WCAP-15047, Revision 2 (Reference 4.1-5), for Units 1 and 2, respectively. As discussed in Section 4.2.3, the pressure-temperature evaluations for both units have been projected to 60 years (48 effective full-power years) in accordance with 10 CFR 54.21(c)(1)(ii). Therefore, the continuation of these exemptions is justified for the period of extended operation.

4.1.3 References for Section 4.1

4.1-1 Donald C. Cook Nuclear Plant Updated Final Safety Analysis Report, Revision 18.

4.1-2 Letter from J. F. Stang, NRC, to A. C. Bakken III, I&M, "Donald C. Cook Nuclear Plant Unit 2, Issuance of Amendment (TAC Nos. MB5699 and MB6948)," dated March 20, 2003.

4.1-3 Letter from J. F. Stang, NRC, to A. C. Bakken III, I&M, "Donald C. Cook Nuclear Plant, Unit 1 – Issuance of Amendment (TAC Nos. MB7162 and MB7163)," dated July 18, 2003

4.1-4 WCAP-15878, "D. C. Cook Unit 1 Heatup and Cooldown Limit Curves for Normal Operation for 40 Years and 60 Years," Revision 0.

4.1-5 WCAP-15047, "D. C. Cook Unit 2 WOG Reactor Vessel 60-Year Evaluation Minigroup Heatup and Cooldown Limit Curves for Normal Operation," Revision 2.

4.1-6 Title 10 of the Code of Federal Regulations (CFR), Part 50, Section 12, "Specific exemptions."

4.1-7 Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix G, "Fracture Toughness Requirements."

4.1-8 Title 10 of the Code of Federal Regulations (CFR), Part 54, Section 3, "Definitions."

4.1-9 Title 10 of the Code of Federal Regulations (CFR), Part 54, Section 21, "Contents of application—technical information."

4.1-10 NUREG-1800, *Standard Review Plan for Review of License Renewal Application for Nuclear Power Plants*, July 2001.

4.1-11 American Society of Mechanical Engineers (AMSE) Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*.

4.1-12 American Society of Mechanical Engineers (AMSE) Boiler and Pressure Vessel Code, Section XI, Appendix G, December 1995, through 1996 Addendum.

4.1-13 American Society of Mechanical Engineers (AMSE) Code Case N-641, "Alternative Pressure-Temperature Relationship and Low Temperature Overpressure Protection System Requirements," approved March 1999.

Table 4.1-1
List of CNP TLAAs

TLAA	Description	Disposition Category	LRA Section
1.	**Reactor Vessel Neutron Embrittlement**		4.2
	Charpy Upper-Shelf Energy	Analysis projected to the end of the period of extended operation 10 CFR 54.21(c)(1)(ii)	4.2.1
	Pressurized Thermal Shock	Analysis projected to the end of the period of extended operation 10 CFR 54.21(c)(1)(ii)	4.2.2
	Pressure-Temperature Limits	Analysis projected to the end of the period of extended operation 10 CFR 54.21(c)(1)(ii)	4.2.3
2.	**Metal Fatigue**		4.3
	Class 1 Fatigue	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.3.1
	Non-Class 1 Fatigue	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.3.2
	Environmentally-Assisted Fatigue (GSI - 190)	Analysis remains valid or are projected to the end of the period of extended operation or effects managed 10 CFR 54.21(c)(1)(i), (ii), and (iii)	4.3.3
3.	**Environmental Qualification of Electrical Components**	Effects of aging on the intended function(s) will be adequately managed for the period of extended operation 10 CFR 54.21(c)(1)(iii)	4.4
4.	**Concrete Containment Tendon Prestress**	Not Applicable	4.5

Table 4.1-1
List of CNP TLAAs (Continued)

TLAA	Description	Disposition Category	LRA Section
5.	**Containment Liner Plate and Penetration Fatigue Analyses**		4.6
	Containment Liner Plate Fatigue	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.6.1
	Containment Penetration Fatigue	Analyses for RHR and main steam penetrations remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.6.2
6.	**Other Plant-Specific TLAAs**		4.7
	RCS Piping Leak-Before-Break	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.7.1
	ASME Code Case N-481 (Reactor Coolant Pump Casings)	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.7.2
	Ice Condenser Lattice Frame	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.7.3
	Reactor Vessel Underclad Cracking	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.7.4
	Steam Generator Tubes — Flow-Induced Vibration	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.7.5
	Fatigue of Cranes	Analyses remain valid for the period of extended operation 10 CFR 54.21(c)(1)(i)	4.7.6

Table 4.1-2
Comparison of CNP TLAAs to TLAAs in NUREG-1800, Tables 4.1-2 and 4.1-3

NUREG-1800 TLAA Listing	Applicable to CNP	LRA Section
Reactor vessel neutron embrittlement	Yes	4.2
Concrete containment tendon prestress	No - CNP containment is reinforced concrete	4.5
Metal fatigue	Yes	4.3
Environmental qualification of electrical components	Yes	4.4
Metal corrosion allowance	No - loss of material by corrosion of mechanical components is addressed as part of the aging management review process discussed in Section 3 of this application	3
Inservice flaw growth analyses that demonstrate structure stability for 40 years	No - review of ISI records indicated no defects that required analytical evaluation of flaws to the end of the service life of the component	4.3
Inservice local metal containment corrosion analyses	No - loss of material by corrosion of structural components addressed as part of the aging management review process discussed in Section 3 of the application	3
High-energy line-break postulation based on fatigue cumulative usage factor (CUF)	No - CNP Class 1 and non-Class 1 piping designed to USAS B31.1	NA
Intergranular separation in the heat-affected zone (HAZ) of reactor vessel low-alloy steel under austenitic SS cladding. Low-temperature overpressure protection (LTOP) analyses	Yes.	4.7.4
Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps	Yes - piping is designed to USAS B31.1 and fatigue is addressed through stress range reduction factor	4.3.2

Table 4.1-2
Comparison of CNP TLAAs to TLAAs in NUREG-1800, Tables 4.1-2 and 4.1-3 (Continued)

NUREG-1800 TLAA Listing	Applicable to CNP	LRA Section
Fatigue analysis for the reactor coolant pump flywheel	No - analysis in CLB was performed for 60 years	4.7.7
Fatigue analysis of polar crane	Yes	4.7.6
Flow-induced vibration endurance limit, transient cycle count assumptions, and ductility reduction of fracture toughness for the reactor vessel internals	No – review did not identify these listings as TLAAs applicable to CNP	NA
Leak before break	Yes	4.7.1
Fatigue analysis for the containment liner plate	Yes	4.6.1
Containment penetration pressurization cycles	Yes	4.6.2
Reactor vessel circumferential weld inspection relief (BWR)	No – applicable only to BWRs	NA

4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The regulations governing reactor vessel integrity are in 10 CFR 50.

- 10 CFR 50.60 (Reference 4.2-15) requires that all light-water reactors meet the fracture toughness and material surveillance program requirements for the reactor coolant boundary as set forth in Appendices G and H of 10 CFR 50.
- 10 CFR 50.61 (Reference 4.2-16) contains fracture toughness requirements for protection against pressurized thermal shock.

CNP analyses (References 4.2-6 and 4.2-7) address the effects of neutron irradiation embrittlement of the reactor vessels. The analyses are TLAAs that evaluated reduction of fracture toughness of the reactor vessels for 40 years. The analyses for the initial 40-year license were updated to address the additional twenty years of operation (i.e., total of 60 years) for license renewal. The Reactor Vessel Integrity Program described in Appendix B of this application will ensure that the reactor vessel neutron embrittlement TLAAs remain valid through the period of extended operation. The reactor vessel neutron embrittlement TLAAs are projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) (Reference 4.2-18) as summarized in Section 4.2.1 and Section 4.2.2, below.

4.2.1 <u>Charpy Upper-Shelf Energy</u>

Appendix G of 10 CFR 50 (Reference 4.2-17) requires that "Reactor vessel beltline materials must have Charpy upper-shelf energy … of no less than 75 ft-lb (102J) initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft-lb (68 J)…." The CNP analyses on upper-shelf energy for 32 EFPY were originally documented in the response to NRC Generic Letter 92-01, Revision 1 (Reference 4.2-3). Thirty-two EFPY is assumed to be the effective full power years at the end of the period of initial operation (40 years), using an assumed 80 percent capacity factor. Similarly, 48 EFPY is assumed to be the effective full power years at the end of the period of extended operation (60 years), using an assumed 80 percent capacity factor.

Regulatory Guide 1.99, Revision 2 (Reference 4.2-1), provides two methods (or positions) for determining Charpy upper-shelf energy (C_VUSE). Following Position 1, the percent drop in C_VUSE, for a stated copper content and neutron fluence, is determined by reference to Figure 2 of Regulatory Guide 1.99. This percentage drop is applied to the initial C_VUSE to obtain the adjusted C_VUSE. For Position 2, the percent drop in C_VUSE is determined by plotting the available data on Figure 2 and fitting the data with a line drawn parallel to the existing lines that represent the upper bounds all the plotted points.

The 48 EFPY C_VUSE values for the reactor vessel beltline materials for Unit 1 are reported in Table A-2 of WCAP-15879, Revision 0 (Reference 4.2-6); and for Unit 2, these values are reported in Table A-2 of WCAP-13517, Revision 1 (Reference 4.2-7). CNP's USE values were calculated using the methodology presented in Position 1. The 48 EFPY fluence at one fourth of the way through the vessel wall (T/4) is based on a peak clad base metal fluence of 2.831×10^{19} n/cm^2 and 2.457×10^{19} n/cm^2 for Units 1 and 2, respectively. The fluence at the T/4 location for Units 1 and 2 was calculated in accordance with Regulatory Guide 1.99, Equation (3).

Fluence values at 48 EFPY were obtained using the method described in Section 6 of WCAP-12483, Revision 1, for Unit 1 (Reference 4.2-8) and WCAP-13515, Revision 1, for Unit 2 (Reference 4.2-9). The projected 48 EFPY exposure for Unit 1 includes the plant- and fuel cycle-specific calculated fluence at the end of cycle 16, a projection to the end of cycle 17, and future projections to 32 EFPY and 48 EFPY. The projection to cycle 17 was based on the cycle 17 design power distribution, continued operation at a core power level of 3250 megawatts-thermal (MWt), and a design cycle length of 1.45 EFPY. Projection beyond cycle 17 was based on the assumption of low leakage fuel management and a representative power distribution burnup averaged over cycles 15 through 17. It was conservatively assumed that for cycles 18 and beyond, the core power level would be uprated to 3600 MWt. In addition, a positive bias of 10 percent was applied to the neutron source in all fuel assemblies located on the core periphery.

The projected 48 EFPY fluence exposure for Unit 2 includes the plant- and fuel cycle-specific calculated fluence at the end of cycle 11, a projection to the end of cycle 12, and projections to 32 EFPY and 48 EFPY. The projection to cycle 12 was based on the cycle 12 design power distribution, continued operation at a core power level of 3411 MWt, and a design cycle length of 1.4 EFPY. Projections beyond cycle 12 were based on the assumption of low-leakage fuel management and that a representative power distribution burnup averaged over cycles 10 through 12 would be typical of future operating cycles. It was conservatively assumed that, for cycles 13 and beyond, the core power level would be uprated to 3800 MWt. In addition, a positive bias of 10 percent was applied to the neutron source in all fuel assemblies located on the core periphery.

Both WCAP-12483 and WCAP-13515 use neutron transport calculations and dosimetry evaluations that meet the requirements of Regulatory Guide 1.190 (Reference 4.2-2). The NRC recently reviewed the fluence methodology in WCAP-13515, Revision 1, and concluded that the methodology uses approximations, geometrical description, and cross sections in accordance with the guidance in Regulatory Guide 1.190 (References 4.2-13 and 4.2-14). In projecting the fluence values, I&M incorporated a power level that would bound anticipated future power uprates. The fluence calculation methods described in WCAP-12483 and WCAP-13515 are concordant.

As shown in Table 4.2-1 and Table 4.2-2 the C_VUSE is maintained above 50 ft-lb for all base metal (plates and forgings) and welds at 48 EFPY for both units. An equivalent margins analysis is not required for either Unit 1 or Unit 2. Therefore, upper-shelf energy has been evaluated in accordance with 10 CFR 54.21(c)(1)(ii), and the analyses have been projected to the end of the period of extended operation.

A comparison of copper content and initial unirradiated C_VUSE values for Units 1 and 2 beltline materials listed in Tables 4.2-1 and 4.2-2 to the values reported in the NRC reactor vessel integrity database (RVID2) indicate slight differences for selected plate and weld materials. These slight differences are not significant and do not alter the conclusion that C_VUSE is maintained above 50 ft-lb for all base metal (plates and forgings) and welds at 48 EFPY for both units. The nozzle shell material for Unit 1 is not listed in Table 4.2-1, since it is not considered to be limiting material in accordance with the beltline definition provided in 10 CFR 50.61.

4.2.2 Pressurized Thermal Shock

10 CFR 50.61(b)(1) provides for the protection of pressurized water reactors against pressurized thermal shock. Licensees are required to assess the projected reference temperature (RT_{PTS}) values whenever a significant change occurs in projected values of RT_{PTS} or upon request for a change in the expiration date of the operation of the facility. For license renewal, RT_{PTS} values were calculated for 48 EFPY and reported in WCAP-15879, Revision 0 (Reference 4.2-6), for Unit 1 and WCAP-13517, Revision 1 (Reference 4.2-7), for Unit 2.

10 CFR 50.61(c) provides two methods for determining RT_{PTS}: (Position 1) for material that does not have surveillance data available and (Position 2) for material that does have surveillance data. Positions 1 and 2 are described in Regulatory Guide 1.99, Revision 2, (Reference 4.2-1). Adjusted reference temperatures are calculated for both Positions 1 and 2 by following the guidance in Regulatory Guide 1.99, Sections 1.1 and 2.1, respectively, using copper and nickel content of CNP beltline materials and end-of-life best estimate fluence projections. Copper and nickel content of the beltline materials are reported in WCAP-15879 for Unit 1 and WCAP-13517, Revision 1, for Unit 2, and are repeated in Table 4.2-3 and Table 4.2-4 of this application. For Unit 1, the peak fluence on the pressure vessel clad/base interface at 48 EFPY is $2.831x10^{19}$ n/cm^2. For Unit 2, the peak fluence on the pressure vessel clad/base interface at 48 EFPY is $2.457x10^{19}$ n/cm^2.

Fluence values at 48 EFPY for Units 1 and 2 were obtained using the method described in Section 6.4 of WCAP-12483, Revision 1 (Reference 4.2-8) for Unit 1 and WCAP-13515, Revision 1 (Reference 4.2-9) for Unit 2. This method meets the uncertainty requirements of Regulatory Guide 1.190. For Unit 1, the peak fluence on the pressure vessel clad/base interface at 48 EFPY is $2.831x10^{19}$ n/cm^2. For Unit 2, the peak fluence on the pressure vessel clad/base interface at 48 EFPY is $2.457x10^{19}$ n/cm^2.

10 CFR 50.61(b)(2) establishes screening criteria for RT_{PTS}: 270°F for plates, forgings, and axial welds; and 300°F for circumferential welds. The RT_{PTS} values were calculated using Regulatory Guide 1.99, Revision 2, Positions 1 and 2, for both Units 1 and 2. The values for RT_{PTS} at 48 EFPY for Unit 1 were provided in WCAP-15879, Revision 0, Table 6, and are reproduced in Table 4.2-3 of this application. The projected RT_{PTS} values are within the established screening criteria for 48 EFPY. Therefore, RT_{PTS} for Unit 1 has been evaluated in accordance with 10 CFR 54.21(c)(1)(ii), and the analyses have been projected to the end of the period of extended operation.

The values for RT_{PTS} at 48 EFPY for Unit 2 are provided in WCAP-13517, Revision 1, Table 6, and are reproduced in Table 4.2-4 of this application. The projected RT_{PTS} values are within the established screening criteria for 48 EFPY. Therefore, the analysis of RT_{PTS} for Unit 2 has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A comparison of copper content, nickel content, and unirradiated RT_{NDT} values for Units 1 and 2 beltline materials listed in Tables 4.2-3 and 4.2-4 to the values reported in the NRC reactor vessel integrity database (RVID2) indicate slight differences for selected plate and weld materials. The most significant difference is the unirradiated RT_{NDT} for Unit 1, Plate 4406-2: RVID2 reports +40ºF compared to +33ºF reported in WCAP-15879. Chemistry factors for surveillance materials have been revised to reflect the use of Regulatory Guide 1.99, Position 2.1. These differences are not significant and do not alter the conclusion that RT_{PTS} values are within the established screening criteria for 48 EFPY. The nozzle shell material for Unit 1 is not listed in Table 4.2-3, since it is not considered to be limiting material in accordance with the beltline definition provided in 10 CFR 50.61.

4.2.3 Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires operation of the reactor pressure vessel within established P-T limits. These limits are established by analyses based on data obtained through the unit-specific Reactor Surveillance Capsule Program.

I&M has submitted license amendment requests for Units 1 and 2 RCS P-T curves (References 4.2-10 and 4.2-5, respectively). The revised Unit 1 P-T curves, which were approved via License Amendment No. 278 (Reference 4.2-14), specify limits on RCS pressure and temperature for up to 32 EFPY). For Cycle 18 and beyond, the curves are based on an assumed core power level of 3600 MWt. The revised Unit 2 P-T curves, which were approved via License Amendment No. 255 (Reference 4.2-13), specify limits on RCS pressure and temperature for up to 32 EFPY, based on an assumed core power level of 3800 MWt. The revised P-T curves are based on fluence analysis that complies with Regulatory Guide 1.190 and utilizes ASME Code Case

N-641. The bases for the Units 1 and 2 EFPY P-T limits are documented in WCAP-15878, Revision 0 (Reference 4.2-12) and WCAP-15047, Revision 2 (Reference 4.2-11), respectively. In addition, the 48 EFPY P-T results are reported in Section 9.0, Figures 9-3 and 9-4, of each respective WCAP. The operating window at 48 EFPY is sufficient to conduct normal heatup and cooldown operations for both Units 1 and 2. Therefore, approved P-T limits for Units 1 and 2 have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.4 References for Section 4.2

4.2-1 Regulatory Guide 1.99, *Radiation Embrittlement of Reactor Vessel Materials*, Revision 2, May 1988.

4.2-2 Regulatory Guide 1.190, *Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence*, March 2001.

4.2-3 Letter from E. E. Fitzpatrick, I&M, to T. E. Murley, NRC, "Generic Letter 92-01, Revision 1, Reactor Vessel Structural Integrity," dated July 13, 1992.

4.2-4 Letter from E. E. Fitzpatrick, I&M, to T. E. Murley, NRC, "Response to Request for Additional Information for GL 92-01, Revision 1," dated November 29, 1993.

4.2-5 Letter from J. E. Pollock, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant, Unit 2, License Amendment Request for Unit 2 Reactor Coolant System Pressure-Temperature Curves, and Request for Exemption from Requirements in 10 CFR 50.60(a) and 10 CFR 50, Appendix G," dated July 23, 2002.

4.2-6 WCAP-15879, "Evaluation of Pressurized Thermal Shock for D. C. Cook Unit 1 for 40 Years and 60 Years," Revision 0.

4.2-7 WCAP-13517, "Evaluation of Pressurized Thermal Shock for D. C. Cook Unit 2," Revision 1.

4.2-8 WCAP-12483, "Evaluation of Capsule U from the American Electric Power Company D. C. Cook Unit 1 Reactor Vessel Radiation Surveillance Program," Revision 1.

4.2-9 WCAP-13515, "Analysis of Capsule U from the Indiana Michigan Power Company D. C. Cook Unit 2 Reactor Vessel Radiation Surveillance Program," Revision 1.

4.2-10 Letter from J. E. Pollock, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant, Unit 1, License Amendment Request for Unit 1 Reactor Coolant System Pressure-Temperature Curves, and Request for Exemption from Requirements in 10 CFR 50.60(a) and 10 CFR 50, Appendix G," dated December 10, 2002.

4.2-11 WCAP-15047, "D. C. Cook Unit 2 WOG Reactor Vessel 60-Year Evaluation Minigroup Heatup and Cooldown Limit Curves for Normal Operation," Revision 2.

4.2-12 WCAP-15878, “D. C. Cook Unit 1 Heatup and Cooldown Limit Curves for Normal Operation for 40 Years and 60 Years,” Revision 0.

4.2-13 Letter from J. F. Stang, NRC, to A. C. Bakken III, I&M, “Donald C. Cook Nuclear Plant Unit 2, Issuance of Amendment,” March 20, 2003.

4.2-14 Letter from J. F. Stang, NRC, to A. C. Bakken III, I&M, “Donald C. Cook Nuclear Plant, Unit 1 – Issuance of Amendment,” July 18, 2003

4.2-15 Title 10 of the Code of Federal Regulations (CFR), Part 50, Section 60, “Acceptance criteria for fracture prevention measures for lightwater nuclear power reactors for normal operation.”

4.2-16 Title 10 of the Code of Federal Regulations (CFR), Part 50, Section 61, “Fracture toughness requirements for protection against pressurized thermal shock events.”

4.2-17 Title 10 of the Code of Federal Regulations (CFR), Part 50, Appendix G, “Fracture Toughness Requirements.”

4.2-18 Title 10 of the Code of Federal Regulations (CFR), Part 54, Section 21, “Contents of application—technical information.”

Table 4.2-1
Evaluation of Reactor Vessel (48 EFPY) Charpy V-Notch Upper-Shelf Energy - Unit 1

Material Description				Copper Composition, %	Initial CvUSE, ft-lbs	48 EFPY Fluence T/4 Location, n/cm^2	Estimated 48 EFPY CvUSE at T/4, ft-lbs	48 EFPY Drop at T/4, %
Reactor Vessel Beltline Region Location	Material ID	Heat Number	Type					
Regulatory Guide 1.99, Revision 2, Position 1								
Intermediate Shell	B4406-1	C1260	A533B	0.12	83	1.70E+19	64	23
Intermediate Shell	B4406-2	C3506	A533B	0.15	96	1.70E+19	69	28
Intermediate Shell	B4406-3	C3506	A533B	0.15	98	1.70E+19	71	28
Lower Shell	B4407-1	C3929	A533B	0.14	103	1.70E+19	75	27
Lower Shell	B4407-3	C3929	A533B	0.14	108	1.70E+19	78	28
Lower Shell	B4407-2	C3932	A533B	0.12	126	1.70E+19	97	23
Int. Shell Axial Welds	2-442A,B,C	13253 / 12008	Linde 1092	0.21	108	1.70E+19	65	40
Lower Shell Axial Welds	3-442A,B,C	13253 / 12008	Linde 1092	0.21	108	1.70E+19	65	40
Int./Lower Shell Circ Weld	9-442	1P3571	Linde 1092	0.287	105	1.70E+19	57	46

Table 4.2-2
Evaluation of Reactor Vessel (48 EFPY) Charpy V-Notch Upper-Shelf Energy - Unit 2

Material Description				Copper Composition, %	Initial CvUSE, ft-lbs	48 EFPY Fluence T/4 Location, n/cm^2	Estimated 48 EFPY CvUSE at T/4, ft-lbs	48 EFPY Drop at T/4, %
Reactor Vessel Beltline Region Location	Material ID	Heat Number	Type					
Regulatory Guide 1.99, Revision 2, Position 1								
Intermediate Shell Plate	10-1	C5556-2	A533 B	0.15	90	1.475E+19	67	26
Intermediate Shell Plate	10-2	C5521-2	A533B	0.13	86	1.475E+19	66	23
Lower Shell Plate	9-1	C5540-2	A533B	0.110	110	1.475E+19	86	22
Lower Shell Plate	9-2	C5592-1	A533B	0.140	103	1.475E+19	77	25
Circumferential Weld		S3986	Linde 124	0.056	77	1.475E+19	68	12
Int. Shell Axial Welds		S3986	Linde 124	0.056	77	1.475E+19	68	12
Lower Shell Axial Welds		S3986	Linde 124	0.056	77	1.475E+19	68	12

Table 4.2-3
Evaluation of Reactor Vessel (48 EFPY) PTS - Unit 1

Material Description				Chemical Composition		Initial RT_{NDT}, °F	Chem. Factor, °F	48 EFPY Fluence, n/cm^2	Margin, °F	RT_{PTS}, °F	Screening Criteria, °F
Reactor Vessel Beltline Region Location	Material ID	Heat Number	Type	Cu %	Ni %						
10 CFR 50.61 (Table Values)											
Intermediate Shell	B4406-1	C1260	A533B	0.12	0.52	+5	81.40	2.831E+19	34	143	270
Intermediate Shell	B4406-2	C3506	A533B	0.15	0.50	+33	104.5	2.831E+19	34	200	270
Intermediate Shell	B4406-3	C3506	A533B	0.15	0.49	+40	104.0	2.831E+19	34	207	270
Lower Shell	B4407-1	C3929	A533B	0.14	0.55	+28	97.8	2.831E+19	34	187	270
Lower Shell	B4407-3	C3929	A533B	0.14	0.50	+38	95.50	2.831E+19	34	194	270
Lower Shell	B4407-2	C3932	A533B	0.12	0.59	-12	82.80	2.831E+19	34	128	270
Int. Shell Axial Welds	2-442ABC	13253 / 12008	Linde 1092	0.21	0.873	-56	208.7	1.883E+19	65.5	254	270
Lower Shell Axial Welds	3-442ABC	13253 / 12008	Linde 1092	0.21	0.873	-56	208.7	1.883E+19	65.5	254	270
Int./Lower Shell Circ Weld	9-442	1P3571	Linde 1092	0.287	0.756	-56	214.0	2.831E+19	65.5	283	300

Material Description				Chemical Composition		Initial RT_{NDT}, °F	Chem. Factor, °F	48 EFPY Fluence, n/cm^2	Margin, °F	RT_{PTS}, °F	Screening Criteria, °F
Reactor Vessel Beltline Region Location	Material ID	Heat Number	Type	Cu %	Ni %						
10 CFR 50.61 (Use of Surveillance Data)[1]											
Intermediate Shell	B4406-2	C3506	A533B	0.15	0.50	+33	102.3	2.831E+19	17	181	270
Intermediate Shell	B4406-3	C3506	A533B	0.15	0.49	+40	102.3	2.831E+19	17	188	270
Int./Lower Shell Circ Weld	9-442	IP3571	Linde 1092	0.287	0.756	-56	218.6	2.831E+19	44	267	300

1. Intermediate Shell Plate (Heat C3506) chemistry factor (CF) calculated using CNP Unit 1 surveillance data. Intermediate to lower shell circumferential weld (Heat IP3571) chemistry factor (CF) calculated using Kewaunee and Maine Yankee surveillance data.

Table 4.2-4
Evaluation of Reactor Vessel (48 EFPY) PTS- Unit 2

Material Description				Chemical Composition		Initial RT_{NDT}, °F	Chem. Factor, °F	48 EFPY Fluence Inside Surface, n/cm^2	Margin, °F	RT_{PTS}, °F	Screening Criteria, °F
Reactor Vessel Beltline Region Location	Material ID	Heat Number	Type	Cu %	Ni %						
10 CFR 50.61 (Table Values)											
Intermediate Shell Plate	10-1	C5556-2	A533 B	0.150	0.57	+58	108.4	2.457E+19	34	227	270
Intermediate Shell Plate	10-2	C5521-2	A533B	0.130	0.58	+38	90.4	2.457E+19	34	184	270
Lower Shell Plate	9-1	C5540-2	A533B	0.110	0.64	-20	74.60	2.457E+19	34	107	270
Lower Shell Plate	9-2	C5592-1	A533B	0.140	0.59	-20	99.5	2.457E+19	34	138	270
Circ. Weld		S3986	Linde 124	0.056	0.956	-35	76.4	2.457E+19	56	116	300
Int. Shell Axial Welds		S3986	Linde 124	0.056	0.956	-35	76.4	2.457E+19	56	116	270
Lower Shell Axial Welds		S3986	Linde 124	0.056	0.956	-35	76.4	2.457E+19	56	116	270

Material Description				Chemical Composition		Initial RT_{NDT}, °F	Chem. Factor, °F	48 EFPY Fluence Inside Surface, n/cm^2	Margin, °F	RT_{PTS}, °F	Screening Criteria, °F
Reactor Vessel Beltline Region Location	**Material ID**	**Heat Number**	**Type**	**Cu %**	**Ni %**						
10 CFR 50.61 (Use of Surveillance Data)[1]											
Intermediate Shell Plate	10-2	C5521-2	A533B	0.130	0.58	+38	102.3	2.457E+19	17	182	270
Beltline Welds		S3986	Linde 124	0.055	0.97	-35	66.3	2.457E+19	28	75	270

1. Intermediate Shell Plate 10-2 (Heat C5521-2) chemistry factor and beltline welds chemistry factor were calculated using CNP Unit 2 surveillance data.

4.3 METAL FATIGUE

The analysis of metal fatigue is a TLAA for Class 1 and selected non-Class 1 mechanical components within the scope of license renewal. Class 1 components that received a code fatigue evaluation in accordance with ASME Boiler and Pressure (B&PV) Code, Section III, Subsection NB (Reference 4.3-23) are the following:

- Pressurizer
- Reactor vessel
- CRDM housings
- Reactor vessel internals
- Steam generators

Class 1 and non-Class 1 piping within the scope of license renewal is designed to USAS B31.1 (Reference 4.3-26). However, the pressurizer surge line, normal and alternate charging lines, and auxiliary spray lines were analyzed to ASME Section III, Subsection NB, in response to NRC Bulletin 88-08, “Thermal Stresses in Piping Connected to Reactor Coolant Systems,” (Reference 4.3-1) and NRC Bulletin 88-11, “Pressurizer Surge Line Thermal Stratification” (Reference 4.3-2).

Non-Class 1 pressure vessels, heat exchangers, storage tanks and pumps at CNP are designed in accordance with ASME Section VIII (Reference 4.3-24) or ASME Section III, Subsection NC or ND (Class 2 or 3). Some tanks and pumps are designed to other industry Codes and Standards such as American Water Works Association (AWWA) standards and Manufacturer’s Standardization Society (MSS) standards. Only ASME Section VIII Division 2 and ASME Section III, Subsection NC-3200 include fatigue design requirements.

Fatigue evaluations are TLAAs, since they are based on design transients defined for the life of the plant (UFSAR, Table 4.1-10). Class 1 metal fatigue TLAAs are evaluated in Section 4.3.1 and non-Class 1 metal fatigue TLAAs are evaluated in Section 4.3.2. The Westinghouse Owners Group (WOG) generic technical reports referenced in this application that have been reviewed and approved by the NRC include WCAP-14574-A, WCAP-14575-A, and WCAP-14577-A (References 4.3-19, and 4.3-20, and 4.3-21). These WCAPs contain applicant action items regarding Class 1 fatigue and environmentally-assisted fatigue, which are addressed in Sections 4.3.1 and 4.3.3.

In addition to metal fatigue, fracture mechanics analyses of defects discovered during inservice inspections may be TLAAs for those analytical evaluations performed to the end of the component’s service life in accordance with ASME Section XI, IWB-3600. A review of inservice inspection records identified no such analytical evaluations of flaws that were required for CNP. Therefore, analytical evaluation of flaws in not a TLAA for CNP.

4.3.1 Class 1 Fatigue

Fatigue evaluations were performed in the design of the Class 1 RCS components in accordance with the requirements specified in ASME Section III and USAS B31.1. (Class 1 in this application is equivalent to ASME Section XI (Reference 4.3-25) IWB inspection boundary plus RCS instrumentation and vent lines.) The fatigue evaluations are contained in calculations and stress reports. Because they are based on a number of design cycles assumed for the life of the plant (Section 4.1.4 of the UFSAR), these evaluations are considered TLAAs.

Design cyclic loadings and thermal and pressure conditions for RCS Class 1 components are defined by the component design specifications. These design cyclic loadings (Table 4.1-10 of the UFSAR) were used to calculate the ability of the components to withstand cyclic operation without fatigue failure. This ability is expressed in terms of calculations required by ASME Section III, i.e., fatigue CUFs.

The fatigue CUFs for Class 1 components designed in accordance with ASME Section III were compiled and the RCS design transients used to develop the CUFs for the following components were reviewed for both units:

- Pressurizer
- Reactor vessel
- CRDM housings
- Steam generators

The numbers of RCS design transients accrued through 1998 for both units were reviewed and linearly extrapolated to 60 years of operation. The projected number of transients at 60 years of operation is reported in Table 4.3-1. In all instances, the number of RCS design transients assumed in the original design was found to be acceptable for 60 years of operation. Therefore, the CUFs for the Class 1 components remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) (Reference 4.3-22). The RCS design transients are monitored through the Fatigue Monitoring Program, which is discussed in Appendix B of this application.

In accordance with Renewal Applicant Action Item 3.3.1.1-1 of the NRC Safety Evaluation for WCAP-14574-A (Reference 4.3-19), license renewal applicants should address the impact of pressurizer insurge/outsurge transients not included in the CLB on the pressurizer vessel items. In the mid-1990s, I&M participated in a program to assess the impact of pressurizer insurge/ outsurge transients on the structural integrity of the pressurizer. CNP operating procedures were modified to decrease the severity of transients resulting from pressurizer surges during heatup and cooldown. New pressurizer lower head transients were developed based on the modified operating procedures and usage factors of the limiting pressurizer items in the lower head were reevaluated and shown to be less than 1.0 for 40 years. This evaluation was updated for 60 years and the usage factors remain below 1.0 for the limiting pressurizer items.

Class 1 piping at CNP has been qualified in accordance with USAS B31.1. The allowable stress limits from USAS B31.1, Section 102.3.2 have generally been applied for this piping using the stress range reduction factor of 1.0 for thermal fatigue stress allowables as long as the location does not exceed 7000 equivalent full-temperature thermal cycles. In order to identify the specific locations where extended operation could invalidate the existing stress range reduction factor in the piping analyses, the design temperatures and operating conditions of Class 1 piping systems were reviewed. The review determined that, based on assumptions of less than 7000 equivalent full-temperature thermal cycles, the analyses for all locations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

I&M performed Class 1 fatigue evaluations (Reference 4.3-3 and Reference 4.3-4) for the pressurizer surge line, normal and alternate charging lines, and auxiliary spray line in response to NRC Bulletins 88-08 and 88-11, as discussed below.

NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems"

NRC Bulletin 88-08 (Reference 4.3-1) requested that licensees (1) review their reactor coolant systems to identify any connected, unisolable piping that could be subjected to temperature distributions that would result in unacceptable thermal stresses; and (2) take action, where such piping is identified, to ensure that the piping will not be subjected to unacceptable thermal stresses.

In response to NRC Bulletin 88-08 and its supplements, I&M completed three action items (References 4.3-11 through 4.3-15).

For Action Item 1, a review of unisolable sections of piping connected to the RCS was completed. The following piping sections were identified as having the potential for being subjected to high-cycle thermal stress caused by leaking valves:

- One 3" alternate charging line to the loop 1 cold leg,
- One 2" auxiliary pressurizer spray line, and
- Four 1-1/2" high-pressure emergency core cooling system (ECCS) injection lines (one injection line to each cold leg).

These lines were initially considered susceptible to thermal fatigue loading based on the potential for upstream valve leakage.

I&M monitored the Unit 1 auxiliary pressurizer spray temperature to demonstrate that the auxiliary pressurizer spray line is not susceptible to high-cycle thermal loads that produce fatigue cracks. This monitoring activity consisted of mounting resistance temperature detectors near appropriate welds and bends and collecting data to determine if the auxiliary pressurizer spray line is subjected to thermal stresses. Data collection was started in March 1992 and was used as input for a detailed fatigue analysis based on the requirements of ASME B&PV Code, 1986 Edition, Section III, Subsection NB-3653, for piping components. The fatigue evaluation of the auxiliary spray line concluded that, for design transients and postulated isolation valve leakage transients, the CUF is less than 1.0, as reported in WCAP-14070 (Reference 4.3-3).

The fatigue evaluation reported in WCAP-14070 is a TLAA, since it was based on CNP design transients and additional information from the auxiliary spray line temperature monitoring program for 40 years. The design transients consider cases that assume a continuous leak in the auxiliary spray isolation valve. As described in Section 6.0 of WCAP-14070, the auxiliary spray line transient definitions are based on 200 heatup and cooldown design transients. The numbers of RCS design transients accrued through 1998 for both units were determined and extrapolated to 60 years of operation. In all instances, the number of RCS design transients assumed in the original design was found to be acceptable for 60 years of operation. Thus, the auxiliary spray line thermal stratification analysis, and the results reported in WCAP-14070, are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

For Action Item 2, nondestructive examinations were performed for potential high stress points for the ECCS and alternate charging lines. Satisfactory volumetric examination results were obtained showing no evidence of thermal fatigue cracking. The high stress points for the auxiliary pressurizer spray lines were also volumetrically examined. Satisfactory volumetric examination results were obtained for all welds and bends that were examined.

For Action Item 3, I&M developed and implemented a long-term program to provide continuing assurance that unisolable sections of piping connected to the RCS will not be subjected to combined cyclic and static stresses (including thermal and other stresses) that could cause fatigue failure. This effort included the following modifications:

- In the 1-1/2” ECCS lines, I&M installed two normally closed manual globe valves in series in the boron injection tank (BIT) bypass line with a telltale connection and manual drain valve between the two valves. Operating procedures were implemented to ensure proper valve position for these valves. In addition, quarterly leak monitoring, by opening the telltale valve, was implemented.

- In 1991, I&M modified the BIT and associated piping as a result of the replacement of the concentrated boric acid solution by a more dilute solution in support of a Technical Specification license amendment (Reference 4.3-16). As part of the modification, the BIT bypass line and associated globe valves and telltale connection were removed and capped, thereby eliminating the concern of leakage from the BIT bypass line to the RCS.
- For the 3" alternate charging line, I&M modified the charging system to operate with two open parallel lines to reduce the potential for cyclic stresses. Operating procedures were revised to incorporate this change.

No modifications were made to the auxiliary spray line based on the fatigue evaluation reported in WCAP-14070. Therefore, I&M responses to Action Item 3 contain no long-term commitments for additional inspections of non-isolable sections of piping connected to the RCS.

Based on these responses, the NRC staff found that CNP met the requirements of NRC Bulletin 88-08 (Reference 4.3-10). There are no I&M commitments made in response to Bulletin 88-08 that must be carried forward to the period of extended operation. The auxiliary spray line thermal stratification analysis and the analysis results reported in WCAP-14070 are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification"

NRC Bulletin 88-11 (Reference 4.3-2) requested that licensees (1) establish and implement a program to confirm pressurizer surge line integrity in view of the occurrence of thermal stratification; and (2) inform the staff of the actions taken to resolve this issue.

Prior to the issuance of NRC Bulletin 88-11, WOG implemented a program to address the issue of surge line stratification. As part of this program, surge line physical and operating data was collected and summarized for all domestic Westinghouse PWRs. Information relating to piping layout, supports and restraints, components, size, material, operating history, etc., was obtained. This data was evaluated generically in conjunction with available monitoring data and plant-specific analyses performed by Westinghouse (Reference 4.3-17).

As the WOG generic evaluation could not be used to satisfy NRC Bulletin 88-11 for CNP, a plant-specific structural analysis of the pressurizer surge line was subsequently performed by Westinghouse (Reference 4.3-4). The results of this analysis, and the fatigue analysis that followed, demonstrated that CNP met both the stress limits and CUF requirements of the ASME code for the duration of licensed operation (32 EFPY). This work led to the NRC's conclusion that CNP is in compliance with the requirements of NRC Bulletin 88-11 (Reference 4.3-17).

The surge line stratification analysis (Reference 4.3-4) was based on the CNP design transients. Specifically, the number of surge line thermal cycles assumed in the analysis (200) was the same as the number of assumed heatup and cooldown design transients. The actual number of heatup and cooldown transients accrued through 1998 for both units was determined and extrapolated to 60 years of operation. The number of heatup and cooldown transients assumed in the original design was found to be acceptable for 60 years of operation. Thus, the existing pressurizer surge line thermal stratification analysis and its results are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.2 Non-Class 1 Fatigue

Each mechanical system reviewed as part of the IPA reported in Sections 3.2 through 3.4 was also screened to identify potential metal fatigue TLAAs. This was accomplished using a screening process to identify non-Class 1 components that may have normal or upset condition operating temperatures in excess of 220^{o}F for carbon steel or 270^{o}F for austenitic stainless steel. Results of the TLAA fatigue review for non-Class 1 mechanical systems within the scope of license renewal are presented below.

Piping

The following mechanical systems, or portions of systems, contain piping components that exceed the screening criteria listed above:

- RCS sample lines
- ECCS (residual heat removal system)
- CVCS (letdown lines)
- Exhaust piping for the EDG and fire protection diesel
- Post-accident containment hydrogen monitoring system (piping containing heat tracing)
- Security diesel (exhaust piping)
- Main feedwater
- Main steam
- AFW (turbine steam supply and exhaust)
- Blowdown systems

The piping components that exceed the screening criteria were evaluated for their potential to exceed 7000 thermal cycles in sixty years of plant operation. It was determined that only the RCS sampling system piping could exceed 7000 cycles during the period of extended operation. However, a calculation was prepared to justify operation of the RCS sample lines for 99,000 full-temperature equivalent cycles. This allows RCS sampling to occur at any reasonable frequency for 60 years of operation without exceeding the allowable number of cycles. Since the analysis did not involve time-limited assumptions defined by the current operating term (for example, 40 years) the analysis is not a TLAA.

Pressure Vessels, Heat Exchangers, Storage Tanks and Pumps

Only non-Class 1 pressure vessels, heat exchangers, storage tanks, and pumps designed and fabricated in accordance with ASME Section VIII, Division 2, or ASME Section III, NC-3200, require evaluation for thermal fatigue. Components designed and fabricated with other design codes (for example, ASME Section VIII Division 1, and tanks and pumps designed to AWWA or MSS) do not require fatigue evaluation, and are suitable for the period of extended operation without further evaluation. Unless specifically directed by the equipment specification, consideration of thermal fatigue is not required by the Code for components (e.g., accumulators) designed in accordance with ASME Section III/Class C and ASME Section VIII, Division 1.

Fatigue analyses for the following vessels and heat exchangers were identified as fatigue TLAAs, since the component equipment specifications included cyclical thermal and pressure design transients as inputs:

- RHR heat exchangers
- Letdown and excess letdown heat exchangers
- Sample heat exchangers
- Regenerative heat exchangers

The tube side of the RHR heat exchangers, letdown and excess letdown heat exchangers, and sample heat exchangers were designed in accordance with ASME Section III/Class C. The shell sides of these heat exchangers were designed in accordance with ASME Section VIII, Division 1, for unfired, welded pressure vessels. The tube and shell sides of the regenerative heat exchangers were designed in accordance with ASME Section III/Class C. The equipment specification for the above heat exchangers requires that the supplier verify that all conditions of ASME Section III, Paragraph N-415.1 (i.e., exemption from fatigue for Class 1 components), are satisfied for the transient conditions specified in the equipment specification. The design transients identified in the equipment-specific specification were reviewed and are consistent with the RCS transients defined in Table 4.1-10 of the UFSAR. As described in Section 4.3.1, the assumed number of RCS design transients are acceptable for 60 years, and the fatigue evaluation considered in the original design of the RHR heat exchangers, letdown and excess letdown heat exchangers, sample heat exchangers, and regenerative heat exchangers will remain valid during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.3.3 **Environmentally-Assisted Fatigue**

Recent test data indicates that certain environmental effects (such as temperature, oxygen, and strain rate) in the primary systems of light water reactors could result in greater susceptibility to fatigue than would be predicted by fatigue analyses based on the ASME Section III design fatigue curves. The ASME design fatigue curves were based on laboratory tests in air at low temperatures. Although the failure curves derived from laboratory tests were adjusted to account for effects such as data scatter, size effect, and surface finish, the NRC is concerned that these adjustments may not be sufficient to account for actual plant operating environments.

The NRC implemented a fatigue action plan (FAP) to systematically assess fatigue issues in operating plants. The results of the FAP were documented in SECY-95-245 (Reference 4.3-5). As reported in SECY-95-245, the NRC believes that no immediate staff or licensee action is necessary to deal with the fatigue issues addressed by the FAP. In addition, the staff concluded that it could not justify requiring a backfit of the environmental fatigue data to operating plants. However, the NRC concluded that because metal fatigue effects increase with service life, the FAP fatigue issues should be evaluated for any proposed extended period of operation for license renewal. Specifically, as part of the resolution of GSI-166 (Reference 4.3-6), which resulted in the initiation of GSI-190 (Reference 4.3-7), the NRC will consider the need to evaluate a sample of components of high fatigue usage using the latest available environmental fatigue data. This is intended to ensure that components will continue to perform their intended functions during the period of extended operation associated with license renewal.

As a part of the effort to close GSI-166 for operating nuclear power plants during the current 40-year license term, Idaho National Engineering Laboratory (INEL) evaluated fatigue-sensitive component locations at plants designed by the four U.S. nuclear steam supply system vendors. NUREG/CR-6260 (Reference 4.3-8) provides the results of those evaluations.

Section 5.5 of NUREG/CR-6260 identified and evaluated the following six component locations to be most sensitive to environmental effects for Westinghouse plants of the same vintage as CNP. These locations and the subsequent calculations are directly relevant to CNP.

(1) Reactor vessel shell and lower head

(2) Reactor vessel inlet and outlet nozzles

(3) Pressurizer surge line (including hot leg and pressurizer nozzles)

(4) Reactor coolant piping charging system nozzle

(5) Reactor coolant piping safety injection nozzle

(6) RHR system Class 1 piping

The evaluation of the six limiting locations for the current term of operation (40 years) and the period of extended operation (60 years) is summarized in NUREG/CR-6260, Table 5-98

(Reference 4.3-8). Of the six limiting locations evaluated, four (i.e., items (2), (4), (5), and (6) above) have CUFs less than 1.0 when extrapolated to 60 years. Evaluations contained in NUREG/CR-6260 used the interim fatigue curves published in NUREG/CR-5999, which have been superseded by fatigue curves reported in NUREG/CR-6717 (Reference 4.3-9).

The latest fatigue analyses for the surge line to assess thermal stratification conditions, as required by NRC Bulletin 88-11, are reported in WCAP-12850 (Reference 4.3-4). Since the Class 1 piping at CNP was designed to USAS B31.1, no fatigue analyses had been conducted for the charging nozzle, safety injection nozzle, and the RHR Class 1 piping. Consequently, INEL performed a fatigue analysis of these locations in NUREG/CR-6260, using representative transients, typical analytical models, and methods of ASME B&PV code, Section III, Subsections NB-3600 and NB-3200, 1992 Edition. Design CUFs for the charging nozzle, safety injection nozzle, and RHR line tee are listed in NUREG/CR-6260, Table 5-98. These CNP-specific design basis CUFs are summarized below.

The limiting locations listed above were evaluated for environmental effects in accordance with the guidance provided in NUREG-1801 (Reference 4.3-18), using the fatigue life correction factors reported in NUREG/CR-6717, Section 5.3. The material used in limiting vessel locations is low-alloy steel and the limiting piping and charging nozzles are manufactured from austenitic stainless steel. Using NUREG/CR-6717, the bounding fatigue life correction factor for low-alloy steel reactor vessel locations is conservatively estimated to be 2.5. The bounding fatigue life correction factor for CNP austenitic stainless steel piping locations is estimated to be approximately 15.0. The revised usage factors, when including these environmental correction factors, are summarized below

NUREG-6260 Item		Usage Factor	Usage Factor w/Environmental Correction Factor
Reactor vessel head-to-shell juncture (low-alloy steel)		0.0182	0.0455
Reactor vessel inlet and outlet nozzles (low-alloy steel)	Inlet	0.0977	0.2443
	Outlet	0.0631	0.1578
Pressurizer surge line (stainless steel)		0.3	4.5
Charging nozzle (stainless steel)		0.03	0.45
Safety injection nozzle (stainless steel)		0.046	0.69
RHR line tee (stainless steel)		0.022	0.33

All limiting low-alloy steel locations are acceptable for the period of extended operation when considering environmental effects. It should be noted that the reactor vessel is clad and the use of environmental fatigue factors is very conservative. In addition, since most of the transients occur with the oxygen concentration below the threshold value in NUREG/CR-6260, there is little environmental effect except during heatup. All limiting stainless steel locations are acceptable for the period of extended operation when considering environmental effects, with the exception of the pressurizer surge line.

For the pressurizer surge line piping, an approach will be developed to show that the effects of fatigue can be managed. Prior to entering the period of extended operation, this approach will be applied to each surge line location that may exceed a CUF of 1.0 when considering environmental effects.

The approach for addressing environmental fatigue for the surge line will include one or more of the following actions:

(1) Further refine of the fatigue analysis to lower pressurizer surge line CUFs to below 1.0;

(2) Repair affected locations;

(3) Replace affected locations;

(4) Manage the effects of pressurizer surge line fatigue by an inspection program that has been reviewed and approved by the NRC (for example, periodic nondestructive examination of the affected locations at inspection intervals to be determined by an NRC-accepted method). The inspections are expected to be able to detect cracking due to thermal fatigue prior to loss of function. Replacement or repair will then be implemented such that the intended function will be maintained for the period of extended operation; and/or

(5) Review changes to ASME B&PV Code related to environmental fatigue. Any refined analysis will use the methodology approved by the ASME Code Committee and the NRC.

Should I&M elect to manage environmentally-assisted fatigue during the period of extended operation, as described in Option 4, inspection details such as scope, qualification, method, and frequency will be provided to the NRC prior to entering the period of extended operation.

The effects of environmentally-assisted thermal fatigue for the limiting locations identified in NUREG-6260 have been evaluated for CNP in accordance with 10 CFR 54.21(c)(1)(i) and (ii). All locations are acceptable for the period of extended operation with the exception of the pressurizer surge line. Aging management of cracking by environmentally-assisted fatigue of the pressurizer surge line is addressed by the Fatigue Monitoring Program, which is discussed in Appendix B of this application, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.4 References for Section 4.3

4.3-1 NRC Bulletin 88-08, "Thimble Tube Thinning in Westinghouse Reactors," July 26, 1988.

4.3-2 NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," December 20, 1988.

4.3-3 WCAP-14070, "Evaluation of Donald C. Cook Units 1 and 2 Auxiliary Spray Piping per NRC Bulletin 88-08," July 1994.

4.3-4 WCAP-12850, "Structural Evaluation of Donald C. Cook Nuclear Plant Units 1 and 2 Pressurizer Surge Lines, Considering the Effects of Thermal Stratification," January 1991.

4.3-5 SECY-95-245, "Completion of Fatigue Action Plan," September 25, 1995.

4.3-6 GSI-166, "Adequacy of Fatigue Life of Metal Components."

4.3-7 GSI-190, "Fatigue Evaluation of Metal Components for 60-year Plant Life."

4.3-8 NUREG/CR-6260, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, March 1995.

4.3-9 NUREG/CR-6717, *Environmental Effects on Fatigue Crack Initiation in Piping and Pressure Vessel Steels*, May 2001.

4.3-10 Letter from J. F. Stang, NRC to E. E. Fitzpatrick, I&M, "NRC Bulletin 88-08, Thermal Stresses in Piping Connected to Reactor Coolant Systems (TAC Nos. M69618 and M69619)," dated August 10, 1992.

4.3-11 Letter from M. P. Alexich, I&M, to T. E. Murley, NRC, "Response to NRC Bulletin No. 88-08: Thermal Stresses in Piping Connected to Reactor Coolant Systems," September 29, 1988.

4.3-12 Letter from M. P. Alexich, I&M, to T. E. Murley, NRC, "NRC Bulletin 88-08: Action Item Status," August 8, 1989.

4.3-13 Letter from E. E. Fitzpatrick, I&M, to T. E. Murley, NRC, "NRC Bulletin 88-08: Thermal Stresses in Piping Connected to Reactor Coolant Systems," dated January 31, 1992.

4.3-14 Letter from E. E. Fitzpatrick, I&M, to T. E. Murley, NRC, "NRC Bulletin 88-08: Thermal Stresses in Piping Connected to Reactor Coolant Systems," dated October 19, 1992.

4.3-15 Letter from E. E. Fitzpatrick, I&M, to T. E. Murley, NRC, "NRC Bulletin 88-08: Thermal Stresses in Piping Connected to Reactor Coolant Systems," dated February 1, 1994

4.3-16 Letter from W. O. Long, NRC, to E. E. Fitzpatrick, I&M, "Amendment Nos. 158 and 142 to Facility Operating License Nos. DPR-58 and DPR-74 (TAC Nos. M80262 and M80263)," dated November 20, 1991.

4.3-17 Letter from W. O. Long, NRC, to E. E. Fitzpatrick, I&M, "Pressurizer Surge Line Thermal Stratification, NRC Bulletin 88-11, Donald C. Cook Nuclear Plant, Units 1 and 2 (TAC Nos. 72125 and 72126)," dated October 28, 1991.

4.3-18 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, April 2001.

4.3-19 WCAP-14574-A, "License Renewal Evaluation: Aging Management for Pressurizer," December 2000.

4.3-20 WCAP-14575-A, "Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components," December 2000.

4.3-21 WCAP-14577-A, "License Renewal Evaluation: Aging Management for Reactor Internals," Revision 1-A, March 2001.

4.3-22 Title 10 of the Code of Federal Regulations (CFR), Part 54, Section 21, "Content of application—technical information."

4.3-23 American Society of Mechanical Engineers (AMSE) Boiler and Pressure Vessel Code Section III, *Rules for Construction of Nuclear Facility Components*.

4.3-24 American Society of Mechanical Engineers (AMSE) Boiler and Pressure Vessel Code Section VIII, *Rules for Construction of Pressure Vessels*.

4.3-25 American Society of Mechanical Engineers (AMSE) Boiler and Pressure Vessel Code Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*.

4.3-26 U.S.A. Standard (USAS) B.31.1, *Power Piping Code*.

Table 4.3-1
RCS Design Transients—Projection to 60 Years

Design Transient	Number of Design Transients	Number of Transients Logged as of 10/31/98		Projected Number of Transients at 60 Years of Operation[1]	
		Unit 1	Unit 2	Unit 1	Unit 2
Level A Limits (Normal)					
Heatup events	200	44	50	110	145
Cooldown events	200	44	49	110	142
Unit loading at 5% of full power per minute	18300 (U2) 11680 (U1)	Not monitored. Since the units are base loaded, the frequency of loading/unloading transients will be of the same order as the number of heatup and cooldown cycles. Therefore, this transient does not need to be tracked.			
Unit unloading at 5% of full power per minute	18300 (U2) 11680 (U1)	Not monitored. See comment above.			
10% step load increase	2000	73[2]	73[2]	183	212
10% step load decrease	2000	57[2]	57[2]	143	166
Large step load decrease with steam dump	200	1	0	3	0
Feedwater cycling/hot standby (secondary side)	18300	Not monitored. I&M has modified the plant design and operations to preclude feedwater nozzle cracking from being a concern.			
Turbine roll test	10	0	0	0	0
Steady-state fluctuations	Infinite	NA	NA	NA	NA
Level B Limits (Upset)					
Loss of load	80	0	0	0	0
Loss of AC electrical power	40	3	2	8	6
Loss of flow in one loop	80	0	0	0	0

Table 4.3-1 (Continued)
RCS Design Transients—Projection to 60 Years

Design Transient	Number of Design Transients	Number of Transients Logged as of 10/31/98		Projected Number of Transients at 60 Years of Operation[1]	
		Unit 1	Unit 2	Unit 1	Unit 2
Reactor trip	400	69.19	68.95	173	200
Operating basis earthquakes – except RPV	400	0	0	0	0
Operating basis earthquakes – RPV	200	0	0	0	0
Level C Limits (Emergency)	None				
Level D Limits (Faulted)					
Large reactor coolant pipe break	1	0	0	0	0
Steam line break	1	0	0	0	0
Safe shutdown earthquake	1	0	0	0	0
Test Conditions					
Primary side leak test	50	1	1	3	3
Hydrostatic test (primary)	5	1	1	3	3
Hydrostatic test (secondary)	5	1	1	3	3

1. Projected cycles = cycles as of 10/25/98 * 2.5 (Unit 1) or *2.9 (Unit 2). Numbers are rounded up to the nearest whole number. 2.5 = 60 years/24 years of operation for Unit 1 and 2.9=60 years/21 years of operation for Unit 2.
2. Only one value for both units.

4.4 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL COMPONENTS

The CNP Environmental Qualification of Electric Components Program manages component thermal, radiation, and cyclical aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) (Reference 4.4-1) qualification methods. As required by 10 CFR 50.49, Environmental Qualification (EQ) components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the qualified aging limits. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered TLAAs for license renewal. The EQ Program ensures that these EQ components are maintained within the bounds of their qualification bases.

The program is an existing CNP program that was established to meet commitments associated with 10 CFR 50.49. The CNP EQ Program is consistent with the program described in NUREG-1801, Section X.E1, "Environmental Qualification (EQ) of Electric Components." (Reference 4.4-4).

CNP was placed into operation prior to the issuance of 10 CFR 50.49 in 1983. Environmental qualification of equipment installed prior to the implementation of 10 CFR 50.49 is addressed in 10 CFR 50.49(k), which states that holders of operating licenses are not required to requalify electric equipment important to safety if the NRC previously required qualification of that equipment under:

- Enclosure 4 to IE Bulletin 79-01B (Reference 4.4-2), "Guidelines for Evaluating Environmental Qualification of Class 1 Electrical Equipment in Operating Reactors" (Division of Operating Reactors [DOR] Guidelines); or
- NUREG-0588, *Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment* (Reference 4.4-3).

This provision applies to CNP such that either the DOR Guidelines or NUREG-0588 is the qualification basis for equipment installed prior to February 22, 1983. 10 CFR 50.49 is the qualification basis for equipment installed after February 22, 1983, unless there are sound reasons to the contrary as noted in 10 CFR 50.49(l).

The program includes consideration of operating experience to modify qualification bases and conclusions, including qualified life. Consistent with NRC guidance (References 4.4-5 and 4.4-6), no additional information is required to address GSI-168, "EQ of Electrical Components" (Reference 4.4-7). Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended functions during accident conditions after experiencing the effects of inservice aging.

Based upon a review of the existing program and operating experience, continued implementation of the Environmental Qualification (EQ) of Electrical Components Program provides reasonable assurance that the aging effects will be managed and that in-scope EQ components will continue to perform their intended function(s) for the period of extended operation. The effects of aging related to EQ evaluations will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.1 References for Section 4.4

4.4-1 Title 10 of the Code of Federal Regulations (CFR), Part 50, Section 49, "Environmental qualification of electric equipment important to safety for nuclear power plants."

4.4-2 NRC Bulletin 79-01B, "Environmental Qualification of Class IE Equipment," January 14, 1980.

4.4-3 NUREG-0588, *Interim Staff Position on Equipment Qualification of Safety-Related Electrical Equipment,* February 1980.

4.4-4 NUREG-1801, *Generic Aging Lessons Learned*, July 2001.

4.4-5 Letter from C. Grimes, NRC, to D. Walters, NEI, "Guidance on Addressing GSI-168 for License Renewal," ML031500232, dated 06/02/1998.

4.4-6 NRC Regulatory Issue Summary (RIS) 2003-009, "Environmental Qualification of Low-Voltage Instrumentation and Control Cables," ML031220078, dated May 2, 2003.

4.4-7 GSI-168, "EQ of Electrical Components."

4.5 CONCRETE CONTAINMENT TENDON PRESTRESS (NOT APPLICABLE)

The prestressing tendons in prestressed concrete containments lose their prestressing forces with time due to creep and shrinkage of concrete, and relaxation of the prestressing steel. During the design phase, engineers estimate these losses to arrive at the predicted prestressing forces at the end of operating life, normally forty years. The loss of tendon prestress analysis is a TLAA only for prestressed concrete containments.

This topic is not applicable to ice condenser containments. The reinforced concrete containments at CNP do not use prestressed tendons.

4.6 CONTAINMENT LINER PLATE AND PENETRATION FATIGUE ANALYSES

The containment building is a reinforced concrete structure consisting of a vertical cylinder with a flat slab base and a hemispherical dome, as described in Section 5.0 of the UFSAR. The steel-lined, reinforced concrete containment structure (including foundations, access hatches, and penetrations) is designed and constructed to maintain full containment integrity when subjected to accident temperatures and pressures, and postulated earthquake conditions. The structure is designed to sustain no loss of function under the tornado or accident conditions described in Section 5.2.2 of the UFSAR.

TLAAs applicable to the reactor containment structure are the containment liner and containment penetration fatigue analyses.

4.6.1 Containment Liner Plate Fatigue

A welded steel liner is attached to the inside face of the concrete shell to ensure a high degree of leak-tightness. The containment structure is designed to contain any radioactive material that might be released following a LOCA. The structure serves as both a biological shield and a pressure container.

The function of the liner is to act as an essentially gas-tight membrane; no credit is taken for the liner's ability to resist primary bursting stresses. The liner is capable of carrying the design pressure within its tension yield capacity without any assistance from the reinforced concrete. Cyclic loads considered in the design of the liner include the following (UFSAR, Section 5.2.3):

(1) Thermal cycling due to annual outdoor temperature variations. Daily variations do not significantly penetrate the concrete shell to influence cycling on the liner. Based on the life of the plant, 40 cycles were considered.

(2) Thermal cycling due to containment interior temperature variations during reactor system startup and shutdown was considered to be 200 cycles.

(3) Thermal cycling due to accident conditions was considered to be 1 cycle.

(4) Cycling due to earthquake was considered to be 10 cycles.

The fatigue life of the liner was evaluated in 1999 after discovery of localized thinning of the liner. The evaluation concluded that, based on testing, the design life of the uncorroded liner plate under a complete stress reversal of ± 20 ksi (1 ksi = 1000 pounds per square inch) is 180,000 cycles.

The amplitude of a thermal stress cycle based on an enveloping assessment of the cyclic design loadings defined in Items 1 through 4 above is from 11.3 ksi compression to no tension. In addition, the number of containment load and thermal cycles experienced during the life of the plant, including the period of extended operation, is insignificant compared to 180,000 cycles at ± 20 ksi. Therefore, the plate was determined to easily endure the small number of load cycles with no fatigue-related degradation; so the fatigue resistance of the containment liner is not a concern for the period of extended operation. This result demonstrates that the analysis of fatigue for the containment liner will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) (Reference 4.6-1).

4.6.2 Containment Penetration Fatigue

The mechanical containment penetrations are discussed in Section 5.2.4 of the UFSAR. Stress intensities for the materials used in the penetration assemblies were determined from the criteria presented in ASME Section III (Reference 4.6-2), 1968 Edition, Figure N-414, Tables N-421 and N-424; and the allowable stresses of USAS Piping Code B 31.1-1967 Edition (Reference 4.6-4). For normal and upset conditions, the UFSAR specifies that primary and secondary stresses in the sleeve and flued head not exceed allowable stresses from Figure N-414 of ASME Section III, which includes consideration of fatigue in accordance with Paragraph N-415.

The original containment penetration stress analysis was reviewed and determined to consider only emergency (pipe break) loads with no specific evaluation of normal and upset loads for fatigue. A generic industry fatigue evaluation is believed to have been completed in the early 1970s, but no CNP-specific mechanical penetration fatigue calculations were located.

Recent plant modifications that required operability reviews of selected containment penetrations and sleeves resulted in the reevaluation of the main steam (CPN-2, -3, -4, and -5) and residual heat removal (CPN-48 and -49) containment penetrations. Specifically, analyses were completed for these penetrations utilizing the operating transients listed in Table 4.1-10 of the UFSAR. These analyses determined that the requirements of ASME Section III, Section N-415.1 (exemption from fatigue) were met and that fatigue evaluations were not required for the main steam and RHR penetrations.

The analyses supporting the exemption–from-fatigue analyses are TLAAs, since the evaluation is based on selected design thermal and loading cycles defined in Table 4.1-10 of the UFSAR. A review of the CNP design thermal and loading cycle definitions determined that the number of design thermal and loading cycles defined for 40 years is projected to be acceptable for 60 years. Therefore, these analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

For the remaining mechanical penetrations that were evaluated generically for fatigue in the 1970s, cracking by fatigue is managed by ASME Section XI (Reference 4.6-3), Subsection IWE. In addition, the exemption-from-fatigue evaluations, which are based on design thermal and loading cycles, for the main steam and RHR penetrations remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3 References for Section 4.6

4.6-1 Title 10 of the Code of Federal Regulation (CFR), Part 54, Section 21, "Contents of application—technical information."

4.6-2 American Society of Mechanical Engineers (AMSE) Boiler and Pressure Vessel Code, Section III, *Rules for Construction of Nuclear Facility Components*.

4.6-3 American Society of Mechanical Engineers (AMSE) Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*.

4.6-4 U.S.A. Standard (USAS) B31.1, *Power Piping Code*.

4.7 OTHER PLANT-SPECIFIC TIME-LIMITED AGING ANALYSES

Other CNP-specific TLAAs include the following:

- Leak-before-break analyses (Section 4.7.1)
- Thermal aging evaluation of the RCP casing (Section 4.7.2)
- Ice condenser lattice frame fatigue analysis (Section 4.7.3)
- Underclad cracking (Section 4.7.4)
- Steam generator flow-induced vibration analysis (Section 4.7.5)
- Fatigue analysis of cranes (Section 4.7.6)

4.7.1 Reactor Coolant System Piping Leak-Before-Break

Leak-before-break analyses evaluate postulated flaw growth in the primary loop piping of the RCS. These analyses consider the thermal aging of the cast austenitic stainless steel (CASS) piping and fatigue transients that drive the flaw growth over the operating life of the plant. Because these two considerations could be influenced by time, leak-before-break analyses are potential TLAAs for CNP.

The CNP leak-before-break evaluations include WCAP-15131, "Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for the D. C. Cook Units 1 and 2 Nuclear Power Plants," Revision 1, (Reference 4.7-1) for RCS primary loop piping and WCAP-15435, "Technical Justification for Eliminating Pressurizer Surge Line Rupture as the Structural Design Basis For D. C. Cook Units 1 and 2 Nuclear Power Plants (non-proprietary)," (Reference 4.7-2) for pressurizer surge line piping. The leak-before-break TLAAs remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i), as discussed in the following sections.

4.7.1.1 RCS Primary Loop Piping

WCAP-15131: Thermal Aging of CASS

The first analysis consideration in WCAP-15131 that could be influenced by time is the material properties of cast austenitic stainless steel. Cast austenitic stainless steels used in the RCS are subject to thermal aging during service. Thermal aging causes an elevation in the yield strength of the material and a decrease in fracture toughness, the decrease being proportional to the level of ferrite in the material. Thermal aging in these stainless steels will continue until a saturation or fully aged point is reached. WCAP-15131, Section 4.3, addresses fracture toughness properties of statically and centrifugally cast CF8M stainless steel. Specifically, fully aged, lower-bounding fracture toughness data from NUREG/CR-6177, *Assessment of Thermal Embrittlement of Cast Stainless Steels* (Reference 4.7-15), was used to conservatively calculate the "J value" for both pipes and elbows. Since the analysis supporting leak-before-break relied on fully aged stainless steel material properties, the analysis does not have a material property time-dependency that requires further evaluation for license renewal.

WCAP-15131: Fatigue Crack Growth Analysis (RCS Piping)

The second analysis consideration that could be influenced by time is the accumulation of actual fatigue transient cycles over time that could invalidate the fatigue crack growth analysis reported in WCAP-15131, Section 8.0. As described in WCAP-15131, a fatigue crack growth analysis of the reactor vessel inlet nozzle safe-end region was performed to determine its sensitivity to the presence of small cracks. The nozzle safe-end connection was selected because crack growth calculated at this location is representative of the entire primary loop.

The nozzle safe-end connection configuration includes an SA 508 Class 2 or Class 3 stainless steel-clad nozzle connected to a stainless steel safe end by a nickel-based alloy weld. A fatigue crack growth rate law for the stainless steel clad low-alloy steel nozzle was obtained from ASME Section XI (Reference 4.7-16). Fatigue crack growth rate laws for stainless steel and Alloy 600 in a PWR environment were developed based on available industry literature. The crack growth rate laws were evaluated for the reactor vessel fatigue transients presented in WCAP-15131, Table 8-1, which are bounded by the fatigue design transients defined in Table 4.1-10 of the UFSAR.

A review of the RCS fatigue transient cycle definitions presented in Table 4.1-10 of the UFSAR has been completed and in all instances the RCS design transients originally defined for 40 years were found to be acceptable for 60 years of operation. Continued implementation of the Fatigue Monitoring Program, which is discussed in Appendix B of this application, provides reasonable assurance that the fatigue crack growth analysis reported in WCAP-15131, Section 8.0, will remain valid during the period of extended operation. This result demonstrates that the LBB TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) (Reference 4.7-12).

4.7.1.2 Pressurizer Surge Line Piping

Successful application of leak-before-break analysis to the RCS pressurizer surge line piping is described in WCAP-15435 (Reference 4.7-2). This report demonstrates compliance with leak-before-break criteria for the pressurizer surge line piping based on a plant-specific analysis. The report documents plant-specific geometry, loading, and material properties used in the fracture mechanics evaluation. The potential TLAA in WCAP-15435 is fatigue crack growth analysis. The surge line piping is fabricated from A376, Type 316, wrought austenitic stainless steel, and is not susceptible to reduction of fracture toughness by thermal embrittlement.

WCAP-15435: Fatigue Crack Growth Analysis

A review of WCAP-15435 determined the only analysis consideration that could be influenced by time is the accumulation of actual fatigue transient cycles that could invalidate the fatigue crack growth analysis reported in Section 6.0 of WCAP-15435. A fatigue crack growth analysis was performed for a plant similar to CNP Units 1 and 2. Two locations were evaluated. The results of the analysis indicate that the maximum fatigue crack growth for 40 years was acceptable by ASME Section XI acceptance standards.

Since the pressurizer pipe size, pipe schedule, and pipe materials are the same, and the design transients are identical to the plant used in the analysis, it was concluded that the CNP Units 1 and 2 pressurizer surge lines will have similar crack growth. The crack growth formulations reported in WCAP-15435 were evaluated for CNP fatigue design transients defined in Table 4.1-10 of the UFSAR.

The RCS transient cycle definition review determined that, in all instances the RCS design transients originally defined for 40 years are acceptable for 60 years of operation. Continued implementation of the Fatigue Monitoring Program, which is discussed in Appendix B of this application, provides reasonable assurance that the fatigue crack growth analysis reported in WCAP-15435 will remain valid for the period of extended operation. In addition, the NRC safety evaluation (Reference 4.7-3) of WCAP-15435 relied on I&M's demonstration that the leakage detection system inside containment was capable of reliably detecting 0.8 gallons per minute of primary system leakage. A December 2000 NRC inspection reviewed the engineering evaluation performed to verify that the Radiation Monitoring System lower containment particulate detectors are capable of detecting this leakage. The inspection resulted in no significant findings (Reference 4.7-4).

Therefore, the pressurizer surge line leak-before-break TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.2 ASME Code Case N-481

Demonstration of compliance of the primary loop pump casings to ASME Code Case N-481 was evaluated generically for all Westinghouse plants in WCAP-13045, "Compliance to ASME Code Case N-481 of the Primary Loop Pump Casings of Westinghouse Type Nuclear Steam Supply Systems," (Reference 4.7-5). The CNP-specific Code Case N-481 evaluation, which references the generic evaluation of WCAP-13045, is reported in WCAP-13128, "Demonstration of

Compliance of the Primary Loop Pump Casings of DC Cook Units 1 and 2 to ASME Code Case N-481," (Reference 4.7-6). The CNP analysis considers thermal aging of the CASS pump casings and fatigue crack growth. Because these analyses could be influenced by time, the Code Case N-481 analysis is a potential TLAA for CNP.

WCAP-13128: Reactor Coolant Pumps - Thermal Aging of CASS

The first analysis consideration in WCAP-13128 that could be influenced by time is the material properties of cast austenitic stainless steel. CASS used in the RCS is subject to thermal aging during service, as discussed in Section 4.7.1.1 of this application. Since the analysis reported in WCAP-13128 supporting Code Case N-481 relied on fully aged stainless steel material properties, the analysis does not have a material property time-dependency that would require further evaluation for license renewal.

WCAP-13128: Reactor Coolant Pumps – Stability Evaluation

The accumulation of actual fatigue transient cycles over time could invalidate the stability evaluation reported in WCAP-13045, Section 12.0, including Table 12-2. A review of the CNP fatigue transient cycle definitions has been completed. The Fatigue Monitoring Program, which is discussed in Appendix B of this application, monitors thermal fatigue design transients (including the transient cycle assumptions reported in WCAP-13045, Table 12-2) for the period of extended operation. The continued implementation of the Fatigue Monitoring Program provides reasonable assurance that the stability evaluation reported in WCAP-13128 will remain valid during the period of extended operation.

Therefore, the fatigue crack growth analysis TLAA will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.3 Ice Condenser Lattice Frame

UFSAR Table 5.3.5.3-2 contains a summary of results of fatigue analysis for the ice condenser lattice frame. The lattice frame was designed in accordance with the American Institute of Steel Construction (AISC) publication AISC-69, *Design, Fabrication, and Erection of Structural Steel for Buildings*, (Reference 4.7-20). The UFSAR states the analysis is based on 400 operational basis earthquakes (OBEs). Based on past operating experience at CNP and other facilities, this OBE limit will not be surpassed during the period of extended operation. Therefore, the lattice frame fatigue analysis will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.4 Reactor Vessel Underclad Cracking

Intergranular separations (underclad cracking) in low-alloy steel heat-affected zones under austenitic stainless steel weld claddings were first detected in SA-508, Class-2, reactor vessel forgings in 1970 during examination of Nucleoelectrica Argentina SA's Atucha-1 reactor vessel. They have been reported to exist in SA-508, Class 2, reactor vessel forgings manufactured to a coarse-grain practice and clad by high-heat-input submerged arc processes. The regulatory position regarding this issue is found in Regulatory Guide (RG) 1.43, *Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components*, (Reference 4.7-13). RG 1.43 states that detection of underclad cracks "normally requires destructively removing the cladding to the weld fusion line and examining the exposed base metal either by metallographic techniques or with liquid penetrant or magnetic particle testing methods."

A detailed analysis of underclad cracks is provided in topical report WCAP-7733 "Reactor Vessels Weld Cladding – Base Metal Interaction," (Reference 4.7-19) in which Westinghouse presented a fracture mechanics analysis to justify continued operation of Westinghouse units for 32 EFPY with underclad cracks in the reactor pressure vessels (RPVs). The analysis reported in WCAP-7733 was identified by the Westinghouse Owners Group and NRC as a TLAA requiring evaluation for license renewal. The Westinghouse Owners Group subsequently evaluated the impact of cracks beneath austenitic stainless steel weld cladding on RPV integrity in WCAP 15338 (Reference 4.7-7), which was approved by the NRC in July 2002 to include all Westinghouse plants (Reference 4.7-8).

The CNP reactor vessels do not contain SA 508, Class 2 forgings in the beltline regions. Only the vessel and closure head flanges and inlet and outlet nozzles are fabricated from SA 508, Class 2 forgings. The evaluation contained in WCAP-15338 has been used to demonstrate that fatigue growth of the subject flaws will be minimal over 60 years and the presence of the underclad cracks are of no concern relative to the structural integrity of the vessels.

The design transients for CNP are reported in Table 4.1-10 of the UFSAR. The numbers of design cycles and transients assumed in the WCAP-15338 analysis bound the numbers of design cycles and transients projected for 60 years of operation. The FSAR supplement, Appendix A of this application, provides a summary description of the evaluation of the TLAA for reactor vessel underclad cracking.

Therefore, the analysis of underclad cracking for CNP remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.5 Steam Generator Tubes – Flow-Induced Vibration

TLAAs applicable to the steam generators include steam generator tube flow-induced vibration. The flow-induced vibration analyses for the Unit 1 and Unit 2 replacement steam generators indicate that the tube bundles are adequately designed and supported for the prevention of detrimental flow-induced vibration over all operating conditions for a 40-year design life. As the replacement steam generators are within scope of license renewal and the tube bundles are relevant to the safe operation of the plant, these calculations meet the 10 CFR 54.3 definition of a TLAA.

The time-dependent assumptions made in the Unit 1 flow-induced vibration calculation pertain to the tube corrosion allowance. The corrosion allowance, and hence the calculation, is based on a 40-year design life of the replacement steam generators. However, as the Unit 1 steam generators were replaced in 2000, their design life extends to 2040. The renewed Unit 1 operating license will expire in 2034, prior to the end of the design life of the Unit 1 replacement steam generators (2040).

Therefore, the Unit 1 replacement steam generator flow-induced vibration analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The time-dependent assumptions made within the Unit 2 flow-induced vibration analysis pertain to the tube wear allowance. The wear allowance, and hence the flow-induced vibration analysis, is based on a 40-year design life of the replacement steam generators. However, this wear allowance is based on the design set of operating transients. The Unit 2 steam generators were replaced in 1988. As described in the Fatigue Monitoring Program, CNP monitors these transient cycles in accordance with requirements of Technical Specification 6.8.1(g), thereby ensuring the current fatigue design basis remains valid for the period of extended operation. This activity also ensures that the 40-year wear allowance remains valid for the additional 20 years of license renewal.

Therefore, the Unit 2 replacement steam generator flow-induced vibration analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.6 Fatigue Analysis of Cranes

In response to NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants* (Reference 4.7-14), I&M stated that the polar cranes, auxiliary building cranes, and screen house crane were in compliance, with limited exceptions, with the design standards of CMAA-70, “Specifications for Electric Overhead Traveling Cranes” (Reference 4.7-17). I&M’s response to NUREG-0612 was approved by the NRC in a safety evaluation dated September 20, 1983 (Reference 4.7-11). Conservative estimates of the number of cycles that could be achieved in 60 years of operation for these five cranes do not exceed the limit in CMAA-70.

Therefore, the crane designs will remain valid for the period of extended operation in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

4.7.7 Reactor Coolant Pump Flywheels

The RCP motors are large, vertical, squirrel cage, induction motors. The motors have flywheels to increase rotational-inertia, thus prolonging pump coastdown and assuring a more gradual loss of main coolant flow to the core in the event that pump power is lost. The flywheel is mounted on the upper end of the rotor, below the upper radial bearing and inside the motor frame. The aging effect of concern is fatigue crack initiation and growth in the flywheel bore keyway from stresses due to starting the motor.

To reduce the RCP flywheel inspection frequency and scope, I&M submitted a license amendment request in 1996 (Reference 4.7-18) based on WCAP-14535, "Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination" (Reference 4.7-9). This topical report includes a stress and fracture evaluation that addresses fatigue crack growth for 60 years. The NRC approved this request via CNP Units 1 and 2 License Amendments 217 and 201 (Reference 4.7-10).

Therefore, the analysis of fatigue crack initiation and growth on the RCP flywheel is not a TLAA, since it is already based on a 60-year term.

4.7.8 References for Section 4.7

4.7-1 WCAP-15131, "Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for the D. C. Cook Units 1 and 2 Nuclear Power Plants," Revision 1, October 1999.

4.7-2 WCAP-15435, "Technical Justification for Eliminating Pressurizer Surge Line Rupture as the Structural Design Basis For D. C. Cook Units 1 and 2 Nuclear Power Plants (non-proprietary)," August 2000.

4.7-3 Letter from J. F. Stang, NRC, to R. P. Powers, I&M, "Review of Leak-Before-Break for the Pressurizer Surge Line Piping as Provided by 10 CFR Part 50, Appendix A, GDC 4 (TAC Nos. MA7834 and MA7835)," dated November 8, 2000.

4.7-4 Letter from G. E. Grant, NRC, to R. P. Powers, I&M, "Inspection Report 50-315/00-25(DRP); 50-316/00-25(DRP)," dated January 12, 2001.

4.7-5 WCAP-13045, "Compliance to ASME Code Case N-481 of the Primary Loop Pump Casings of Westinghouse Type Nuclear Steam Supply Systems," September 1991.

4.7-6 WCAP-13128, "Demonstration of Compliance of the Primary Loop Pump Casings of DC Cook Units 1 and 2 to ASME Code Case N-481," March 1992.

4.7-7 WCAP-15338, "A Review of Cracking Associated with Weld Deposited Cladding in Operating PWR Plants," March 2001.

4.7-8 Revised Safety Evaluation of WCAP-15338, "A Review of Cracking Associated with Weld Deposited Cladding in Operating Pressurized Water Reactor (PWR) Plants," September 25, 2002.

4.7-9 WCAP-14535, "Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination," January 1996.

4.7-10 Letter from J. B. Hickman, NRC, to E. E. Fitzpatrick, I&M, "Issuance of Amendments 217 for Unit 1 and 201 for Unit 2 Re: Reactor Coolant Pump Flywheel Inspection Frequency (TAC Nos. M97888 and M97889)," August 8, 1997.

4.7-11 Letter from S. A. Varga, NRC, to J. Dolan, I&M, "Control of Heavy Loads (Phase 1) – NUREG-0612 Donald C. Cook Nuclear Plant, Unit Nos. 1 and 2," dated September 20, 1983.

4.7-12 Title 10 of the Code of Federal Regulations, Part 54, Section 21, "Contents of application—technical information."

4.7-13 NRC Regulatory Guide 1.43, *Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components*, May 1973.

4.7-14 NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants,* July 1980.

4.7-15 NUREG/CR-6177, *Assessment of Thermal Embrittlement of Cast Stainless Steels,* May 1994.

4.7-16 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, Rules *for Inservice Inspection of Nuclear Power Plant Components*.

4.7-17 CMAA-70, Crane Manufacturers Association of America, Specification #70, "Specification for Electric Overhead Traveling Cranes," 1975.

4.7-18 Letter from E. E. Fitzpatrick, I&M, to NRC Document Control Desk, "Proposed License and Technical Specification Changes of Reactor Coolant Pump Flywheel Inspection Frequency," dated December 20, 1996.

4.7-19 WCAP-7733, "Reactor Vessels Weld Cladding – Base Metal Interaction," July 1971.

4.7-20 American Institute of Steel Construction, *Design, Fabrication, and Erection of Structural Steel for Buildings*, 1969 Edition.

APPENDIX A

UPDATED FINAL SAFETY ANALYSIS REPORT SUPPLEMENT

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A.0 INTRODUCTION

This appendix provides the information to be submitted in a Final Safety Analysis Report Supplement as required by 10 CFR 54.21(d) for the Donald C. Cook Nuclear Plant license renewal application (Application). The Application contains the technical information required by 10 CFR 54. Section 4 of the Application documents the evaluations of time-limited aging analyses (TLAAs) for the period of extended operation. Appendix B of the CNP Application provides descriptions of the programs and activities that will manage the effects of aging for the period of extended operation. These parts of the Application, in particular, have been used to prepare the program and activity descriptions for the CNP Updated Final Safety Analysis Report (UFSAR) Supplement information in this appendix.

This appendix is divided into two parts. The first part (Section A.1) identifies changes to the existing sections of the UFSAR related to license renewal. The second part (Section A.2) provides new information to be incorporated into the UFSAR. The information presented in both parts will be incorporated into the UFSAR following issuance of the renewed operating license. Upon inclusion of the UFSAR Supplement in the CNP UFSAR, changes to these sections of the UFSAR will be subject to the requirements of 10 CFR 50.59.

A.1 CHANGES TO EXISTING UFSAR INFORMATION

This section identifies changes to the existing sections of the UFSAR that reflect a renewed operating license. In the proposed changes to the existing UFSAR, reference to [Chapter A.2] of the UFSAR indicates the chapter which will incorporate the new UFSAR section provided in Section A.2 of this appendix. Proposed text deletions are indicated by a strikethrough and proposed text additions are indicated by double underline.

A.1.1 UFSAR Chapter 2 Change

Section 2.1.5 – Last paragraph

While the Warren Dunes State Park has changed from a 1976 summer peak of 23,958 days visitors of which 1300 were overnight campers to a 1992 day peak of 20,881 visitors of which 1600 were overnight campers, there has been a decline in the number of people occupying summer homes over the years with a decrease from 4,000 in 1964 to 3,000 in 1971 due to the high cost of home maintenance. Hence, the potential for a significant increase in transient population over the ~~40-year~~ life of the plant does not seem probable especially within the Low Population Zone which comprises about 3 miles of lake shore front already containing four beach areas.

A.1.2 UFSAR Chapter 4 Changes

Section 4.1.4 – Insert new paragraph between second and third paragraphs

A renewed operating license extends the license term an additional 20 years for CNP, Units 1 and 2. This extension was justified based on the design transient cyclic loads defined in Table 4.1-10. The reactor coolant system was originally qualified using a conservative estimate of design cycles for a 40-year life. However, design life is dependent in part on fatigue cycles, not years of service. In evaluations performed for CNP, the actual number of cycles was extrapolated to 60 years. For the major reactor coolant system components, the extrapolated numbers of cycles over a 60-year life will not exceed the design cycles. The actual transient cycles are tracked and documented to ensure they remain below the allowable number of design cycles, as further discussed in [Chapter A.2] of the UFSAR.

Section 4.1.4 – Last paragraph

~~Clearly it is difficult to discuss in absolute terms the transients that the plant will actually experience during the 40 years operating life.~~ In accordance with Technical Specifications, CNP tracks the number of transient occurrences listed in the following sections. ~~For clarity, however, each~~ Each transient condition is discussed in order to make clear the nature and basis for the various transients.

Section 4.1.4.2 – First and second paragraphs

The unit loading and unloading cases considered for the original design are conservatively represented by a continuous and uniform ramp power change of 5% per minute between 15% load and full load. This load swing is the maximum possible consistent with operation with automatic reactor control. The reactor coolant temperature will vary with load as programmed by the temperature control system. The number of each operation is specified at 18,300 times over the life of the plant. ~~times or 1 time per day with approximately 25% margin for plants with 40 year design life.~~

For Unit 1 rerating conditions these cases are conservatively represented by a continuous and uniform ramp power change of 5% per minute between 0% load and full load. The number of each operation is specified at 11,680 times over the life of the plant. ~~times or 1 time per day assuming 80% availability for plants with 40-year life design.~~

Section 4.1.4.3 – Last paragraph

Following a step load increase in turbine load, the reverse situation occurs, i.e., the secondary side steam pressure and temperature initially decrease and the reactor coolant average temperature and pressure initially decrease. The control system automatically withdraws the control rods to increase core power. The decreasing pressure transient is reversed by actuation of the pressurizer heaters and eventually the system pressure is restored to its normal value. The reactor coolant average temperature will be raised to a value above its initial equilibrium value at the beginning of the transient. The number of each operation is specified at 2000 times over the life of the plant. ~~times or 50 per year for the 40 year plant design life.~~

Section 4.1.4.4 – Last paragraph

The number of occurrences of this transient is specified at 200 times over the life of the plant. ~~times or 5 per year for the 40 year plant design life. Reference to the Yankee-Rowe record indicates that this basis is adequately conservative.~~

Section 4.1.4.5 – Last paragraph

The number of occurrences of this transient is specified at 80 times over the life of the plant. ~~times or 2 per year for the 40 year plant design life.~~ Since redundant means of tripping the reactor upon turbine trip are provided as part of the Reactor Protection System, transients of this nature are not expected.

Section 4.1.4.6 – Last paragraph

The number of occurrences of this transient is specified at 40 times over the life of the plant. ~~times or 1 per year for the 40-year plant design life~~.

Section 4.1.4.7 – Last paragraph

The number of occurrences of this transient is specified at 80 times over the life of the plant. ~~times or 2 per year for the 40 year plant design life~~.

Section 4.1.4.8 – Last paragraph

The number of occurrences of this transient is specified at 400 times over the life of the plant. ~~times or 10 per year for the 40 year plant design life~~.

Section 4.1.5 – Fifth paragraph

To establish the service life of the Reactor Coolant System components as required by the ASME (Section III) Boiler and Pressure Vessel Code for "A" vessels, unit operating conditions ~~have been~~ were established for the initial 40-year design life. These operating conditions include the cyclic application of pressure loadings and thermal transients. The numbers of operating transients during the 60-year licensed life are not projected to exceed the number of transients assumed for the initial plant design life.

Section 4.2.2.5 – Thirteenth paragraph

A fracture mechanics evaluation was ~~made on~~ completed for the reactor coolant pump flywheel. ~~This evaluation considered the following assumptions:~~

~~a. Maximum tangential stress at an assumed overspeed of 125%.~~

~~b. A crack through the thickness of the flywheel at the bore.~~

~~c. 400 cycles of start-up operation in 40 years.~~

~~Using critical crack stress intensity factors and crack growth data attained on flywheel material, the critical crack size for failure was greater than 17 inches radially and the crack growth data was 0.030" to 0.060" per 1000 cycles.~~ To estimate the magnitude of fatigue crack growth during plant life, an initial radial crack length of 10% of the distance through the flywheel (from the keyway to the flywheel outer radius) was conservatively assumed. The analysis assumed 6000 cycles of pump starts and stops. The existing analysis is valid for the period of extended operation associated with license renewal.

Table 4.1-1 – First page table entry and new footnote

Original plant ~~Plant~~ design life, years [3]	40	40

[3] Licensed life is 60 years in accordance with [Chapter A.2] of the UFSAR.

Table 4.1-10 – Footnote 1

[1] For Unit 1 Model 51R replacement steam generator manway and handhole stud preloads, the design considers 100 cycles each of tensioning and detensioning or torquing and detorquing, as appropriate. ~~over the 40 year life of the RSG.~~

A.1.3 UFSAR Chapter 5 Changes

Section 5.2.3, Liner – Twelfth paragraph

Cycling loads considered in the initial design of the liner were:

1) Thermal cycling due to annual outdoor temperature variations. Daily variations do not significantly penetrate the concrete shell to influence cycling on the liner. ~~Based on the life of the plant, 40 cycles were considered.~~

2) Thermal cycling due to containment interior temperature varying during reactor system startup and shutdown was considered to be 200 cycles.

3) Thermal cycling due to accident condition was considered to be 1 cycle.

4) Cycling due to earthquake was considered to be 10 cycles.

Evaluations concluded that the fatigue analysis for the containment liner remains valid for the period of extended operation associated with license renewal.

Section 5.3.3.4 – First paragraph, item d)

d) The ice condenser internals are designed for a lifetime consistent with that of the plant. Evaluations concluded that these internals will continue to meet the design and licensing basis requirements through the period of extended operation associated with license renewal.

Section 5.3.5.4.2, Design Considerations – Item b)

b) The ice baskets are designed to facilitate maintenance and for a lifetime consistent with that of the plant. Evaluations concluded that the ice baskets will continue to meet the design and licensing basis requirements through the period of extended operation associated with license renewal.

A.1.4 UFSAR Chapter 9 Changes

Table 9.2-2 – Table entry and new footnote

Original plant ~~Plant~~ design life, years	40[3]

[3] Note: Licensed life is 60 years in accordance with [Chapter A.2] of the UFSAR.

Table 9.3-2 – First page table entry and new footnote

Original plant ~~Plant~~ design life, years	40[2]

[2] Licensed life is 60 years in accordance with [Chapter A.2] of the UFSAR.

A.1.5 UFSAR Chapter 14 Changes

Section 14.3.3.6 (Unit 1) – Add new paragraph at end of this section

Evaluations have concluded that the LBB analyses remain acceptable for the period of extended operation as described in [Chapter A.2] of the UFSAR.

Section 14.3.3.6 (Unit 2) – Add new paragraph at end of this section

Evaluations have concluded that the LBB analyses remain acceptable for the period of extended operation as described in [Chapter A.2] of the UFSAR.

A.2 NEW UFSAR SECTION

The following information will be integrated into the UFSAR to document aging management programs and activities credited in the CNP license renewal review and time-limited aging analyses evaluated for the period of extended operation.

A.2.0 Supplement for Renewed Operating Licenses

I&M prepared a license renewal application (Application) for Donald C. Cook Nuclear Plant, Units 1 and 2 (Reference A.2.3.1). The Application, including information provided in supplemental correspondence, provided sufficient basis for the NRC to make the findings required by 10 CFR 54.29 (Final Safety Evaluation Report) (Reference A.2.3.2). As required by 10 CFR 54.21(d), this UFSAR supplement contains a summary description of the programs and activities for managing the effects of aging (Section A.2.1) and the evaluation of time-limited aging analyses for the period of extended operation (Section A.2.2). The period of extended operation is 20 years after the expiration dates of the original operating licenses. With the period of extended operations, the term of each plant operating license is 60 years.

A.2.1 Aging Management Programs and Activities

The integrated plant assessment and the time-limited aging analyses for license renewal identified existing and new aging management programs necessary to provide reasonable assurance that structures and components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis (CLB) for the period of extended operation. This section describes the aging management programs and activities that will be required during the period of extended operation. Existing aging management programs, including those requiring license renewal enhancements, are described in the present tense; whereas new aging management programs that are developed for license renewal are presented in the future tense

A.2.1.1 Alloy 600 Aging Management Program

This program will manage aging effects of Alloy 600/690 components and Alloys 52/152 and 82/182 welds in the reactor coolant system that are not addressed by the following aging management programs:

- The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program, Section A.2.1.9;
- The Steam Generator Integrity Program, Section A.2.1.34; and
- The Reactor Vessel Internals Programs, Section A.2.1.30 and Section A.2.1.31.

The Alloy 600 Aging Management Program will detect cracking from primary water stress corrosion cracking (PWSCC) by using the examination and inspection requirements specified in ASME Section XI. This program will be implemented prior to the period of extended operation.

A.2.1.2 BOLTING AND TORQUING ACTIVITIES PROGRAM

The Bolting and Torquing Activities Program manages the loss of mechanical closure integrity for bolted connections and bolted closures in high temperature systems and in applications subject to significant vibration. This program relies on industry recommendations as delineated in EPRI guidelines for a comprehensive bolting integrity program.

A.2.1.3 BORAL SURVEILLANCE PROGRAM

The Boral Surveillance Program monitors changes in neutron attenuation, dimensional measurements, and weight and specific gravity of representative coupon samples. The Boral coupon samples are located in the spent fuel pool, surrounded by freshly discharged fuel assemblies, to monitor performance of the absorber material without disrupting the integrity of the storage system. Coupons are removed on a prescribed schedule and their properties are measured. From this data, the stability and integrity of Boral in the storage cells are assessed.

A.2.1.4 BORIC ACID CORROSION PREVENTION PROGRAM

The Boric Acid Corrosion Prevention Program relies on implementation of recommendations of NRC Generic Letter 88-05 to monitor the condition of ferritic steel and electrical components on which borated reactor water may leak. The program detects boric acid leakage by periodic visual inspection of systems containing borated water for deposits of boric acid crystals and the presence of moisture; and by inspection of adjacent structures, components, and supports for evidence of leakage.

This program manages loss of material and loss of mechanical closure integrity, and will manage loss of circuit continuity, as applicable. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.5 BOTTOM-MOUNTED INSTRUMENTATION THIMBLE TUBE INSPECTION PROGRAM

The Bottom-Mounted Instrumentation Thimble Tube Inspection Program detects loss of material due to wear in the bottom-mounted instrumentation (BMI) thimble tubes prior to leakage. The thimble tubes are part of the reactor coolant pressure boundary. The program monitors tube wall degradation of the BMI thimble tubes using eddy current testing. The replacement, repositioning, or isolation of the BMI tubes is based on analysis of the data obtained, using wear rate relationships.

A.2.1.6 BURIED PIPING INSPECTION PROGRAM

The Buried Piping Inspection Program will manage the effects of corrosion on the pressure-retaining capability of buried carbon steel piping and tanks. This program will include periodic inspections and preventive measures to mitigate corrosion. Preventive measures will be in accordance with standard industry practice for maintaining external coatings and wrappings. Buried piping and tanks will be inspected when they are excavated during maintenance. The Buried Piping Inspection Program will be implemented prior to the period of extended operation.

A.2.1.7 CAST AUSTENITIC STAINLESS STEEL EVALUATION PROGRAM

The Cast Austenitic Stainless Steel (CASS) Evaluation Program will augment the inspection of reactor coolant system components in accordance with ASME Section XI. The CASS Evaluation Program will manage the effects of loss of fracture toughness in reactor coolant system CASS components susceptible to thermal aging embrittlement using additional inspections and a component-specific flaw tolerance evaluation. This program will not include CASS components within reactor vessel internals, which are evaluated and inspected as part of the Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Program (Section Reactor Vessel Internals Cast Austenitic Stainless Steel Program). The CASS Evaluation Program will be implemented prior to the period of extended operation.

A.2.1.8 CONTAINMENT LEAKAGE RATE TESTING PROGRAM

This section supplements discussion of containment leakage testing in other UFSAR sections, including Sections 5.4.4 and 5.7.3. As described in 10 CFR 50, Appendix J, containment leakage rate tests are required to assure that:

- Leakage through the primary reactor containment and systems and components penetrating primary containment does not exceed allowable leakage rate values; and

- Periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of the containment, and systems and components penetrating primary containment.

This program manages loss of material, cracking, and change in material properties, as applicable, for the equipment constituting the containment pressure boundary.

A.2.1.9 CONTROL ROD DRIVE MECHANISM AND OTHER VESSEL HEAD PENETRATION INSPECTION PROGRAM

The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program manages primary water stress corrosion cracking (PWSCC) of nickel-based alloy reactor vessel head penetrations exposed to borated water to ensure that the pressure boundary function is maintained. The ASME Section XI, Subsection IWB, IWC and IWD Inservice Inspection (Section A.2.1.17) and Water Chemistry Control Programs (Section A.2.1.43) are used in conjunction with this program to manage cracking of the reactor vessel head penetrations.

A.2.1.10 DIESEL FUEL MONITORING PROGRAM

The Diesel Fuel Monitoring Program ensures that adequate diesel fuel quality is maintained to prevent corrosion of the fuel oil systems associated with the emergency diesel engines, diesel-driven fire pump, and security diesel. This program manages aging effects on the internal surfaces of diesel fuel oil tanks and components, as applicable, within the scope of license renewal. The program monitors fuel oil quality and the contaminant concentrations in the fuel oil. Visual inspections of tanks drained for cleaning ensures that significant degradation is not occurring. This program manages the loss of material and cracking, as applicable, for fuel oil system components.

A.2.1.11 ENVIRONMENTAL QUALIFICATION OF ELECTRIC COMPONENTS PROGRAM

The Environmental Qualification of Electric Components Program manages component thermal, radiation, and cyclical aging of electrical equipment as required by 10 CFR 50.49. This program manages aging effects through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, environmentally qualified (EQ) components not qualified for the license term are to be refurbished or replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation.

A.2.1.12 FATIGUE MONITORING PROGRAM

The Fatigue Monitoring Program monitors and tracks the number of critical thermal and pressure transients for selected reactor coolant system components in order not to exceed the design limit on fatigue usage. The program maintains the basis for component analyses containing explicit thermal cycle count assumptions. Components managed by this program are those shown to be acceptable by analyses that explicitly addressed thermal and pressure fatigue transient limits. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.13 FIRE PROTECTION PROGRAM

The Fire Protection Program includes fire barrier and diesel-driven fire pump inspections.

Fire barrier inspections include:

- Periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors; and
- Periodic visual inspection and functional tests of fire-rated doors to ensure that their operability is maintained.

Diesel-driven fire pump inspections include periodic pump testing to ensure that the fuel supply line can perform its intended function. This program also includes periodic inspection and testing of the halon/carbon dioxide fire suppression system. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.14 FIRE WATER SYSTEM PROGRAM

The Fire Water System Program applies to water-based fire protection systems (consisting of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, water storage tanks, and aboveground and underground piping and components) that are tested in accordance with the applicable National Fire Protection Association (NFPA) codes and standards.

Such testing assures the minimum functionality of the systems. These systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated. A sample of sprinkler heads will be inspected using the guidance of NFPA 25, Section 2.3.3.1. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.15 FLOW-ACCELERATED CORROSION PROGRAM

The Flow-Accelerated Corrosion (FAC) Program assures that the structural integrity of carbon steel pipes containing high-energy fluids is maintained. This program includes:

(a)An analysis to determine critical locations;

(b)Limited baseline inspections to determine the extent of thinning at these locations;

(c)Follow-up inspections to confirm the predictions; and

(d)Component repair or replacement, as necessary.

A.2.1.16 HEAT EXCHANGER MONITORING PROGRAM

The Heat Exchanger Monitoring Program will manage loss of material and cracking, as applicable, on heat exchangers exposed to treated water in various systems. The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation using nondestructive examinations, such as eddy-current inspections or visual inspections, or, if appropriate, the heat exchanger will be replaced. If degradation is found, then an evaluation will be performed to determine its effects on the heat exchanger's design functions. The Heat Exchanger Monitoring Program will be implemented prior to the period of extended operation.

A.2.1.17 INSERVICE INSPECTION – ASME SECTION XI, SUBSECTIONS IWB, IWC AND IWD PROGRAM

The ASME Section XI, Subsections IWB, IWC and IWD Program implements the applicable requirements of ASME Section XI, approved NRC alternatives and relief requests, and other requirements specified in 10 CFR 50.55a. Every 10 years, the Inservice Inspection (ISI) Long-Term Plan is updated for each unit to the latest ASME Section XI code edition and addendum approved by the NRC in the current edition of 10 CFR Part 50. The ISI Long-Term Plan is a detailed listing and inspection schedule of components within the ISI boundary.

A.2.1.18 Inservice Inspection – ASME Section XI, Subsection IWE Program

ASME Code Section XI, Subsection IWE and the additional requirements specified in 10 CFR 50.55a(b)(2) constitute an existing required program applicable to managing aging of steel liners of concrete containments and other containment components. The ASME Section XI, Subsection IWE Program uses visual examination, limited volumetric examination, and surface examination, as required.

A.2.1.19 Inservice Inspection – ASME Section XI, Subsection IWF Program

Inservice inspection of supports for ASME piping and components is addressed in Section XI, Subsection IWF. ASME Section XI, Subsection IWF constitutes an existing required program applicable to managing aging of ASME Class 1, 2, 3, and MC supports. The ASME Section XI, Subsection IWF Program uses visual examinations of a sample of the total support population.

A.2.1.20 Inservice Inspection – ASME Section XI Inservice Inspection, Subsection IWL Program

10 CFR 50.55a specifies the examination requirements of the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWL for reinforced concrete containments (Class CC). ASME Code Section XI, Subsection IWL and the additional requirements specified in 10 CFR 50.55a(b)(2) constitute an existing required program applicable to managing aging of reinforced concrete containment systems. The ASME Section XI, Subsection IWL Program uses visual examinations of accessible portions of the containment concrete walls and domes.

A.2.1.21 Inservice Inspection – Augmented Inspections Program

The ASME Section XI, Augmented Inspections Program will manage the effects of aging on selected components outside the jurisdiction of ASME Section XI. To the extent practical, augmented inspections will be consistent with the applicable ASME requirements of ASME Section XI (i.e., selection of inspection methods, inspection frequency, percentage of components examined within a population, and acceptance criteria). This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.22 Instrument Air Quality Program

The Instrument Air Quality Program periodically documents the control air system air quality for maximum dewpoint, particulate size, and dryer condition, pursuant to the performance requirements of ANSI Standard ISA-S7.3-1975. This program ensures that the control air supplied to components within the scope of license renewal is maintained free of water and significant contaminants. This program requires an enhancement that will be implemented prior to the period of extended operation.

A.2.1.23 Non-EQ Inaccessible Medium-Voltage Cable Program

The Non-EQ Inaccessible Medium-Voltage Cable Program will apply to inaccessible (e.g., in conduit or direct-buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with applied voltage. Under this program, in-scope medium-voltage cables that are exposed to significant moisture and voltage will be tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test. The Non-EQ Inaccessible Medium-Voltage Cable Program will be implemented prior to the period of extended operation.

A.2.1.24 Non-EQ Instrumentation Circuits Test Review Program

The Non-EQ Instrumentation Circuits Test Review Program will manage aging effects for electrical cables that:

- Are not subject to the environmental qualification requirements of 10 CFR 50.49, and
- Are used in instrumentation circuits with sensitive, high-voltage, low-level signals exposed to adverse localized environments caused by heat, radiation, or moisture.

An adverse localized environment is defined as being significantly more severe than the specified service environment for the cable. This program will detect aging effects by reviewing calibration or surveillance results for components within the program scope. The Non-EQ Instrumentation Circuits Test Review Program will be implemented prior to the period of extended operation.

A.2.1.25 NON-EQ INSULATED CABLES AND CONNECTIONS PROGRAM

The Non-EQ Insulated Cables and Connections Program will apply to accessible insulated cables and connections installed in structures that are within the scope of license renewal and prone to adverse localized environments. An adverse localized equipment environment is designed as being significantly more severe than the specified service condition for the insulated cable or connection. The program will visually inspect a representative sample of accessible insulated cables and connections for cable and connection jacket surface anomalies. The Non-EQ Insulated Cables and Connections Program will be implemented prior to the period of extended operation.

A.2.1.26 OIL ANALYSIS PROGRAM

The Oil Analysis Program ensures that the lubricating oil environment in the mechanical systems in the scope of license renewal is maintained to the required quality. By monitoring oil quality, the Oil Analysis Program maintains oil systems free of contaminants (primarily water and particulates), thereby preserving an environment that is not conducive to loss of material, cracking, or fouling.

A.2.1.27 PRESSURIZER EXAMINATIONS PROGRAM

The Pressurizer Examinations Program manages cracking of the pressurizer cladding (and items attached to the cladding) which may propagate into the underlying ferritic steel. This program will also determine the condition of the internal spray head, spray head locking bar, and coupling by a one-time visual examination of these components in one CNP unit. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.28 PREVENTIVE MAINTENANCE PROGRAM

The Preventive Maintenance (PM) Program comprises those preventive maintenance tasks which are intended to sustain plant equipment within design parameters and maintain the equipment's intrinsic reliability. PM activities will provide for periodic component inspections and testing to detect the various aging effects applicable to those components included in the scope of the PM Program for license renewal. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.29 REACTOR VESSEL INTEGRITY PROGRAM

The Reactor Vessel Integrity Program manages reduction of fracture toughness of reactor vessel beltline materials to assure that the pressure boundary function of the reactor vessel is maintained. The program is based on ASTM E-185-82, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels," and includes an evaluation of radiation damage based on pre-irradiation and post-irradiation testing of Charpy V-notch and tensile specimens. Through the Reactor Vessel Integrity Program, reports are submitted as required by 10 CFR 50, Appendix H. The Reactor Vessel Integrity Program also encompasses other activities associated with managing the integrity of the reactor vessel, including updating the RT_{PTS} analysis, as required by 10 CFR 50.61, and maintenance of the pressure-temperature curves, as required by 10 CFR 50, Appendix G. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.30 REACTOR VESSEL INTERNALS PLATES, FORGINGS, WELDS, AND BOLTING PROGRAM

The Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program will manage aging effects of reactor vessel internals plates, forgings, welds, and bolting. This program will supplement the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Programs. This program will manage the effects of:

- Crack initiation and growth due to stress corrosion cracking or irradiation-assisted stress corrosion cracking,
- Loss of fracture toughness due to neutron irradiation embrittlement, and
- Distortion due to void swelling.

This program will provide visual inspections and non-destructive examinations of the reactor vessel internals. The Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program will be implemented prior to the period of extended operation.

A.2.1.31 Reactor Vessel Internals Cast Austenitic Stainless Steel Program

The Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Program will manage aging effects of CASS reactor vessel internals components. This program will supplement the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program. The program will manage cracking, reduction of fracture toughness, and dimensional changes using visual inspections and non-destructive examinations of applicable components. Applicability will be determined based on the neutron fluence and thermal embrittlement susceptibility of a component. The Reactor Vessel Internals CASS Program will be implemented prior to the period of extended operation.

A.2.1.32 Service Water System Reliability Program

The Service Water System Reliability Program relies on implementation of the recommendations of NRC Generic Letter 89-13 to ensure that the effects of aging on the essential service water (ESW) system will be managed. The program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the ESW system or structures and components serviced by the ESW system. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.33 Small Bore Piping Program

The Small Bore Piping Program will manage cracking of small bore Class 1 piping (< 4 inch nominal pipe size), including pipe, fittings, and branch connections, in the reactor coolant system. The Small Bore Piping inspection will be a one-time volumetric examination of susceptible items in selected locations of Class 1 small bore piping that will occur prior to the period of extended operation.

A.2.1.34 Steam Generator Integrity Program

The Steam Generator Integrity Program uses nondestructive examination techniques to identify tubes that are defective and need to be removed from service or repaired in accordance with the Technical Specifications.

A.2.1.35 STRUCTURES MONITORING – STRUCTURES MONITORING PROGRAM

Implementation of the Structures Monitoring Program under 10 CFR 50.65, the Maintenance Rule, is addressed in NRC Regulatory Guide 1.160, Rev. 2, and NUMARC 93-01, Rev. 2. These two documents provide guidance for development of licensee-specific programs to monitor the condition of structures and structural components within the scope of both the Maintenance Rule and license renewal such that there is no loss of structure or structural component intended function. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.36 STRUCTURES MONITORING – CRANE INSPECTION PROGRAM

The Crane Inspection Program includes testing and monitoring to provide assurance that the structures and components of cranes in the scope of license renewal are capable of sustaining their rated loads. Crane rails and structural components will be visually inspected on a routine basis for degradation to manage loss of material. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.37 STRUCTURES MONITORING – DIVIDER BARRIER SEAL INSPECTION PROGRAM

The Divider Barrier Seal Inspection Program detects cracking and change in material properties of elastomeric pressure seals for penetrations and openings through the containment divider barrier. The program detects aging effects through visual examination of the seals.

A.2.1.38 STRUCTURES MONITORING – ICE BASKET INSPECTION PROGRAM

The Ice Basket Inspection Program verifies that ice condenser baskets are free of detrimental structural wear, cracks, corrosion, or noticeable damage. The Ice Basket Inspection Program detects loss of material of the ice baskets by visual inspections as required by Technical Specifications.

A.2.1.39 STRUCTURES MONITORING – MASONRY WALL PROGRAM

The Masonry Wall Program manages cracking of masonry walls within the scope of license renewal. Masonry walls are visually inspected as part of the Structures Monitoring Program conducted for 10 CFR 50.65, the Maintenance Rule. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.40 SYSTEM TESTING PROGRAM

The System Testing Program encompasses a number of miscellaneous system and component testing activities credited for managing the effects of aging. These activities are typically surveillance activities required by the Technical Specifications or normal monitoring of plant operation (for example, plant log readings or other normal monitoring techniques). In general, these activities are conducted on a periodic basis (surveillances) or routinely (logs) during plant operation. They are intended to verify the continuing capability of safety-related systems and components to meet established performance requirements. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.41 SYSTEM WALKDOWN PROGRAM

The System Walkdown Program manages loss of material, loss of mechanical closure integrity and cracking, as applicable, for systems and components within the scope of license renewal. The program uses general visual inspections of readily accessible system and component surfaces during system walkdowns. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.42 WALL THINNING MONITORING PROGRAM

The Wall Thinning Monitoring Program will manage loss of material of carbon steel piping and valves in the containment isolation and auxiliary feedwater systems. Inspections will be performed to ensure wall thickness is above the minimum required in order to avoid leaks or failures. The Wall Thinning Monitoring Program will be implemented prior to the period of extended operation.

A.2.1.43 WATER CHEMISTRY CONTROL – PRIMARY AND SECONDARY WATER CHEMISTRY CONTROL PROGRAM

The Primary and Secondary Water Chemistry Control Program mitigates damage caused by corrosion and stress corrosion cracking (SCC). The program relies on monitoring and control of water chemistry based on EPRI guidelines. This program requires enhancements that will be implemented prior to the period of extended operation.

A.2.1.44 WATER CHEMISTRY CONTROL – CLOSED COOLING WATER CHEMISTRY CONTROL PROGRAM

The Closed Cooling Water Chemistry Control Program includes preventive measures that manage loss of material, cracking, and fouling, as applicable, for the component cooling water (CCW) system and components cooled by CCW that are in the scope of license renewal. These chemistry activities provide for monitoring and controlling closed cooling water chemistry using procedures and processes based on EPRI guidelines.

A.2.1.45 WATER CHEMISTRY CONTROL – AUXILIARY SYSTEMS WATER CHEMISTRY CONTROL PROGRAM

The Auxiliary Systems Water Chemistry Control Program manages loss of material and fouling, as applicable, of components in the scope of license renewal that are exposed to treated water environments. The program implements sampling activities and analyses to monitor and control relevant chemistry conditions of these environments.

A.2.1.46 WATER CHEMISTRY CONTROL – CHEMISTRY ONE-TIME INSPECTION PROGRAM

The Chemistry One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control Program to ensure that aging effects are effectively managed during the period of extended operation. Using a combination of non-destructive examinations (NDE), including visual, ultrasonic and surface techniques, a representative sample of components that credit the Water Chemistry Control Programs will be inspected. The Chemistry One-Time Inspection Program will be implemented prior to the period of extended operation.

A.2.2 Evaluation of Time-Limited Aging Analyses

As part of the application for a renewed license, 10 CFR 54.21(c) requires an evaluation of TLAAs for the period of extended operation. The following TLAAs have been identified and evaluated to meet this requirement.

A.2.2.1 Reactor Vessel Neutron Embrittlement

Three analyses that address the effects of neutron irradiation embrittlement of the reactor vessels have been identified as TLAAs. These analyses address:

- Charpy Upper-Shelf Energy (C_VUSE),
- Pressurized Thermal Shock (PTS), and
- Pressure-Temperature (P-T) Limits.

The analyses were updated to 48 effective full power years (EFPY), which represents the end of the period of extended operation (60 years) using an assumed capacity factor of 80%. The Reactor Vessel Integrity Program described in Section A.2.1.29 ensures that time-dependent parameters in these TLAAs remain valid through the period of extended operation. The reactor vessel neutron embrittlement TLAAs are projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Charpy Upper-Shelf Energy

Appendix G of 10 CFR 50 requires that reactor vessel beltline materials maintain a C_VUSE of no less than 50 ft-lb throughout the life of the vessel. The 48 EFPY C_VUSE values for the reactor vessel beltline materials for Unit 1 are reported in Table A-2 of WCAP-15879 (Reference A.2.3.6); and for Unit 2, in Table A-2 of WCAP-13517 (Reference A.2.3.7). The C_VUSE values were calculated using Regulatory Guide 1.99, Revision 2, Position 1. The C_VUSE is maintained above 50 ft-lb for all base metal (plates and forgings) and welds at 48 EFPY for both units. Therefore, Charpy upper-shelf energy has been evaluated in accordance with 10 CFR 54.21(c)(1)(ii).

Pressurized Thermal Shock

10 CFR 50.61(b)(1) provides for the protection of pressurized water reactors against pressurized thermal shock. The projected values of reference temperature for pressurized thermal shock (RT_{PTS}) are required to be assessed upon request for a change in the expiration date for operation of the facility.

10 CFR 50.61(b)(2) establishes screening criteria for RT_{PTS}: 270°F for plates, forgings, and axial welds; and 300°F for circumferential welds. The values for RT_{PTS} at 48 EFPY for Unit 1 are provided in Table 6 of WCAP-15879 (Reference A.2.3.6); and for Unit 2, in Table 6 of WCAP-13517 (Reference A.2.3.7). For both units, the projected RT_{PTS} values for 48 EFPY are within the established screening criteria. Therefore, RT_{PTS} for Units 1 and 2 have been evaluated in accordance with 10 CFR 54.21(c)(1)(ii).

Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires operation of the reactor pressure vessel within established pressure-temperature (P-T) limits. The P-T limits for Unit 1 are documented in WCAP-15878 (Reference A.2.3.8); and for Unit 2 in WCAP-15047 (Reference A.2.3.9). The 48 EFPY P-T results are reported in Section 9.0, Figures 9-3 and 9-4 of each respective WCAP. The operating window at 48 EFPY is sufficient to conduct normal heatup and cooldown operations for both Units 1 and 2. Therefore, P-T limits for Units 1 and 2 have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21 (c)(1)(ii).

A.2.2.2 METAL FATIGUE

The analysis of metal fatigue is a TLAA for Class 1 and selected non-Class 1 mechanical components within the scope of license renewal.

Class 1 Metal Fatigue

Fatigue evaluations performed in the design of the Class 1 reactor coolant system (RCS) components were based on a number of design cycles assumed for the life of the plant. The RCS design transients used in the fatigue evaluations for the Class 1 components were reviewed for both units. The numbers of actual RCS design transients from plant operating history were extrapolated to 60 years of operation. In all instances, the number of RCS design transients assumed in the original design was greater than the extrapolated number for 60 years of operation. Therefore, the fatigue evaluations for the Class 1 components remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The RCS design transients are monitored through the Fatigue Monitoring Program, which is discussed in Section A.2.1.12.

Class 1 piping has been qualified in accordance with USAS B31.1. The allowable stress limits for the piping implicitly assumes a limit of 7000 equivalent full-temperature thermal cycles. To identify the specific locations where extended operation could invalidate the stress limits, the design temperatures and operating conditions of the Class 1 piping systems were reviewed. This review determined that, based on assumptions of fewer than 7000 equivalent full-temperature thermal cycles, the analyses for all locations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

In response to NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," and its supplements, a fatigue evaluation of the auxiliary spray line was performed and reported in WCAP-14070 (Reference A.2.3.10). The fatigue evaluation is based on CNP design transients. As described above, the number of RCS design transients assumed in the original design was greater than the extrapolated number for 60 years of operation. Thus, the auxiliary spray line thermal stratification analysis and its results are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A plant-specific structural analysis of the pressurizer surge line performed and reported in WCAP-12850 (Reference A.2.3.11) supports the conclusion that CNP is in compliance with the requirements of NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification." The surge line stratification analysis was based on the CNP design transients. As described above, the number of RCS design transients assumed in the original design was greater than the extrapolated number for 60 years of operation. Thus, the existing pressurizer surge line thermal stratification analysis and its results are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Non-Class 1 Metal Fatigue

Non-Class 1 piping within the scope of license renewal was designed to USAS B31.1. Piping components that may have Normal or Upset Condition operating temperatures in excess of 220^{o}F for carbon steel, or 270^{o}F for austenitic stainless steel, were evaluated for fatigue. These piping components were evaluated for their potential to exceed the limiting number of equivalent full-temperature cycles used for the original design in sixty years of plant operation. With one exception, the review determined that none of the piping or components would exceed the limit of equivalent full-temperature thermal cycles. Thus, for all but the one exception, fatigue considerations for the original piping and component design are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). For the exception, RCS sampling system piping, a calculation was prepared to justify a new limit to support RCS sampling for 60 years of operation.

Only non-Class 1 pressure vessels, heat exchangers, storage tanks, and pumps designed and fabricated in accordance with the ASME Boiler and Pressure Vessel (B&PV) Code, Section VIII, Division 2 or Section III, NC-3200 (Class B) require evaluation for thermal fatigue. Of these components, consideration of thermal fatigue is not required unless specifically directed by the equipment specification. A review of the components designed to the above Code requirements determined that the components with equipment specifications requiring consideration of thermal fatigue used design transients identified consistent with the RCS transients defined in Table 4.1-10 of the UFSAR. As described for Class 1 metal fatigue in this section, the assumed number of RCS design transients is acceptable for 60 years so the fatigue evaluation considered in the original design of these components will remain valid during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Environmentally-Assisted Fatigue

Recent test data indicates that certain environmental effects (such as temperature, oxygen, and stress rate) in the primary systems of light water reactors could result in greater susceptibility to fatigue than would be predicted by fatigue analyses based on the ASME Section III design fatigue curves. Although the NRC has concluded that the environmental effects associated with fatigue life are not safety significant through the end of the initial license term, they also determined that the effects of fatigue should be addressed for license renewal.

The effects of environmentally-assisted thermal fatigue for the limiting locations identified in NUREG/CR-6260, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, have been evaluated for CNP in accordance with 10 CFR 54.21(c)(1)(i and ii) and all locations were determined to be acceptable for the period of extended operation with the exception of the pressurizer surge line. Aging management of cracking by environmentally-assisted fatigue of the pressurizer surge line is addressed by the Fatigue Monitoring Program, which is discussed in Section A.2.1.12, in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.2.3 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL COMPONENTS

The CNP Environmental Qualification of Electric Components Program, discussed in Section A.2.1.11, manages component thermal, radiation, and cyclical aging, as applicable, through the use of aging evaluations based on the applicable qualification methods:

- 10 CFR 50.49(f),
- NUREG-0588, *Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment*, or
- Enclosure 4 to IE Bulletin 79-01B, "Guidelines for Evaluating Environmental Qualification of Class 1 Electrical Equipment in Operating Reactors."

Aging evaluations for EQ components that specify a qualification of at least 40 years are considered TLAAs for license renewal. The Environmental Qualification of Electric Components Program ensures that these EQ components will be maintained within the bounds of their qualification bases. The effects of aging will thus be managed in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.2.4 CONTAINMENT LINER PLATE AND PENETRATION FATIGUE ANALYSES

TLAAs applicable to the containment structure are the containment liner plate and the containment penetration fatigue analyses.

Containment Liner Plate Fatigue

The fatigue life of the liner was evaluated in 1999 after discovery of localized thinning of the liner. The evaluation, based on testing, determined a fatigue cyclic loading limit for the uncorroded liner plate, of 180,000 cycles at an amplitude of ± 20 ksi. The amplitude of a thermal stress cycle based on an enveloping assessment of the liner design cyclic loads (UFSAR, Section 5.2.3) is well within the amplitude of the evaluated limit. Additionally, the number of containment load and thermal cycles expected during the plant life including the period of extended operation is insignificant compared to 180,000 cycles. Therefore, the analysis of fatigue for the containment liner will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Containment Penetration Fatigue

Analyses for the main steam and residual heat removal (RHR) penetrations were developed using the operating transients listed in Table 4.1-10 of the UFSAR. The analyses determined that the requirements of ASME III, Section N-415.1 (exemption from fatigue) were met and that fatigue evaluations were not required for the main steam and RHR penetrations. The analyses supporting the exemption-from-fatigue analyses are TLAAs, since the evaluation is based on selected design thermal and loading cycles. As described for Class 1 metal fatigue in Section A.2.2.2, the assumed number of RCS design transients is acceptable for 60 years. Therefore, the exemption-from-fatigue evaluations for the main steam and RHR containment penetration analyses remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.2.5 OTHER PLANT-SPECIFIC TIME-LIMITED AGING ANALYSES

Other CNP-specific TLAAs include:

- Leak-before-break (LBB) analyses,
- Thermal aging evaluation of the reactor coolant pump (RCP) casing,
- Ice condenser lattice frame fatigue analysis,
- Underclad cracking evaluation,
- Steam generator flow-induced vibration analyses, and
- The fatigue analysis of cranes.

Reactor Coolant System Piping Leak-Before-Break

The leak-before-break analyses include WCAP-15131 (Reference A.2.3.12) for RCS primary loop piping and WCAP-15435 (Reference A.2.3.13) for pressurizer surge line piping. For both analyses, the only consideration that could be influenced by time is the accumulation of actual fatigue transient cycles. Both analyses were evaluated for fatigue design transients defined in Table 4.1-10 of the UFSAR. As described for Class 1 metal fatigue in Section A.2.2.2, the assumed number of RCS design transients is acceptable for 60 years so these analyses will remain valid during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

ASME Code Case N-481

Compliance of the reactor coolant pump casings to ASME Code Case N-481 was evaluated generically for all Westinghouse plants in WCAP-13045 (Reference A.2.3.14). The CNP-specific Code Case N-481 evaluation, which references WCAP-13045, is reported in WCAP-13128 (Reference A.2.3.15). The evaluation uses transient cycle assumptions included in the CNP fatigue design transients. As presented in Section A.2.2.2 for Class 1 metal fatigue, the assumed number of RCS design transients is acceptable for 60 years, so the Code Case N-481 evaluation will remain valid during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Ice Condenser Lattice Frame

UFSAR Table 5.3.5.3-2, which contains a summary of results of fatigue analysis for the lattice frame, is based on 400 operational basis earthquakes (OBEs). Based on past operating experience at CNP and other facilities, this OBE limit will not be surpassed during the period of extended operation. Therefore, the lattice frame fatigue analysis will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Reactor Vessel Underclad Cracking

A detailed analysis of underclad cracks in SA-508, Class 2 reactor vessel forgings is provided in topical report WCAP-7733 (Reference A.2.3.16), which presented a fracture mechanics analysis to justify the continued operation of Westinghouse units for 32 EFPY with underclad cracks in the reactor pressure vessels. WCAP-15338 (Reference A.2.3.17) evaluates the impact of cracks beneath austenitic stainless steel weld cladding on reactor pressure vessel integrity for 60 years of operation.

The CNP reactor vessels do not contain SA 508, Class 2 forgings in the beltline regions. Only the vessel and closure head flanges and inlet and outlet nozzles are fabricated from SA 508, Class 2 forgings. The evaluation contained in WCAP-15338 has been used to demonstrate that fatigue growth of the subject flaws will be minimal over 60 years and the presence of the underclad cracks are of no concern relative to the structural integrity of the vessels. The design transients assumed are listed in Table 4.1-10 of the UFSAR. As described for Class 1 metal fatigue in Section A.2.2.2, the assumed number of RCS design transients is acceptable for 60 years. The numbers of design cycles and transients assumed in the WCAP-15338 analysis bound the numbers of design cycles and transients projected for 60 years of operation. This result demonstrates that the analysis of underclad cracking remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Steam Generator Tubes – Flow-Induced Vibration

The TLAAs applicable to the steam generators are the analyses of steam generator tube flow-induced vibration. The time-dependent assumptions used in the Unit 1 flow-induced vibration calculation are based on a 40-year design life for the steam generators. The Unit 1 replacement steam generators were installed in 2000 and their design life, which extends to 2040, surpasses the period of extended operation. Therefore, this Unit 1 steam generator flow-induced vibration analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The time-dependent assumptions made within the Unit 2 flow-induced vibration analysis are based on the design set of operating transients. As described for Class 1 metal fatigue in Section A.2.2.2, the assumed number of RCS design transients is acceptable for 60 years. Therefore, the Unit 2 steam generator flow-induced vibration analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Cranes

In response to NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants Resolution of Generic Technical Activity A-36,* I&M stated that the polar cranes, auxiliary building cranes, and screenhouse crane were in compliance with the design standards of CMAA-70, "Specification for Electric Overhead Traveling Cranes," with limited exceptions. This position was approved in an NRC safety evaluation dated September 20, 1983 (Reference A.2.3.22). Conservative estimates of the number of cycles that could be achieved in 60 years of operation for these five cranes do not exceed the limit in CMAA-70. As a result, the crane designs will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.2.6 TLAAs Contained in Exemptions

I&M requested that the NRC staff exempt Units 1 and 2 from application of specific requirements of Appendix G to 10 CFR 50 (References A.2.3.18 and A.2.3.19, respectively). The proposed exemption requests were granted (References A.2.3.20 and A.2.3.21, respectively). These exemptions are used for the calculation of the P-T limits detailed in WCAP-15878 (Reference A.2.3.8) and WCAP-15047 (Reference A.2.3.9) for Units 1 and 2, respectively. As discussed in Section A.2.2.1, these evaluations have been updated in accordance with 10 CFR 54.21(c)(1)(ii) to include 60 years (48 EFPY) for both units. Therefore, the continuation of these exemptions is justified for the period of extended operation.

A.2.3 References

A.2.3.1 (CNP License Renewal Application - later)

A.2.3.2 (NRC SER for CNP License Renewal - later)

A.2.3.3 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, U.S. Nuclear Regulatory Commission, July 2001.

A.2.3.4 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report, U.S. Nuclear Regulatory Commission*, July 2001.

A.2.3.5 NUREG-1743, *Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 1*, U.S. Nuclear Regulatory Commission, April 2001.

A.2.3.6 WCAP-15879, “Evaluation of Pressurized Thermal Shock for D. C. Cook Unit 1 for 40 Years and 60 Years,” Revision 0.

A.2.3.7 WCAP-13517, “Evaluation of Pressurized Thermal Shock for D. C. Cook Unit 2,” Revision 1.

A.2.3.8 WCAP-15878, “D.C. Cook Unit 1 Heatup and Cooldown Limit Curves for Normal Operation for 40 Years and 60 Years,” Revision 0.

A.2.3.9 WCAP-15047, “D.C. Cook Unit 2 WOG Reactor Vessel 60-Year Evaluation Minigroup Heatup and Cooldown Limit Curves for Normal Operation,” Revision 2.

A.2.3.10 WCAP-14070, “Evaluation of Donald C. Cook Units 1 and 2 Auxiliary Spray Piping Per NRC Bulletin 88-08,” July 1994.

A.2.3.11 WCAP-12850, “Structural Evaluation of Donald C. Cook Nuclear Plant Units 1 and 2 Pressurizer Surge Lines, Considering the Effects of Thermal Stratification,” January 1991.

A.2.3.12 WCAP-15131, “Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for the D. C. Cook Units 1 and 2 Nuclear Power Plants,” Revision 1, September 1999.

A.2.3.13 WCAP-15435, "Technical Justification for Eliminating Pressurizer Surge Line Rupture as the Structural Design Basis For D. C. Cook Units 1 and 2 Nuclear Power Plants (non-proprietary)," August 2000.

A.2.3.14 WCAP-13045, "Compliance to ASME Code Case N-481 of the Primary Loop Pump Casings of Westinghouse Type Nuclear Steam Supply Systems," September 1991.

A.2.3.15 WCAP-13128, "Demonstration of Compliance of the Primary Loop Pump Casings of D. C. Cook Units 1 and 2 to ASME Code Case N-481," March 1992.

A.2.3.16 WCAP-7733, "Reactor Vessels Weld Cladding – Base Metal Interaction," July 1971.

A.2.3.17 WCAP-15338, "A Review of Cracking Associated with Weld Deposited Cladding in Operating PWR Plants," March 2001.

A.2.3.18 Letter from J. E. Pollock, I&M, to NRC Document Control Desk, "D. C. Cook Nuclear Plant, Unit 1, License Amendment Request for Unit 1 Reactor Coolant System Pressure-Temperature Curves, and Request for Exemption from Requirements in 10 CFR 50.60(a) and 10 CFR 50, Appendix G," AEP:NRC:2349-01, dated December 10, 2002.

A.2.3.19 Letter from J. E. Pollock, I&M, to NRC Document Control Desk, (D. C. Cook Nuclear Plant, Unit 2, License Amendment Request for Unit 2 Reactor Coolant System Pressure-Temperature Curves, and Request for Exemption from Requirements in 10 CFR 50.60(a) and 10 CFR 50, Appendix G," AEP:NRC:2349-01, dated July 23, 2002.

A.2.3.20 Letter from J. F. Stang, NRC, to A. C. Bakken III, I&M, "Donald C. Cook Nuclear Plant Unit 1, Issuance of Amendment," dated July 18, 2003

A.2.3.21 Letter from J. F. Stang, NRC, to A. C. Bakken III, I&M, "Donald C. Cook Nuclear Plant Unit 2, Issuance of Amendment," dated March 20, 2003.

A.2.3.22 Letter from S. A. Varga, NRC, to J. Dolan, I&M, "Control of Heavy Loads (Phase 1) – NUREG-0612 Donald C. Cook Nuclear Plant, Unit Nos. 1 and 2," dated September 20, 1983.

APPENDIX B

AGING MANAGEMENT PROGRAMS AND ACTIVITIES

TABLE OF CONTENTS

B.0 INTRODUCTION

B.0.1 Overview

The aging management review results for the integrated plant assessment of the Donald C. Cook Nuclear Plant (CNP) are presented in Sections 3.1 through 3.6 of this application. Programs credited in the integrated plant assessment for managing aging effects are described in this appendix.

An acceptable aging management program consists of ten programmatic elements in accordance with the guidance in NUREG-1800 (Reference B.3-11) Appendix A.1, Table A.1-1, "Elements of an Aging Management Program for License Renewal." For those aging management programs that are comparable to the programs described in Sections X and XI of NUREG-1801 (Reference B.3-12), the ten elements have been compared to the elements of the NUREG-1801 program; the degree of consistency is summarized in this appendix. For plant-specific programs (i.e., those that do not correlate with NUREG-1801), the method of satisfying each of the ten elements is provided in the program description.

B.0.2 Format of Presentation

For those aging management programs that are comparable to the programs described in Sections X and XI of NUREG-1801, the program discussion is presented in the following format:

- **Program Description** — presents an abstract of the overall program.
- **NUREG-1801 Consistency —** provides a summary of the degree of consistency between the CNP program and the corresponding NUREG-1801 program, when applicable (i.e., degree of similarity, etc.).
- **Exceptions to the NUREG-1801** — when applicable, this section outlines exceptions to the NUREG-1801 program, including a justification for the exceptions.
- **Enhancements** — when applicable, this section presents future program enhancements with a proposed schedule for their completion. Additional program features to manage aging effects not addressed by the NUREG-1801 program are also described as enhancements.
- **Operating Experience** — this section provides a discussion of operating experience information specific to the program.
- **Conclusion —** this section provides a statement of reasonable assurance that the program is effective, or will be effective, once implemented with necessary enhancements.

For plant-specific programs, the above format is generally followed, with additional discussion of each of the ten elements.

Existing aging management programs are described in the present tense; whereas enhancements to existing programs and new aging management programs that are developed for license renewal are presented in the future tense.

B.0.3 CNP Corrective Actions, Confirmation Process, and Administrative Controls

Three elements common to all aging management programs are corrective actions, confirmation process, and administrative controls. Discussion of these elements is presented below. As necessary, program-specific details for corrective actions are included in the Program Description section of individual programs. Further discussion of the confirmation process and administrative controls is not necessary and is not included in the descriptions of the individual programs.

Corrective Actions

CNP quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B (Reference B.3-2). Conditions adverse to quality (such as failures, malfunctions, deviations, defective material and equipment, and nonconformances) are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the nonconformance is determined and that corrective action is taken to preclude repetition. In addition, the root cause of the significant condition adverse to quality and the corrective action implemented are documented and reported to appropriate levels of management. Corrective actions for both safety-related and nonsafety-related structures and components are accomplished through the existing Corrective Action Program. CNP corrective actions are consistent with NUREG-1801.

Confirmation Process

CNP QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The Corrective Action Program includes the requirement that measures be taken to preclude repetition of significant conditions adverse to quality. These measures include actions to verify effective implementation of proposed corrective actions. Corrective actions for both safety-related and nonsafety-related structures and components are accomplished through the existing Corrective Action Program. The confirmation process is part of the Corrective Action Program and for significant conditions adverse to quality, 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.

Follow-up inspections required by the confirmation process are documented in accordance with the Corrective Action Program. The Corrective Action Program constitutes the confirmation process for aging management programs and activities. The CNP confirmation process is consistent with NUREG-1801.

Administrative Controls

CNP QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing Document Control Program in accordance with the Quality Assurance Program Description (QAPD) (Reference B.3-20). CNP administrative controls are consistent with NUREG-1801.

B.0.4 Operating Experience

Operating experience pertaining to the programs and activities credited with managing the effects of aging was reviewed, including past corrective actions resulting in program enhancements. This review, which included both plant-specific and industry operating experience, demonstrated that existing programs will adequately manage the applicable aging effects. New programs will be based on relevant plant-specific and/or industry operating experience.

An extensive restart effort conducted during 1997-2000 resulted in significant improvements to most of the existing programs discussed in this appendix. For, example, the Maintenance Rule and Preventive Maintenance Programs were significantly enhanced. A review of site operating experience subsequent to these changes indicates that the existing programs are effective. In addition, self-assessments and program "health reports" are used to assure that the programs continue to be effective.

B.0.5 Aging Management Programs

The following aging management programs are described in the listed sections of this appendix. Programs are identified as either existing or new.

1) Alloy 600 Aging Management Program [Section B.1.1] [New]

2) Bolting and Torquing Activities Program [Section B.1.2] [Existing]

3) Boral Surveillance Program [Section B.1.3] [Existing]

4) Boric Acid Corrosion Prevention Program [Section B.1.4] [Existing]

5) Bottom-Mounted Instrumentation Thimble Tube Inspection Program [Section B.1.5] [Existing]

6) Buried Piping Inspection Program [Section B.1.6] [New]

7) Cast Austenitic Stainless Steel Evaluation Program [Section B.1.7] [New]

8) Containment Leakage Rate Testing Program [Section B.1.8] [Existing]

9) Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program [Section B.1.9] [Existing]

10) Diesel Fuel Monitoring Program [Section B.1.10] [Existing]

11) Fire Protection Program [Section B.1.11] [Existing]

12) Fire Water System Program [Section B.1.11.2] [Existing]

13) Flow-Accelerated Corrosion Program [Section B.1.12] [Existing]

14) Heat Exchanger Monitoring Program [Section B.1.13] [New]

15) Inservice Inspection – ASME Section XI, Inservice Inspection, Subsection IWB, IWC, IWD Program [Section B.1.14] [Existing]

16) Inservice Inspection – ASME Section XI, Inservice Inspection, Subsection IWE Program [Section B.1.15] [Existing]

17) Inservice Inspection – ASME Section XI, Inservice Inspection, Subsection IWF Program [Section B.1.16] [Existing]

18) Inservice Inspection – ASME Section XI, Inservice Inspection, Subsection IWL Program [Section B.1.17] [Existing]

19) Inservice Inspection – ASME Section XI, Augmented Inspections Program [Section B.1.18] [Existing]

20) Instrument Air Quality Program [Section B.1.19] [Existing]

21) Non-EQ Inaccessible Medium-Voltage Cable Program [Section B.1.20] [New]

22) Non-EQ Instrumentation Circuits Test Review Program Section B.1.21] [New]

23) Non-EQ Insulated Cables and Connections Program [Section B.1.22] [New]

24) Oil Analysis Program [Section B.1.23] [Existing]

25) Pressurizer Examinations Program [Section B.1.24] [Existing]

26) Preventive Maintenance Program [Section B.1.25] [Existing]

27) Reactor Vessel Integrity Program [Section B.1.26] [Existing]

28) Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program [Section B.1.27] [New]

29) Reactor Vessel Internals Cast Austenitic Stainless Steel Program [Section B.1.28] [New]

30) Service Water System Reliability Program [Section B.1.29] [Existing]

31) Small Bore Piping Program [Section B.1.30] [New]

32) Steam Generator Integrity Program [Section B.1.31] [Existing]

33) Structures Monitoring – Structures Monitoring Program [Section B.1.32] [Existing]

34) Structures Monitoring – Crane Inspection Program [Section B.1.33] [Existing]

35) Structures Monitoring – Divider Barrier Seal Inspection Program [Section B.1.34] [Existing]

36) Structures Monitoring – Ice Basket Inspection Program [Section B.1.35] [Existing]

37) Structures Monitoring – Masonry Wall Program [Section B.1.36] [Existing]

38) System Testing Program [Section B.1.37] [Existing]

39) System Walkdown Program [Section B.1.38] [Existing]

40) Wall Thinning Monitoring Program [Section B.1.39] [New]

41) Water Chemistry Control – Primary and Secondary Water Chemistry Control Program [Section B.1.40] [Existing]

42) Water Chemistry Control – Closed Cooling Water Chemistry Control Program [Section B.1.40.2] [Existing]

43) Water Chemistry Control – Auxiliary Systems Water Chemistry Control Program [Section B.1.40.3] [Existing]

44) Water Chemistry Control – Chemistry One-Time Inspection Program [Section B.1.41] [New]

B.0.6 Time-Limited Aging Analyses Aging Management Programs

The following programs are credited in the evaluation of time-limited aging analyses (TLAAs). As demonstrated in Section 4 of this application, these programs manage the effects of aging on the intended function(s) for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

1) Environmental Qualification of Electric Components Program [Section B.2.1] [Existing]

2) Fatigue Monitoring Program [Section B.2.2] [Existing]

B.0.7 Correlation with NUREG-1801 Aging Management Programs

The programs listed in Sections B.0.5 and B.0.6 are either plant-specific or are comparable to those discussed in NUREG-1801. Table B-1 provides a correlation between generic NUREG-1801 programs and comparable CNP programs, and includes a listing of plant-specific programs. Programs that are comparable to generic NUREG-1801 programs are either fully consistent or are consistent with exceptions. For the CNP programs, links to appropriate sections of this appendix are provided.

Table B-1

NUREG-1801 Number	NUREG-1801 Program	CNP Program
XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Inservice Inspection – ASME Section XI Inservice Inspection, Subsection IWB, IWC, IWD Program [Section B.1.14]
XI.M2	Water Chemistry	Water Chemistry Control – Primary and Secondary Water Chemistry Control Program [Section B.1.40]
XI.M3	Reactor Head Closure Studs	Not Applicable — cracking of reactor vessel closure bolting will be managed by the Inservice Inspection – ASME Section XI Inservice Inspection, Subsection IWB, IWC, IWD Program [Section B.1.14]
XI.M4	BWR Vessel ID Attachment Welds	Not Applicable — this is a BWR program
XI.M5	BWR Feedwater Nozzle	Not Applicable — this is a BWR program
XI.M6	BWR Control Rod Drive Return Line Nozzle	Not Applicable — this is a BWR program
XI.M7	BWR Stress Corrosion Cracking	Not Applicable — this is a BWR program
XI.M8	BWR Penetrations	Not Applicable — this is a BWR program
XI.M9	BWR Vessel Internals	Not Applicable — this is a BWR program
XI.M10	Boric Acid Corrosion	Boric Acid Corrosion Prevention Program [Section B.1.4]

NUREG-1801 Number	NUREG-1801 Program	CNP Program
XI.M11	Nickel-Alloy Nozzles and Penetrations	Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program [Section B.1.9]
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Cast Austenitic Stainless Steel Evaluation Program [Section B.1.7]
XI.M13	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	Reactor Vessel Internals Cast Austenitic Stainless Steel Program [Section B.1.28]
XI.M14	Loose Part Monitoring	Not Applicable — loss of preload of reactor vessel internals will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program [Section B.1.27]
XI.M15	Neutron Noise Monitoring	Not Applicable — loss of preload of reactor vessel internals will be managed by the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program [Section B.1.27]
XI.M16	PWR Vessel Internals	Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program [Section B.1.27]
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion Program [Section B.1.12]
XI.M18	Bolting Integrity	Not Applicable — cracking and/or loss of mechanical closure integrity will be managed by different programs as indicated in Section 3.0 tables
XI.M19	Steam Generator Tube Integrity	Steam Generator Integrity Program [Section B.1.31]

NUREG-1801 Number	NUREG-1801 Program	CNP Program
XI.M20	Open-Cycle Cooling Water System	Service Water System Reliability Program [Section B.1.29]
XI.M21	Closed-Cycle Cooling Water System	Water Chemistry Control – Closed Cooling Water Chemistry Control Program [Section B.1.40.2]
XI.M22	Boraflex Monitoring	Not Applicable — Boraflex is not used at CNP
XI.M23	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Structures Monitoring – Crane Inspection Program [Section B.1.33]
XI.M24	Compressed Air Monitoring	Not Applicable — see Item 3.3.1-19 in Table 3.3.1
XI.M25	BWR Reactor Water Cleanup System	Not Applicable — this is a BWR program
XI.M26	Fire Protection	Fire Protection Program [Section B.1.11]
XI.M27	Fire Water System	Fire Water System Program [Section B.1.11.2]
XI.M28	Buried Piping and Tanks Surveillance	Not Applicable — the NUREG-1801 XI.M34 program is used
XI.M29	Aboveground Carbon Steel Tanks	Not Applicable — Loss of material of tanks in scope is managed by the Service Water System Reliability Program [Section B.1.29]
XI.M30	Fuel Oil Chemistry	Diesel Fuel Monitoring Program [Section B.1.10]
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Integrity Program [Section B.1.26]

NUREG-1801 Number	NUREG-1801 Program	CNP Program
XI.M32	One-Time Inspection	Small Bore Piping Program [Section B.1.30] Water Chemistry Control – Chemistry One-Time Inspection Program [Section B.1.41]
XI.M33	Selective Leaching of Materials	Not Applicable — Loss of material due to selective leaching, where applicable, will be managed by the • Service Water System Reliability Program [Section B.1.29]; • System Walkdown Program [Section B.1.38]; and/or • Water Chemistry Control Programs – - Primary and Secondary Water Chemistry Control [Section B.1.40], - Closed Cooling Water Chemistry Control [Section B.1.40.2], and/or - Auxiliary Systems Water Chemistry Control [Section B.1.40.3]
XI.M34	Buried Piping and Tanks Inspection	Buried Piping Inspection Program [Section B.1.6]
XI.E1	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Insulated Cables and Connections Program [Section B.1.22]
XI.E2	Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Non-EQ Instrumentation Circuits Test Review Program [Section B.1.21]
XI.E3	Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Non-EQ Inaccessible Medium-Voltage Cable Program [Section B.1.20]

NUREG-1801 Number	NUREG-1801 Program	CNP Program
XI.S1	ASME Section XI, Subsection IWE	Inservice Inspection – ASME Section XI Inservice Inspection, Subsection IWE Program [Section B.1.15]
XI.S2	ASME Section XI, Subsection IWL	Inservice Inspection – ASME Section XI Inservice Inspection, Subsection IWL Program [Section B.1.17]
XI.S3	ASME Section XI, Subsection IWF	Inservice Inspection – ASME Section XI Inservice Inspection, Subsection IWF Program [Section B.1.16]
XI.S4	10 CFR 50, Appendix J	Containment Leakage Rate Testing Program [Section B.1.8]
XI.S5	Masonry Wall Program	Structures Monitoring – Masonry Wall Program [Section B.1.36]
XI.S6	Structures Monitoring Program	Structures Monitoring – Structures Monitoring Program [Section B.1.32]
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Not Applicable — CNP is not committed to RG 1.127; however, aging effects of applicable in scope structures will be managed by the Structures Monitoring Program [Section B.1.32]
XI.S8	Protective Coating Monitoring and Maintenance Program	Not Applicable — protective coatings are not relied upon to manage aging effects at CNP
Chapter X		
X.M1	Metal Fatigue of Reactor Coolant Pressure Boundary	Fatigue Monitoring Program [Section B.2.2]
X.E1	Environmental Qualification (EQ) of Electric Components	Environmental Qualification of Electric Components Program [Section B.2.1]

NUREG-1801 Number	NUREG-1801 Program	CNP Program
X.S1	Concrete Containment Tendon Prestress	Not Applicable — prestressed tendons are not used at CNP
Plant-Specific Programs		
NA	Plant-specific program	Alloy 600 Aging Management Program [Section B.1.1]
NA	Plant-specific program	Bolting and Torquing Activities Program [Section B.1.2]
NA	Plant-specific program	Boral Surveillance Program [Section B.1.3]
NA	Plant-specific program	Bottom-Mounted Instrumentation Thimble Tube Inspection Program [Section B.1.5]
NA	Plant-specific program	Heat Exchanger Monitoring Program [Section B.1.13]
NA	Plant-specific program	Inservice Inspection – ASME Section XI, Augmented Inspections Program [Section B.1.18]
NA	Plant-specific program	Instrument Air Quality Program [Section B.1.19]
NA	Plant-specific program	Oil Analysis Program [Section B.1.23]
NA	Plant-specific program	Pressurizer Examinations Program [Section B.1.24]
NA	Plant-specific program	Preventive Maintenance Program [Section B.1.25]
NA	Plant-specific program	Structures Monitoring – Divider Barrier Seal Inspection Program [Section B.1.34]

NUREG-1801 Number	NUREG-1801 Program	CNP Program
NA	Plant-specific program	Structures Monitoring – Ice Basket Inspection Program [Section B.1.35]
NA	Plant-specific program	System Testing Program [Section B.1.37]
NA	Plant-specific program	System Walkdown Program [Section B.1.38]
NA	Plant-specific program	Wall Thinning Monitoring Program [Section B.1.39]
NA	Plant-specific program	Water Chemistry Control – Auxiliary Systems Water Chemistry Control Program [Section B.1.40.3]
NA	Plant-specific program	Water Chemistry Control – Chemistry One-Time Inspection Program [Section B.1.41]

B.1 AGING MANAGEMENT PROGRAMS

B.1.1 Alloy 600 Aging Management

Program Description

The Alloy 600 Aging Management Program is a new, plant-specific program that I&M will implement prior to the period of extended operation. There is no comparable NUREG-1801 program.

This program will manage aging effects of Alloy 600/690 components and Alloy 52/152 and 82/182 welds in the reactor coolant system that are not addressed by other aging management programs. This program will detect primary water stress corrosion cracking (PWSCC) prior to loss of component intended function by using the examination and inspection requirements specified in American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI. The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program (Section B.1.9) will manage the Alloy 600 reactor vessel head penetrations and the Steam Generator Integrity Program (Section B.1.31) will manage cracking of the Alloy 690 steam generator tubes for the period of extended operation. Cracking of nickel-based alloys used in reactor vessel internals will be addressed by the Reactor Vessel Internals Programs (Sections B.1.27 and B.1.28).

Aging Management Program Elements

Scope

The scope of the Alloy 600 Aging Management Program will include Alloy 600/690 components and Alloys 52/152 and 82/182 welds in the reactor coolant system that are not addressed by other aging management programs.

For the reactor vessel, the following items will be included in this program:

- Reactor vessel low-alloy steel nozzle-to-stainless steel safe end buttering and welds,
- Bottom-mounted instrumentation (BMI) nozzles,
- Core support pads, and
- Unit 1 vessel flange leakage tubes.

For the pressurizer, the following items will be included in this program:

- Low-alloy spray nozzle-to-stainless steel safe end welds (connects the thermal sleeve to the safe end),

- Low-alloy steel surge nozzle-to-stainless steel safe end welds (connects the thermal sleeve to the safe end), and
- Low-alloy steel safety relief and safety valve nozzles to stainless steel safe ends.

For the steam generators, the following items will be included:

- Low-alloy steel primary nozzle-to-stainless steel safe ends,
- Primary tubesheet cladding,
- Partition plate,
- Unit 1 primary manway insert plates, and
- Primary nozzle closure rings.

Preventive Actions

This is a condition monitoring program; no actions will be taken to prevent aging effects or mitigate aging degradation.

Parameters Monitored or Inspected

The Alloy 600 Aging Management Program will detect degradation by using the examination and inspection requirements specified in ASME Section XI. The parameters monitored will be the presence and extent of cracking.

Detection of Aging Effects

This program will detect cracking by PWSCC prior to loss of component intended function. The following locations will receive volumetric examination during each inspection interval in accordance with the 1989 Edition of ASME Section XI, Examination Category B-F:

- Reactor vessel — reactor vessel nozzle-to-stainless steel safe end dissimilar metal welds.
- Steam generators — steam generator inlet and exit nozzle-to-stainless steel safe end dissimilar metal welds.
- Pressurizer — surge nozzle, spray nozzle, safety, and relief nozzle-to-safe end dissimilar metal welds.

Other locations (the bottom-mounted instrumentation [BMI] nozzles and the core support pads) will receive visual examinations in accordance with ASME Section XI, Examination Categories B-P and B-N-2, respectively.

The items that receive volumetric examination in accordance with ASME Section XI, Examination Category B-F will adequately represent the remaining Alloy 600 items and Alloy 52/152 and Alloy 82/182 welds that are not inspected volumetrically or visually.

Monitoring and Trending

Records of the inspection program, examination and test procedures, examination/test data, and corrective actions taken or recommended will be maintained in accordance with the requirements of ASME Section XI, Subsection IWA.

The Electric Power Research Institute (EPRI) Material Reliability Program (MRP), in conjunction with the PWR owners groups, is developing a strategic plan to manage and mitigate PWSCC of nickel-based alloy items. The main goal of the MRP is to provide short- and long-term guidance for inspection, evaluation, and management of Alloy 600 base material and Alloy 52/152 and 82/182 weld metal locations in PWR primary systems. Guidance developed by the MRP and the owners groups is expected to be used to identify critical locations for inspection and augment existing ISI inspections at CNP where appropriate.

Acceptance Criteria

Acceptance criteria for the volumetric inspections of dissimilar metal welds will be in accordance with ASME Section XI, IWB-3514. The acceptance standards for visual examination required by Examination Category B-P will be in accordance with IWB-3522. Acceptance standards for visual inspection of the core support pads are provided in IWB-3520.

Corrective Actions

Components that do not meet the acceptance criteria will be evaluated for continued service and repaired or replaced in accordance with the requirements of ASME Section XI. Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The Alloy 600 Aging Management Program is a new program for which there is no CNP-specific operating experience. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

The Alloy 600 Aging Management Program will manage the effects of aging on the Alloy 600/690 components and Alloys 52/152 and 82/182 welds during the period of extended operation. It will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. Implementation of the Alloy 600 Aging Management Program will provide reasonable assurance that the effects of aging will be managed so that the components within the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation. The program will be implemented prior to the period of extended operation.

B.1.2 Bolting and Torquing Activities

Program Description

The Bolting and Torquing Activities Program is an existing plant-specific program. There is no comparable NUREG-1801 program. A similar program was previously evaluated and approved by the NRC in NUREG-1743 (Reference B.3-13).

The Bolting and Torquing Activities Program relies on industry recommendations as delineated in EPRI guidelines for a comprehensive bolting integrity program.

Aging Management Program Elements

Scope

The program covers bolting in high-temperature systems and in applications subject to significant vibration, as identified in the aging management reviews.

Preventive Actions

Preventive actions include proper selection of bolting material and the use of the appropriate lubricants and sealants in accordance with EPRI guidelines.

Initial inspection of bolting for pressure-retaining components includes a check of the bolt torque and uniformity of the gasket compression after assembly. Hot torque checks are not applied to all bolted closures within the scope of this program, but are controlled procedurally if vendor-recommended or if determined necessary on a case-by-case basis.

Parameters Monitored or Inspected

Torque values are monitored when the bolted closure is assembled. Maintenance personnel visually inspect components used in the bolted closures to assess their general condition during maintenance. Gaskets, gasket seating surfaces, and fasteners are inspected for damage that would prevent proper sealing.

Detection of Aging Effects

This is a preventive program. Actions performed under the program prevent the aging effect of loss of mechanical closure integrity. This program is credited with managing the loss of mechanical closure integrity for bolted connections and bolted closures.

Monitoring and Trending

Torque values are monitored during the bolt torquing process. Trending is not applicable to this program.

Acceptance Criteria

Acceptance criteria are provided in CNP site procedures. Typical criteria are that mating surfaces are smooth and free of major defects. Other criteria include proper and adequate thread engagement and use of appropriate torque values.

Corrective Actions

Repair and replacement are in conformance with recommendations of EPRI guidelines. Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The review of operating experience relative to CNP bolting and torquing activities included condition reports, licensee event reports, and NRC inspection reports. The review revealed limited problems with bolting and torquing activities. Operating experience, both at CNP and in the nuclear industry, has been and continues to be factored into program improvements.

Condition reports identified in the operating experience review included aspects of bolting and torquing, and indicated no pattern of repeat conditions. An example of a condition report related to CNP bolting and torquing activities is one that identified better criteria for flexitallic gasket crush than bolt torque alone. A combination of bolt torque and gasket crush, as measured by flange gap, was incorporated into the procedure.

A condition documented in a 1995 licensee event report found loose Conax seal assemblies on reactor vessel post-accident vent solenoid valves. The torque specified in the assembly procedure was below the manufacturer's recommended torque and ferrules were missing from the connections. Procedures were revised to increase the torque value to the manufacturer's recommended value and to better identify all parts required to assemble the connections.

Conclusion

The Bolting and Torquing Activities Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the aging effects associated with bolted closures will be managed such that applicable structures and components will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.3 Boral Surveillance

Program Description

The Boral Surveillance Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The Boral Surveillance Program depends primarily on representative coupon samples located in the spent fuel pool to monitor performance of the absorber material without disrupting the integrity of the storage system. To ensure the coupons experience a higher radiation dose than the Boral in the racks, the coupon tree is surrounded by freshly discharged fuel assemblies.

Over the duration of the coupon testing program, the coupons accumulate more radiation dose than the expected lifetime dose for other storage cells. Coupons are removed from the coupon tree on a prescribed schedule and certain physical and chemical properties are measured. From this data, the stability and integrity of the Boral in the storage cells are assessed.

Aging Management Program Elements

Scope

The Boral Surveillance Program includes the Boral in the CNP spent fuel pool.

Preventive Actions

This is an inspection program; no actions are taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

The coupon surveillance program is intended to monitor changes in the following physical properties of the Boral coupon material.

- Neutron attenuation
- Dimensional measurements (length, width, and thickness)
- Weight and specific gravity

Detection of Aging Effects

During the first fuel off-load after the 1993 spent fuel pool re-rack, and after installation of the coupon tree, the eight storage cells surrounding the tree were loaded with freshly discharged fuel assemblies that were among the higher specific power assemblies in the core. Shortly before the second reload after the spent fuel pool re-rack, one coupon was removed for evaluation. The coupon tree was again surrounded by freshly discharged fuel assemblies.

This procedure is repeated at intervals specified in the program procedure. Thus, the coupons accumulate more radiation dose than the other storage cells. The removed coupons are examined and certain physical and chemical properties are measured. From this data, the stability and integrity of the Boral in the storage cells are assessed.

Monitoring and Trending

The periodic inspection measurements and analysis are compared to values of previous measurements and analysis to provide data for trend analysis.

Acceptance Criteria

Acceptance criteria for these measurements are as follows:

- A decrease of no more than 5 percent in Boron-10 content, as determined by neutron attenuation.
- An increase in thickness at any point not exceeding 10 percent of the initial thickness at that point.

The remaining measurement parameters are examined for early indications of potential Boral degradation and possibly a change in the measurement schedule. These indications include:

- Visual or photographic evidence of unusual surface pitting, corrosion or edge deterioration
- Unaccountable weight loss in excess of the measurement accuracy
- The existence of areas of reduced boron density in the neutron radiograph

Corrective Actions

If a change occurs in either the neutron attenuation measurement or the dimensional measurement as described above, an investigation and engineering evaluation must be performed. The engineering evaluation is performed to identify further testing (such as blackness testing on the storage racks) or corrective action that may be necessary.

Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

Review of CNP operating experience relative to the Boral Surveillance Program included condition reports, procedure revisions, and an inspection report for the last Boral coupon tested.

Condition reports resulted in the correction of procedural problems, including:

- Insufficiently defined responsibilities in the controlling procedure leading to missed samples,
- Missing references to NRC commitments, and
- Noncompliance with administrative guidelines.

Another condition report documented a CNP review of industry operating experience concerning hydrogen gas generated by the interaction of fuel pool water with Boral. No program changes were deemed necessary at CNP for this condition.

The above condition reports demonstrate that this program is continually being reviewed, and that operating experience from CNP and the industry is being reviewed. The results of these reviews are used to improve the program.

In the documentation of the most recent Boral coupon testing, the results were compared with data taken when the coupon was initially prepared. The comparison demonstrated that the material continues to perform well. There were no significant changes in coupon dimensions, weight, specific gravity, and Boron-10 areal density. Some minor corrosion pitting was noted and optical microscopy was performed. The corrosion pitting had not progressed to the extent it would affect the function of the Boral.

Conclusion

The Boral Surveillance Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed so that the components crediting this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.4 Boric Acid Corrosion Prevention

Program Description

The Boric Acid Corrosion Prevention Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M10, Boric Acid Corrosion.

The program relies on implementation of recommendations in NRC Generic Letter (GL) 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," (Reference B.3-6) to monitor the condition of ferritic steel components on which borated reactor water may leak. Periodic visual inspection of adjacent structures, components, and supports for evidence of leakage and corrosion is an element of the GL 88-05 monitoring program.

NUREG-1801 Consistency

With the inclusion of program enhancements, the Boric Acid Corrosion Prevention Program will be consistent with the program described in NUREG-1801, Section XI.M10.

Enhancements

The following enhancements to the Boric Acid Corrosion Prevention Program will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope	The program scope will be revised to include electrical components in addition to ferritic steel.
6. Acceptance Criteria	The program acceptance criteria will be revised to address electrical components in addition to ferritic steel.

Operating Experience

Review of CNP operating experience for the Boric Acid Corrosion Prevention Program included condition reports, procedure revisions and an inspection report. Most condition reports relating to boric acid leakage addressed minor leakage that was corrected before component damage occurred. A condition report identifying a condition in which damage did occur documented an accumulation of boric acid crystals on a heat exchanger flange. A brown stain was noted in the acid crystals, indicating corrosion of the carbon steel bolts. The bolts were replaced with stainless steel bolts to prevent recurrence. This demonstrates that the program is actively monitoring, correcting, and making changes to prevent recurrences.

An NRC inspection of the CNP Boric Acid Corrosion Program against the requirements of GL 88-05 determined that I&M adequately implemented the program. The 1989 inspection report concluded that the program meets the intent of GL 88-05.

This program continues to be improved based on operating experience. Program procedure revisions have incorporated lessons learned from condition reports and industry guidance.

Conclusion

The Boric Acid Corrosion Prevention Program effectively manages aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Boric Acid Corrosion Prevention Program will provide reasonable assurance that the effects of aging will be managed such that components crediting this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.5 Bottom-Mounted Instrumentation Thimble Tube Inspection

Program Description

The Bottom-Mounted Instrumentation Thimble Tube Inspection Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The purpose of the Bottom-Mounted Instrumentation Thimble Tube Inspection Program is to identify loss of material due to wear in the bottom-mounted instrumentation (BMI) thimble tubes prior to leakage. The thimble tubes are part of the reactor coolant pressure boundary.

Aging Management Program Elements

Scope

The Bottom-Mounted Instrumentation Thimble Tube Inspection Program includes all thimble tubes installed in each reactor vessel.

Preventive Actions

This is an inspection program; no actions are taken as part of this program to prevent aging effects or mitigate aging degradation.

Parameters Monitored or Inspected

The Bottom-Mounted Instrumentation Thimble Tube Inspection Program monitors tube wall degradation of the BMI thimble tubes. Failure of the thimble tubes would result in a breach of the reactor coolant pressure boundary.

Detection of Aging Effects

The Bottom-Mounted Instrumentation Thimble Tube Inspection Program detects loss of material due to wear of the tube outer diameter prior to loss of component intended function. Inspection of the BMI thimble tubes is performed using eddy current testing. Thimble tube inspections are scheduled to be performed every third refueling outage.

Monitoring and Trending

The replacement, repositioning, or isolation of BMI tubes is based on analysis of the data obtained using wear rate relationships that are predicted based on Westinghouse research presented in WCAP-12866, “Bottom Mounted Instrumentation Flux Thimble Wear” (Reference B.3-17). These wear rates, as well as the results of the eddy current examinations are documented in plant-specific calculations. This approach ensures that the thimble tubes continue to perform their pressure boundary function.

Acceptance Criteria

The acceptance criterion for BMI thimble tubes is 80 percent through-wall (thimble tube wall thickness is not less than 20 percent of initial wall thickness). The acceptance criterion was developed by Westinghouse in WCAP-12866. Per CNP guidelines, tubes with 80 percent through-wall wear shall be replaced or isolated. Thimble tubes with wear exceeding 40 percent through-wall, but projected to remain under 80 percent by the next inspection, may be repositioned. Thimble tubes with wear projected to exceed 80 percent by the next inspection will be repositioned, replaced, or isolated.

Corrective Actions

Thimble tubes that are projected to exceed the acceptance criterion may be replaced, isolated, or repositioned. Specific corrective actions will be implemented in accordance with the Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The NRC issued Bulletin 88-09, “Thimble Tube Thinning in Westinghouse Reactors,” (Reference B.3-3) based in part on the experience at Salem Generating Station, where flux thimble tube wear was first identified. CNP's Bottom-Mounted Instrumentation Thimble Tube Inspection Program was developed based on the guidance in Bulletin 88-09.

This program has been effective in identifying thimble tube wear and repositioning or replacing tubes with wall degradation prior to the onset of leakage. In 2000, based on program inspection results, all thimble tubes were replaced with tubes that are chrome-plated in the area subject to wear. Based on successful operating experience with the chrome-plated tubes, CNP revised the thimble tube eddy current inspection frequency to once every third refueling outage.

Conclusion

The Bottom-Mounted Instrumentation Thimble Tube Inspection Program effectively manages aging effects by identifying loss of material due to wear in the thimble tubes prior to leakage. Continued implementation of this program provides reasonable assurance that aging effects will be managed such that the BMI thimble tubes will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

B.1.6 Buried Piping Inspection

Program Description

The Buried Piping Inspection Program is a new program that I&M will implement prior to the period of extended operation. This program will be comparable to the program described in NUREG-1801, Section XI.M34, Buried Piping and Tanks Inspection.

The Buried Piping Inspection Program will include (a) preventive measures to mitigate corrosion and (b) periodic inspection to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel piping and tanks. Preventive measures will be implemented in accordance with standard industry practice for maintaining external coatings and wrappings. Buried piping and tanks will be inspected when they are excavated during maintenance.

NUREG-1801 Consistency

The Buried Piping Inspection Program is a new program that will be consistent with, but include an exception to, the program described in NUREG-1801, Section XI.M34.

Exceptions to NUREG-1801

The Buried Piping Inspection Program at CNP will include the following exception to the program described in NUREG-1801, Section XI.M34.

Element Affected	Exception
4. Detection of Aging Effects	NUREG-1801 refers to periodic inspections with a scheduled frequency. CNP intends to inspect buried tanks and piping only when excavated during maintenance activities. [1]

1. CNP intends to inspect buried tanks and piping only when excavated during maintenance activities since excavating such components solely to perform inspections poses undue risk of damage to protective coatings. CNP operating experience shows that the anticipated frequency of excavating buried tanks and piping for maintenance activities will be sufficient to provide reasonable assurance that the effects of aging will be identified prior to loss of intended function. Multiple excavations of similar underground piping have been conducted in recent years.

Operating Experience

The Buried Piping Inspection Program is a new program for which there is no plant-specific operating experience. However, in recent years, multiple excavations have been conducted of underground piping similar to the piping and tanks to be included in the program. The piping and valves that were uncovered and inspected were of the same material (carbon steel) or a less corrosion-resistant material than the buried piping and tanks in the scope of this program. Future inspection results from similar excavations are expected to be indicative of the condition of fuel oil system components. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

Implementation of the Buried Pipe Inspection Program will provide reasonable assurance that the effects of aging will be managed so that the components within the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation. The program will be implemented prior to the period of extended operation.

B.1.7 Cast Austenitic Stainless Steel Evaluation

Program Description

The Cast Austenitic Stainless Steel (CASS) Evaluation Program is a new program that I&M will implement prior to the period of extended operation. The program will be comparable to the program described in NUREG-1801, Section XI.M12, Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS).

Reactor coolant system components will be inspected in accordance with the ASME Section XI. This program will manage reduction of fracture toughness due to thermal aging embrittlement of CASS components. The CASS Evaluation Program will include a determination of the susceptibility of the CASS components to thermal aging embrittlement based on casting method, molybdenum content, and percent ferrite. The applicable CNP components will be limited to main reactor coolant system CASS (hot, cold, and cross-over legs only), including all elbows. The stainless steel safe ends connected to the reactor vessels are forgings and are not susceptible to reduction of fracture toughness by thermal embrittlement. For potentially susceptible components, aging management will be accomplished utilizing additional inspections and a component-specific flaw tolerance evaluation.

This program will not include reactor vessel internals CASS components which are evaluated and inspected as part of the Reactor Vessel Internals Program (Section B.1.28). Additionally, screening for susceptibility to thermal aging will not be required for pump casings and valve bodies. The existing ASME Section XI inspection requirements, including the alternative requirements of ASME Code Case N-481 for pump casings, will be adequate for all pump casings and valve bodies.

NUREG-1801 Consistency

The CASS Evaluation Program will be consistent with the program described in NUREG-1801, Section XI.M12.

Operating Experience

This is a new program at CNP; however, it will be based on extensive fracture toughness data in literature. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

Implementation of the CASS Evaluation Program will provide reasonable assurance that the effects of aging will be managed so that the components within the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation. Prior to the period of extended operation, CNP will develop aging management program details (for example, plans for additional volumetric inspections or flaw tolerance evaluations) for the RCS piping heats of material that are susceptible to reduction of fracture toughness. The program will be implemented prior to the period of extended operation.

B.1.8 Containment Leakage Rate Testing

Program Description

The Containment Leakage Rate Testing Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.S4, 10 CFR 50, Appendix J. As described in 10 CFR 50, Appendix J, containment leakage rate tests are required to assure that:

(a) Leakage through the primary reactor containment and systems and components penetrating primary containment shall not exceed allowable values as specified in the Technical Specifications or associated Bases; and

(b) Periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of the containment, and systems and components penetrating primary containment.

NUREG-1801 Consistency

The Containment Leakage Rate Testing Program is consistent with the program described in NUREG-1801, Section XI.S4.

Operating Experience

The CNP Containment Leakage Rate Testing Program has previously been benchmarked against the Arkansas Nuclear One Appendix J program. The CNP integrated leakage rate test (ILRT) method has been benchmarked against the Catawba Nuclear Station ILRT method. The CNP program is consistent with comparable industry programs. An interface with industry peers from Duke Energy Corporation, the Tennessee Valley Authority, Exelon Generation Corporation, and Entergy is actively maintained to stay abreast of industry Appendix J issues and initiatives.

A self-assessment of the Containment Leakage Rate Testing Program performed in 1999 identified several weaknesses with the program. A subsequent assessment in 2000 found that program improvements that were implemented following the previous self-assessment resolved the majority of the issues. A check of the program status in 2003 found that improvements have continued, which indicates that CNP is actively and critically self-assessing this program and implementing corrective actions, as necessary.

Conclusion

The Containment Leakage Rate Testing Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed so that components included in this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.9 Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection

Program Description

The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program is an existing program at CNP. It is comparable to the program described in NUREG-1801, Section XI.M11, Nickel-Alloy Nozzles and Penetrations.

The purpose of the Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program is to manage cracking of nickel-based alloy reactor vessel head penetrations exposed to borated water. Continued implementation of this program will ensure that the pressure boundary function is maintained during the period of extended operation. The ASME Section XI, Subsection IWB, IWC, and IWD Inservice Inspection (Section B.1.14) and Water Chemistry Control Programs (Section B.1.40) are used in conjunction with this program to manage cracking of the reactor vessel head penetrations. This program manages primary water stress corrosion cracking (PWSCC) of high nickel alloy reactor vessel head penetrations.

NUREG-1801 Consistency

The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program is consistent with, but includes an exception to, the program described in NUREG-1801, Section XI.M11.

Exceptions to NUREG-1801

The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program includes the following exception to the program described in NUREG-1801, Section XI.M11:

Element Affected	Exception
4. Detection of Aging Effects	The CNP program is based on responses to NRC Bulletins 2002-01 (Reference B.3-4) and 2002-02 (Reference B.3-5), not NRC GL 97-01 (Reference B.3-9). [1]

1. The requirements of NRC Bulletins 2002-01 and 2002-02 supersede the GL 97-01 requirements.

Operating Experience

The discovery of a void in the reactor vessel closure head at Davis-Besse Nuclear Power Station resulted in NRC requirements regarding programs to prevent boric acid corrosion of vessel head penetrations. The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program is based on these requirements. CNP will continue to refine the program as the requirements resulting from the event at Davis-Besse evolve.

No vessel head penetration (VHP) leakage has been detected for either CNP Unit 1 or Unit 2. However, during the CNP Unit 2 Cycle 10 refueling outage in 1994, eddy current testing (ECT) was performed on 71 of the 78 VHPs. The results of the ECT showed closely-spaced axial indications in one penetration. The flaw evaluation results showed that the Nuclear Energy Institute (NEI) acceptance criteria (75 percent through-wall) would not be violated for the next 18-month fuel cycle. During the CNP Unit 2 Cycle 11 refueling outage in 1996, re-inspection of this penetration identified no significant flaw growth. The penetration was repaired by embedding the flaw using an alternate repair method approved by the NRC.

During refueling outages completed on June 9, 2002, for Unit 1 and February 28, 2002, for Unit 2, 100 percent bare-metal visual inspections of the RV heads under the insulation were performed. Additionally, either surface examination (utilizing ECT or liquid penetrant) or ultrasonic testing was performed on the control rod drive mechanism (CRDM) nozzle penetrations. No unacceptable flaws or degradation requiring repair were identified in these inspections. During the Unit 2 refueling outage completed on June 20, 2003, small indications were identified and repaired on two penetrations and indications on two other penetrations were evaluated as not needing repair.

Conclusion

The Control Rod Drive Mechanism and Other Vessel Head Penetration Inspection Program effectively manages aging effects on nickel-based alloy reactor vessel head penetrations. Continued implementation of this program provides reasonable assurance that the aging effects will be managed so that the CRDMs and other head penetrations will perform their intended function consistent with the current licensing basis for the period of extended operation.

B.1.10 Diesel Fuel Monitoring

Program Description

The Diesel Fuel Monitoring Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M30, Fuel Oil Chemistry Program.

The purpose of the Diesel Fuel Monitoring Program is to ensure that adequate diesel fuel quality is maintained to prevent corrosion of the fuel oil systems associated with the EDGs, diesel-driven fire pump, and security diesel.

NUREG-1801 Consistency

The Diesel Fuel Monitoring Program is consistent with, but includes exceptions to, the program described in NUREG-1801, Section XI.M30.

Exceptions to NUREG-1801

The Diesel Fuel Monitoring Program includes the following exceptions to the program described in NUREG-1801, Section XI.M30.

Element Affected	Exception
1. Scope	CNP does not address microbiologically influenced corrosion (MIC). [1]
2. Preventive Actions	CNP does not use additives beyond those added by the refiner during production. [2]
3. Parameters Monitored/Inspected	CNP program does not monitor the levels of microbiological organisms in the fuel oil [1]
	CNP uses only ASTM Standard D1796 for determination of water and sediment, rather than Standards D1796 and D2709. [3]
	CNP uses ASTM D2276, Method A, with a 0.8 µm filter, instead of the modified ASTM D2276, Method A, with a 3.0 µm filter. [4]

Element Affected	Exception
4. Detection of Aging Effects	CNP does not sample specifically for microbiological organisms. [1]
	CNP does not perform ultrasonic thickness measurement of diesel oil storage tank bottom surfaces. [6]
5. Monitoring and Trending	CNP does not trend water and particulate contamination or biological activity. [5]
6. Acceptance Criteria	CNP uses only ASTM Standard D1796 for determination of water and sediment, rather than Standards D1796 and D2709. [3]
	CNP uses ASTM D2276, Method A, with a 0.8 µm filter, instead of the modified ASTM D2276, Method A, with a 3.0 µm filter. [4]
7. Corrective Actions	CNP does not address MIC. [1]

1. CNP does not sample or treat diesel fuel for microbiological organisms since plant-specific operating experience has not indicated significant problems related to MIC. The lack of such problems can be attributed to minimizing water contamination in the diesel fuel storage tanks. Since water contamination is minimized, the potential for MIC is limited.

2. The diesel fuel used at CNP contains a comprehensive additive package. Also enhancing the fuel's long-term stability is use of a storage system that maintains the fuel at a nearly constant temperature of 55 °F. In 25 years experience at CNP, no evidence of microbial degradation of the fuel or MIC-related corrosion to EDG fuel system components has been experienced.

3. NUREG-1801 states that ASTM Standards D1796 and D2709 are used for determination of water and sediment. However, these standards describe the determination of water and sediment for oils with different viscosities. Standard D1796 is the only standard that applies to the CNP diesel fuel and is therefore used for determination of water and sediment at CNP. This applies to the “Parameters Monitored/ Inspected” and to “Acceptance Criteria” elements of this program.

4. CNP conducts particulate analysis using a 0.8 micron filter, rather than the 3.0 micron filter specified in NUREG-1801. Use of a filter with a smaller pore size results in a larger sample of particulates, since smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of the 3.0 micron filter specified in NUREG-1801.

5. CNP does not trend water and particulate contamination or biological activity. However, the Corrective Action Program is applicable to the Diesel Fuel Monitoring Program. This provides reasonable assurance that trends entailing repeat failures to meet acceptance criteria will be identified and addressed with appropriate corrective actions.

6. Compliance with diesel fuel oil standards and periodic sampling provides assurance that fuel oil contaminants that cause degradation are below appropriate limits. Internal surfaces of tanks that are drained for cleaning are visually inspected for degradation.

Operating Experience

A review of condition reports associated with the Diesel Fuel Monitoring Program demonstrates this program has been improved through evaluation of site and industry operating experience. As an example, the procedure that implements Technical Specification surveillance requirements for sampling diesel fuel was found to be inadequate in providing explicit instructions for consideration of the dyes that are used to identify the type of the fuel. A condition report documented the procedural deficiency and provided a root cause analysis to resolve the issues. Corrective actions were implemented to prevent recurrence.

The Diesel Fuel Monitoring Program has been effective at managing aging effects. In CNP's 25 years of operating experience, no evidence of microbial degradation of the fuel or MIC-related corrosion to fuel system components has been observed.

Conclusion

The Diesel Fuel Monitoring Program effectively manages aging effects. The program has been improved through evaluation of site and industry operating experience. Continued implementation of this program provides reasonable assurance that the aging effects will be managed so that the components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.11 Fire Protection

The Fire Protection Program consists of two programs: Fire Protection Program and Fire Water System Program.

B.1.11.1 Fire Protection

Program Description

The Fire Protection Program is an existing CNP program. The aging management aspects of the CNP Fire Protection Program are comparable to the program described in NUREG-1801, Section XI.M26, Fire Protection.

The Fire Protection Program includes fire barrier and diesel-driven fire pump inspections.

Fire barrier inspections include:

- Periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors; and
- Periodic visual inspection and functional tests of fire-rated doors.

Diesel-driven fire pump inspections include periodic pump testing to ensure that the fuel supply line can perform its intended function.

The Fire Protection Program also includes periodic inspection and testing of the halon/carbon dioxide (CO2) fire suppression system.

NUREG-1801 Consistency

With the inclusion of program enhancements, the aging management aspects of the Fire Protection Program will be consistent with, but include exceptions to, the program described in NUREG-1801, Section XI.M26.

Exceptions to NUREG-1801

The Fire Protection Program at CNP includes the following exceptions to the program described in NUREG-1801, Section XI.M26:

Element Affected	Exception
3. Parameters Monitored /Inspected	Fire door clearances are inspected when fire doors are physically removed for maintenance or repair or for new installations, rather than bimonthly. [1]
	Functional tests of fire doors are performed every six months (rather than daily, weekly, or monthly) to verify the operability of automatic hold-open, release, closing mechanisms, and latches. [1]
	Periodic visual inspection and functional tests of the halon/carbon dioxide fire suppression system are performed every 18 months, rather than every 6 months.[1] Consistent with ISG-4, inspections for charging pressure, valve lineups, and automatic mode of operation are not credited for aging management.

Element Affected	Exception
4. Detection of Aging Effects	Fire door clearances are inspected when fire doors are physically removed for maintenance or repair or for new installations, rather than bimonthly. [1]
	Functional tests of fire doors are performed every six months (rather than daily, weekly, or monthly) to verify the operability of automatic hold-open, release, closing mechanisms, and latches. [1]
	Periodic visual inspection and function tests of the halon/carbon dioxide fire suppression system are performed every 18 months, rather than every six months. [1] Consistent with ISG-4, inspections for charging pressure, valve lineups, and automatic mode of operation are not credited for aging management.
5. Monitoring and Trending	CNP performs trending for the Fire Protection Program via the Corrective Action Program.[2]

1. The NUREG-1801 program entails testing and inspections being done at various frequencies. In some instances, the CNP Fire Protection Program specifies tests and inspections on different frequencies. Since aging effects are typically manifested over several years, this difference in inspection and testing frequencies is insignificant.

2. The Corrective Action Program is applicable to this program. This provides reasonable assurance that trends entailing repeat failures to meet acceptance criteria will be identified and addressed with appropriate corrective actions.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
3. Parameters Monitored/Inspected	In the CO_2 and halon procedures, ensure that conditions that may affect the performance of the system (such as corrosion, mechanical damage, or damage to dampers) are observed and degraded conditions are addressed.
	Enhance procedures to ensure the diesel fuel supply line is monitored for degradation during performance testing.
4. Detection of Aging Effects	In the CO_2 and halon procedures, ensure that conditions that may affect the performance of the system (such as corrosion, mechanical damage, or damage to dampers) are observed and degraded conditions are addressed.
	Enhance procedures to ensure the diesel fuel supply line is monitored for degradation during performance testing.
5. Monitoring and Trending	In the CO_2 and halon procedures, ensure that materiel conditions that may affect the performance of the system (such as corrosion, mechanical damage, or damage to dampers) are observed and degraded conditions are addressed.
	Enhance procedures to ensure the diesel fuel supply line is monitored for degradation during performance testing.

Element Affected	Enhancement
6. Acceptance Criteria	In the CO_2 and halon procedures, ensure that materiel conditions that may affect the performance of the system (such as corrosion, mechanical damage, or damage to dampers) are observed and degraded conditions are addressed.
	Enhance procedures to ensure the diesel fuel supply line is monitored for degradation during performance testing.
7. Corrective Actions	In the CO_2 and halon procedures, ensure that materiel conditions that may affect the performance of the system (such as corrosion, mechanical damage, or damage to dampers) are observed and degraded conditions are addressed via the Corrective Action Program.

Operating Experience

A review of CNP operating experience relative to the Fire Protection and Fire Water System (Section B.1.11.2) Programs included condition reports, self-assessments, and an NRC inspection report. The two programs were reviewed as one because the CNP procedures, self-assessments, and NRC inspections cover both programs as one.

The condition report review found that minor problems with fire protection equipment have been identified and resolved. Self-assessments of the program in 1995 and 2002 have identified no significant aging of fire protection components. This operating experience demonstrates that the program is effectively managing the effects of aging on fire protection equipment. This conclusion is corroborated by the findings of a 1998 NRC inspection that fire protection equipment was well-maintained.

Based on the review of condition reports, self-assessments, and NRC inspections, implementation of the existing Fire Protection Program maintains fire protection equipment and meets applicable regulatory requirements, and thus this program is managing aging effects on fire protection equipment.

Conclusion

The Fire Protection Program effectively manages aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Fire Protection Program will provide reasonable assurance that the aging effects will be managed so that the fire protection components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

B.1.11.2 Fire Water System

Program Description

The Fire Water System Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M27, Fire Water System.

The Fire Water System Program applies to water-based fire protection systems that consist of components that are tested in accordance with the applicable National Fire Protection Association (NFPA) codes and standards. This includes sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, water storage tanks, and aboveground and underground piping and components.

Such testing assures the minimum functionality of the systems. These systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated. In addition, a sample of sprinkler heads is to be inspected using the guidance in Section 2.3.3.1 of NFPA 25, *Inspection, Testing, & Maintenance of Water-Based Fire Protection Systems* (Reference B.3-16).

NUREG-1801 Consistency

With the inclusion of program enhancements, the Fire Water System Program will be consistent with, but include exceptions to, the program described in NUREG-1801, Section XI.M27.

Exceptions to NUREG-1801

The Fire Water System Program at CNP includes the following exceptions to the program described in NUREG-1801, Section XI.M27:

Element Affected	Exception
3. Parameters Monitored/Inspected	CNP does not implement NRC GL 89-13 commitments in the Fire Water Program. The fire water system is not a service water system. The fire protection system is supplied by the Lake Charter Township potable water system. [2, 3]
4. Detection of Aging Effects	Fire hydrant hose gasket inspections are performed every 18 months, rather than annually. [1]
	Fire hydrant hose hydrostatic tests and fire hydrant flow tests are performed at least every 3 years, rather than annually. [1]
5. Monitoring and Trending	CNP performs trending for the Fire Water System Program via the Corrective Action Program. [4]

1. The NUREG-1801 program recommends testing and inspections be performed at various frequencies. In some instances, the CNP program performs tests and inspections on different frequencies. Since aging effects are typically manifested over several years, this difference in inspection and testing frequencies is insignificant.

2. Every fire main segment (excluding individual system supplies) is verified clear of obstruction by a full flow test at least once every 3 years.

3. Procedures require internal pipe examination whenever intrusive maintenance is required.

4. The Corrective Action Program is applicable to the program. This provides reasonable assurance that trends entailing repeat failures to meet acceptance criteria will be identified and addressed with appropriate corrective actions.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
1. Scope	A sample of sprinkler heads will be inspected using the guidance of NFPA 25, Section 2.3.3.1. This NFPA section states, “where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing.” It also contains guidance to perform this sampling every 10 years after the initial field service testing.
	The Fire Water System Program will be enhanced to implement the requirements of the NRC interim staff guidance pertaining to nonintrusive measurement of pipe wall thickness.
4. Detection of Aging Effects	A sample of sprinkler heads will be inspected using the guidance of NFPA 25, Section 2.3.3.1.
	The Fire Water System Program will be enhanced to implement the requirements of the NRC interim staff guidance pertaining to nonintrusive measurement of pipe wall thickness.
5. Monitoring and Trending	The Fire Water System Program will be enhanced to implement the requirements of the NRC interim staff guidance pertaining to nonintrusive measurement of pipe wall thickness.

Operating Experience

A review of CNP operating experience relative to the Fire Protection (Section B.1.11) and Fire Water System Programs included condition reports, self-assessments and an NRC inspection report. The two programs were reviewed as one because the CNP procedures, self-assessments, and NRC inspections cover both programs as one.

The condition report review found minor fire protection equipment problems that had been identified and resolved. Self-assessments of the program in 1995 and 2002 have identified no significant aging of fire protection components. This operating experience demonstrates that the program is effectively managing the effects of aging on fire water system equipment. This conclusion is corroborated by the findings of a 1998 NRC inspection that fire protection equipment was well-maintained.

Based on the review of condition reports, self-assessments, and NRC inspections, implementation of the existing Fire Water System Program adequately maintains fire water system equipment, piping, and components and meets applicable regulatory requirements, and thus this program is managing aging effects on the fire water system.

Conclusion

The Fire Water System Program effectively manages aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Fire Water System Program will provide reasonable assurance that the aging effects will be managed so fire water system components will continue to perform their intended function consistent with the current licensing basis for the period of extended operation.

B.1.12 Flow-Accelerated Corrosion

Program Description

The Flow-Accelerated Corrosion (FAC) Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M17, Flow-Accelerated Corrosion.

The FAC Program assures that the structural integrity of carbon steel lines containing high-energy fluids is maintained. This program includes:

- An analysis to determine critical locations;
- Limited baseline inspections to determine the extent of thinning at those locations;
- Follow-up inspections to confirm the predictions; and
- Repair or replacement of components as necessary.

NUREG-1801 Consistency

The FAC Program at CNP is consistent with NUREG-1801, Section XI.M17.

Operating Experience

A review of condition reports provides evidence of the effectiveness of the FAC program. As an example, a number of carbon steel components were replaced with stainless steel components in 2002 to preclude recurrence of inspection findings. In another instance, a 2002 condition report identified a specific component sample location that did not meet the FAC inspection criteria. Engineering evaluation based on operating history and experience determined the need to expand the number of sample locations and increase inspection requirements.

Quarterly “health reports” are used by site management to track the performance of the FAC Program. Performance indicators are used to determine if the FAC Program is meeting industry and regulatory standards. These reports document inspection effectiveness in identifying components for replacement prior to failure.

Conclusion

The FAC Program effectively manages aging effects. This program has been improved through evaluation of operating experience and implementation of lessons learned. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed so that components in the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.13 Heat Exchanger Monitoring

Program Description

The Heat Exchanger Monitoring Program is a new, plant-specific program that I&M will implement prior to the period of extended operation. There is no comparable NUREG-1801 program.

The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation using nondestructive examinations, such as eddy current inspections or visual inspections or, if appropriate, the heat exchanger will be replaced. If degradation is found, an evaluation will be performed to determine its effects on the heat exchanger design functions.

Aging Management Program Elements

Scope

The Heat Exchanger Monitoring Program will manage aging effects on various heat exchangers in the following systems:

- Containment spray system
- Emergency core cooling system
- Containment equalization / hydrogen skimmer system
- Component cooling water system
- Emergency diesel generator
- Engineered safety features ventilation system
- Control room ventilation system
- Chemical and volume control system
- Auxiliary feedwater system

Preventive Actions

This is a monitoring program; no actions will be taken as part of this program to prevent degradation.

Parameters Monitored or Inspected

Nondestructive examinations, such as eddy current inspections or visual inspections, will be performed or, if appropriate, the heat exchanger will be replaced. Eddy current inspections may be performed on shell-and-tube heat exchangers where practical. Eddy current inspections of shell-and-tube heat exchangers will consist of a sample inspection of the heat exchanger tubes to identify wall thinning and crack indications. Visual inspections will be performed on the heat exchanger heads, covers, and tube sheets where accessible.Detection of Aging Effects

The aging effects for the heat exchanger tubes that will be managed by this program are loss of material and cracking. Eddy current inspection of the tubes will be performed every 10 years or more frequently if inspection results indicate a need for more frequent inspections. Visual inspections of accessible heat exchangers will be performed on the same frequency as the eddy current inspections. If nondestructive examinations are not practical, heat exchanger replacement is an option.

An appropriate sample population of heat exchangers will be determined based on operating experience prior to the inspections. The extent and schedule of the inspections prescribed by the program will be designed to maintain seismic qualification and ensure that aging effects will be discovered and repaired before the loss of intended function of the heat exchangers. Inspection can reveal cracking and loss of material that could result in degradation in the seismic qualification of the heat exchangers. Fouling will be managed by other programs, such as Service Water System Reliability (Section B.1.29), System Testing (Section B.1.37) and System Walkdown (Section B.1.38) Programs, as applicable, and will not be addressed by this program.

Monitoring and Trending

Results will be evaluated against established acceptance criteria and an assessment of inspection findings will be made regarding the applicable degradation mechanism, degradation growth rate, and allowable degradation level. This information will be used to develop future inspection scope and associated inspection intervals.

Acceptance Criteria

The tube repair (plugging limit) for each heat exchanger to be eddy current inspected will be established based upon a component-specific engineering evaluation. This evaluation will produce conservative acceptance criteria that will identify when degraded tubes must be removed from service.

The acceptance criterion for the visual inspections of the heat exchanger heads, covers, and tubesheets will be that no evidence of degradation is detected that could lead to loss of function. If degradation that could lead to loss of intended function is detected, a condition report will be written and the issue resolved in accordance with the CNP Corrective Action Program.

Corrective Actions

Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The Heat Exchanger Monitoring Program is a new program for which there is no operating experience. Eddy current inspections and heat exchanger internal visual inspections are standard industry methods to manage aging effects in heat exchangers. These methods are consistent with NRC-accepted industry practices. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

The Heat Exchanger Monitoring Program will effectively manage aging effects, since it will incorporate proven monitoring techniques and conservative acceptance criteria. Implementation of the Heat Exchanger Monitoring Program will provide reasonable assurance that the effects of aging will be managed so components within the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation. This program will be implemented prior to the period of extended operation.

B.1.14 Inservice Inspection – ASME Section XI, Subsection IWB, IWC, and IWD

Program Description

The ASME Section XI, Subsection IWB, IWC, and IWD Inservice Inspection Program is an existing CNP program. The CNP program is comparable to that described in NUREG-1801, Section XI.M1, ASME Section XI, Subsections IWB, IWC and IWD.

CNP has implemented the applicable requirements of the 1989 Edition of ASME Boiler and Pressure Vessel (B&PV) Code Section XI, approved NRC alternatives and relief requests, and other requirements specified in 10 CFR 50.55a for the third ISI interval.

NUREG-1801 Consistency

The CNP Subsection IWB, IWC, and IWD Program is consistent with the program described in NUREG-1801, Section XI.M1.

Operating Experience

A self-assessment of the Subsection IWB, IWC, and IWD Program was performed in the fall of 1999. This assessment concluded that the CNP program provides the necessary administrative controls to ensure Code compliance, although programmatic elements relating to conflicting policy and procedures contributed to a lack of overall program cohesiveness. Program procedures were revised to incorporate the changes recommended by this self-assessment.

Condition reports document the identification and resolution of program findings, which demonstrates that the program effectively monitors pressure-retaining components and prescribes appropriate actions when problems are found.

Conclusion

The ASME Section XI, Subsection IWB, IWC, and IWD Inservice Inspection Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed such that components in the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.15 Inservice Inspection – ASME Section XI, Subsection IWE

Program Description

The ASME Section XI, Subsection IWE Inservice Inspection Program is an existing CNP program. The CNP program is comparable to that described in NUREG-1801, Section XI.S1, ASME Section XI, Subsection IWE.

10 CFR 50.55a specifies the examination requirements of the ASME B&PV Code, Section XI, Subsection IWE for steel liners of concrete containments and other containment components. CNP has implemented ASME Section XI, 1992 Edition with the 1992 Addenda, as approved in 10 CFR 50.55a. Subsection IWE and the additional requirements specified in 10 CFR 50.55a(b)(2) constitute an existing required program that is applicable to managing aging for license renewal. The full scope of Subsection IWE includes the following:

- Steel liners for the concrete containment and their integral attachments;
- Containment hatches and airlocks;
- Seals, gaskets and moisture barriers; and
- Pressure-retaining bolting.

The primary inservice inspection method specified in Subsection IWE is visual examination (general visual, VT-3, or VT-1). Limited volumetric examination (ultrasonic thickness measurement) and surface examination (e.g., liquid penetrant) may also be necessary in some instances. Subsection IWE specifies acceptance criteria, corrective actions, and expansion of the inspection scope when degradation exceeding the acceptance criteria is found.

NUREG-1801 Consistency

The CNP Subsection IWE Program is consistent with, but includes exceptions to, the program described in NUREG-1801, Section XI.S1.

Exceptions to NUREG-1801

The CNP Subsection IWE Program includes the following exceptions to the program described in NUREG-1801, Section XI.S1.

Element Affected	Exception
1. Scope	Category E-D: Seals and Gaskets are not examined per the CNP program [1]
	Category E-G: Bolt Torque or Tension Test is not included in the CNP program. [3]
3. Parameters Monitored/Inspected	Category E-D: Seals and Gaskets are not examined. [1]
	Category E-G: Bolt Torque or Tension Test is not included in the CNP program. [3]
5. Monitoring and Trending	The successive examinations required by IWE-2420(b) and IWE-2430(c) are limited to Class MC components accepted by evaluation per IWE-3122.4. This limitation excludes successive examination of repaired components. [2]

1. An approved relief request includes the alternate provisions that the pressure-retaining capability of seals and gaskets will be verified by 10 CFR 50, Appendix J, Type B leakage testing. Appendix J Type B leakage testing is performed at least once each inspection interval.

2. An approved relief request limits the successive examinations required by IWE-2420(b) and IWE-2430(c) to Class MC components accepted by evaluation per IWE-3122.4. This limitation excludes successive examination of repaired components.

3. An approved relief request includes the alternate provisions that the following examinations and tests required by Subsection IWE ensure the structural integrity and the leak-tightness of Class MC pressure-retaining bolting, and, therefore, no additional alternative examinations are proposed:

   (a) Exposed surfaces of bolted connections shall be visually examined in accordance with requirements of Table IWE-2500-1, Examination Category E-G, Pressure Retaining Bolting, Item No. E8.10, and

   (b) Bolted connections shall meet the pressure test requirements of Table IWE-2500-1 Examination Category E-P, All Pressure Retaining Components, Item No. E9.40.

Operating Experience

A self-assessment of the Subsection IWE and IWL Programs was performed in the fall of 1999. The programs were under development at the time and program documents were reviewed in draft form. The review concluded that the IWE and IWL Programs would be effective structural monitoring programs.

Operating experience, as documented in condition reports and licensee event reports, indicates that the program effectively monitors containment liner condition and prescribes appropriate actions when problems are found. For example, a hole was found in the Unit 2 containment liner during the IWE general visual examination. The hole, which went undetected until the first IWE examination, was caused by an inadequate repair of a hole erroneously drilled through the liner during original construction. As another example, liner corrosion was identified when the concrete floor-to-liner joint seal was removed. This area of the liner plate is normally inaccessible and exempt from IWE examination requirements. However, the IWE Program was revised to add examinations of this area.

Conclusion

The ASME Section XI, Subsection IWE Inservice Inspection Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed such that components crediting this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.16 Inservice Inspection – ASME Section XI, Subsection IWF

Program Description

The ASME Section XI, Subsection IWF Inservice Inspection Program is an existing CNP program. The CNP program is comparable to that described in NUREG-1801, Section XI.S3, ASME Section XI, Subsection IWF.

10 CFR 50.55a specifies the requirements of the ASME B&PV Code, Section XI, Subsection IWF for inservice inspection of supports for ASME piping and components. CNP has implemented the applicable requirements of the 1989 Edition of ASME Section XI, approved NRC alternatives and relief requests, and other requirements specified in 10 CFR 50.55a for the third ISI interval. The Subsection IWF Program constitutes an existing required program applicable to managing aging of ASME Class 1, 2, 3, and MC supports.

The IWF scope of inspection is a sample of the total support population. Sample size varies depending on the ASME Class. The largest sample size is specified for the most critical supports (ASME Class 1). Sample size decreases for the less critical supports (ASME Class 2 and 3). Discovery of support deficiencies during regularly scheduled inspections triggers an increase in the inspection scope, in order to ensure that the full extent of deficiencies is identified. The primary inspection method is visual examination. Degradation that potentially compromises support function or load capacity is identified for evaluation. Subsection IWF specifies acceptance criteria and corrective actions. Supports requiring corrective actions are re-examined during the next inspection period.

NUREG-1801 Consistency

The CNP Subsection IWF Program is consistent with the program described in NUREG-1801, Section XI.S3.

Operating Experience

A self-assessment of the Subsection IWF Program was performed in the fall of 1999. This assessment concluded that the program provides the necessary administrative controls to ensure code compliance, but that elements relating to conflicting policy and procedures had contributed to a lack of overall program cohesiveness. Procedures were revised to incorporate the changes recommended by this self-assessment.

Based on these improvements, to date the program has found and resolved only minor problems, such as missing fasteners on ductwork supports. This operating experience indicates that the program is effectively monitoring supports and taking appropriate actions when problems are found.

Conclusion

The ASME Section XI, Subsection IWF Inservice Inspection Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed such that components crediting this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.17 Inservice Inspection – ASME Section XI, Subsection IWL

Program Description

The ASME Section XI, Subsection IWL Inservice Inspection Program is an existing CNP program. The CNP program is comparable to that described in NUREG-1801, Section XI.S2, ASME Section XI, Subsection IWL.

10 CFR 50.55a specifies the examination requirements of the ASME B&PV Code, Section XI, Subsection IWL for reinforced concrete containments (Class CC). I&M has implemented the 1992 Edition with the 1992 Addenda, as approved in 10 CFR 50.55a. ASME Section XI, Subsection IWL, and the additional requirements specified in 10 CFR 50.55a(b)(2), constitute an existing required program that is applicable to managing the aging of reinforced concrete containment systems.

NUREG-1801 Consistency

The CNP Subsection IWL Program is consistent with, but includes exceptions to, the program described in NUREG-1801, Section XI.S2.

Exceptions to NUREG-1801

The CNP Subsection IWL Program includes the following exceptions to the program described in NUREG-1801, Section XI.S2.

Element Affected	Exception
1. Scope	Post-tensioning systems are not in the scope of this program since CNP does not have a post-tensioning system.
3. Parameters Monitored/Inspected	Post-tensioning systems are not in scope of this program, since CNP does not have a post-tensioning system.

Element Affected	Exception
4. Detection of Aging Effects	The maximum direct examination distance specified in Table IWA-2210-1 for remote visual examinations may be extended and the minimum illumination requirements specified in Table IWA-2210-1 may be decreased provided the conditions or indications for which the visual examination is performed can be detected at the chosen distance and illumination. [1]
5. Monitoring and Trending	Post-tensioning systems are not in the scope of this program since CNP does not have a post-tensioning system.
6. Acceptance Criteria	Post-tensioning systems are not in the scope of this program since CNP does not have a post-tensioning system.

1. An approved relief request includes the alternate provisions that when performing the visual examinations required per IWL-2510 remotely, the maximum direct examination distance specified in Table IWA-2210-1 may be extended and the minimum illumination requirements specified in Table IWA-2210-1 may be decreased provided that the conditions or indications for which examination is performed can be detected at the chosen distance and illumination.

Operating Experience

A self-assessment of the Subsections IWE and IWL Programs was performed in 1999. The programs were under development at the time and program documents were reviewed in draft form. The review concluded that the IWE and IWL Programs would be effective Structural Monitoring Programs.

Operating experience for the Subsection IWL Program, although limited, indicates that this program effectively monitors containment concrete condition and prescribes appropriate actions when problems are found. Program inspections have identified only minor problems. A Subsection IWL inservice inspection conducted in 2001 revealed several surface discrepant conditions in the form of buried wood, exposed rebar, and plastic. Evaluation of the conditions concluded that the containment structural integrity was unaffected.

Conclusion

The ASME Section XI, Subsection IWL Inservice Inspection Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed so that components in the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.18 Inservice Inspection – ASME Section XI, Augmented Inspections

Program Description

The ASME Section XI, Augmented Inspections Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The purpose of the ASME Section XI Augmented Inspections Program is to manage the effects of aging on selected components that are outside the jurisdiction of ASME Section XI. Augmented inspections shall be consistent, to the extent practical, with the appropriate ASME requirements of ASME Section XI, specifically:

- Selection of inspection methods,
- Inspection frequency,
- Percentage of components examined within a population, and
- Acceptance criteria.

CNP has implemented the applicable requirements of the 1989 Edition of ASME Section XI, approved NRC alternatives and relief requests, and other requirements specified in 10 CFR 50.55a for the third ISI interval.

Aging Management Program Elements

Scope

In addition to existing augmented inspections on selected components that are outside the jurisdiction of ASME Section XI, nondestructive inspections will be implemented prior to the period of extended operation to manage aging effects on portions of the containment spray system.

Preventive Actions

This is an inspection program; no actions are or will be taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

Nondestructive inspections monitor for cracking and loss of material (wall thinning).

Detection of Aging Effects

Nondestructive inspections are used, such as volumetric examination methods used for Section XI inspections on Class 1, 2, and 3 components. The frequency of inspections is specified in the Inservice Inspection (ISI) Long-Term Plan.

This program will include inspections to manage the following containment spray system aging effects:

- Loss of material and cracking of the spray additive tanks (SATs) and the portions of the containment spray system that are wetted by sodium hydroxide (e.g., piping up to the first normally closed valve).
- Loss of material and cracking of the portions of the discharge header in containment that may contain untreated water (with concentrated contaminants due to evaporation).

Monitoring and Trending

The new inspections will be implemented prior to the period of extended operation. This program does not perform trending. However, the Corrective Action Program is applicable to the Augmented Inspections Program. This provides reasonable assurance that trends entailing repeat failures to meet acceptance criteria will be identified and addressed with appropriate corrective actions.

Acceptance Criteria

Flaws detected during examination are evaluated by comparing the examination results to the acceptance standards established in ASME Section XI.

Corrective Actions

Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The augmented inspections being added prior to the period of extended operation are new. However, the monitoring techniques used in this program are supported by extensive industry operating experience. Operating experience at CNP will provide input to adjust the program, as needed, and to develop new augmented inspections.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope	An augmented ISI volumetric inspection of the SATs and portions of the containment spray system that are wetted by sodium hydroxide.
	An augmented ISI volumetric inspection of the portions of the discharge header in containment that may contain water with concentrated contaminants.
4. Detection of Aging Effects	An augmented ISI volumetric inspection of the SATs and portions of the containment spray system that are wetted by sodium hydroxide.
	An augmented ISI volumetric inspection of the portions of the discharge header in containment that may contain water with concentrated contaminants.

Conclusion

The ASME Section XI – Augmented Inspections Program uses the same nondestructive examination methods that are used for Section XI inspections on Class 1, 2, and 3 structures and components. These methods have proven effective in the industry for identifying cracking and loss of material. With enhancements to be incorporated prior to the period of extended operation, continued implementation of this program will provide reasonable assurance that the aging effects will be managed such that the structures and components in the scope of the program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.19 Instrument Air Quality

Program Description

The Instrument Air Quality Program is an existing plant-specific program. There is no comparable NUREG-1801 program. A similar program based on ANSI Standard ISA-S7.3-1975 has previously been evaluated and approved by the NRC in NUREG-1743 (Reference B.3-13).

The purpose of the Instrument Air Quality Program, with respect to license renewal, is to prevent and mitigate aging effects on control air system components by maintaining the system free of water and significant contaminants. The control air system is part of the compressed air system (see Section 2.3.3.4 of this application).

Aging Management Program Elements

Scope

This program applies to those components within the scope of license renewal and subject to aging management review that are supplied with control air where pressure boundary integrity is required for the component to perform its intended function.

Preventive Actions

System air quality is monitored and maintained in accordance with CNP testing and inspection plans, which are designed to ensure that the control air system and equipment meet specified operating requirements. These requirements are derived from guidelines presented in ANSI Standard ISA-S7.3-1975.

Parameters Monitored or Inspected

This program periodically monitors the control air system air quality pursuant to the following performance requirements from ANSI Standard ISA-S7.3-1975.

- Maximum dewpoint (monitored approximately weekly)
- Particulate size (afterfilter differential pressure monitored daily)
- Dryer condition inspection (monitored approximately monthly)

Detection of Aging Effects

The guidelines in ANSI Standard ISA-S7.3-1975 are followed to ensure timely detection of degradation of the control air system function. Degradation of the piping and equipment would become evident by observation of excessive corrosion, discovery of unacceptable leakage rates, or failure of the system or equipment to meet specified performance limits. This program is credited with managing the loss of material of the carbon steel, copper, and brass/bronze components in the control air systems.

Monitoring and Trending

Trends for dewpoint are maintained in a trending database. The control air afterfilter differential pressure is checked daily.

Acceptance Criteria

The dewpoint at line pressure shall be at least 18F below the minimum temperature to which any part of the instrument air system is exposed at any season of the year. In no case should dewpoint at line pressure exceed 35F.

Plant procedures prescribe removal of the afterfilter from service based on a specified high differential pressure limit (commitment from GL 88-14, "Instrument Air Supply System Problems Affecting Safety-Related Equipment" [Reference B.3-7]).

Corrective Actions

Corrective actions are taken if parameters such as dewpoint in the air system are out of acceptable ranges. Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

GL 88-14 was issued based on industry operating experience with air systems. The CNP Instrument Air Quality Program is based on program elements specified in the generic letter. Instrument air quality that does not meet the administrative control criteria for sampling is documented through the Corrective Action Program, which includes trending for adverse conditions and repetitive failures of system components.

The lack of a significant number of condition reports regarding loss of material due to corrosion in the air systems indicates the program has been effective in preventing the effects of aging. As an example, a condition report was written documenting failure of the Unit 2 east control air dryer. Left uncorrected, this condition could have led to a failure to comply with the dewpoint requirements for air quality.

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Element Affected	Enhancement
3. Parameters Monitored/Inspected	Enhance the CNP program procedure prior to the period of extended operation to clearly specify frequencies for the dewpoint and dryer tours.

Conclusion

The Instrument Air Quality Program effectively manages aging effects. Operating experience verifies that control air quality is being maintained. With one enhancement to be incorporated prior to the period of extended operation, continued implementation of the Instrument Air Quality Program will provide reasonable assurance that the aging effects will be managed such that components supplied with control air will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.20 Non-EQ Inaccessible Medium-Voltage Cable

Program Description

The Non-EQ Inaccessible Medium-Voltage Cable Program is a new program that I&M will implement prior to the period of extended operation. The CNP program will be comparable to that described in NUREG-1801, Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

This program applies to inaccessible (e.g., in conduit or direct-buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with applied voltage. This program will test these cables to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test.

NUREG-1801 Consistency

The CNP program will be consistent with the program described in NUREG-1801, Section XI.E3.

Operating Experience

The Non-EQ Inaccessible Medium-Voltage Cable Program is a new program. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

The Non-EQ Inaccessible Medium-Voltage Cable Program will effectively manage aging effects, since it will incorporate appropriate testing techniques. Implementation of this program will provide reasonable assurance that the effects of aging will be managed such that components within the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation. The program will be implemented prior to the period of extended operation.

B.1.21 Non-EQ Instrumentation Circuits Test Review

Program Description

The Non-EQ Instrumentation Circuits Test Review Program is a new program that I&M will implement prior to the period of extended operation. The CNP program will be comparable to the program described in NUREG-1801, Section XI.E2, Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

The purpose of this program is to provide reasonable assurance that the intended functions of specified non-EQ electrical cables will be maintained consistent with the current licensing basis through the period of extended operation. The electrical cables included in the scope of this program meet all of the following criteria.

- Not subject to the EQ requirements of 10 CFR 50.49;
- Used in instrumentation circuits with sensitive, high voltage, low-level signals; and
- Exposed to adverse localized environments caused by heat, radiation, or moisture.

An adverse localized environment is one that is significantly more severe than the specified service environment for the cable.

NUREG-1801 Consistency

The CNP program will be consistent with, but include an exception to, the program described in NUREG-1801, Section XI.E2.

Exceptions to NUREG-1801

The Non-EQ Instrumentation Circuits Test Review Program will include the following exception to the program described in NUREG-1801, Section XI.E2.

Element Affected	Exception
4. Detection of Aging Effects	Rather than perform the reviews at the normal calibration frequency specified in the Technical Specifications, the first reviews will be performed before the period of extended operation and every 10 years thereafter. Calibrations or surveillances that fail to meet the acceptance criteria will be reviewed at the time of the calibration or surveillance. [1]

1. This method is consistent with those discussed with the NRC staff during the March 13, 2003, meeting regarding NUREG-1801, Section XI.E2 (Reference B.3-19).

Operating Experience

The Non-EQ Instrumentation Circuits Test Review Program is a new program. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

The Non-EQ Instrumentation Circuits Tests Review Program will effectively manage aging effects, since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. Implementation of the Non-EQ Instrumentation Circuits Tests Review Program will provide reasonable assurance that the effects of aging will be managed such that components within the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation. The program will be implemented prior to the period of extended operation.

B.1.22 Non-EQ Insulated Cables and Connections

Program Description

The Non-EQ Insulated Cables and Connections Program is a new program that I&M will implement prior to the period of extended operation. The CNP program will be comparable to the program described in NUREG-1801, Section XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

The Non-EQ Insulated Cables and Connections Program will apply to accessible insulated cables and connections installed in structures within the scope of license renewal and prone to adverse localized environments. The program will provide reasonable assurance that the intended functions of insulated cables and connections exposed to adverse localized equipment environments caused by heat, radiation, or moisture will be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized equipment environment is significantly more severe than the specified service condition for the insulated cable or connection.

NUREG-1801 Consistency

The Non-EQ Insulated Cables and Connections Program will be consistent with the program described in NUREG-1801, Section XI.E1.

Operating Experience

The Non-EQ Insulated Cables and Connections Program is a new program. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

The Non-EQ Insulated Cables and Connections Program will effectively manage aging effects, since it will incorporate proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. Implementation of this program will provide reasonable assurance that the effects of aging will be managed such that components within the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation. The program will be implemented prior to the period of extended operation.

B.1.23 <u>Oil Analysis</u>

Program Description

The Oil Analysis Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The purpose of the Oil Analysis Program is to ensure the lubricating oil environment in mechanical systems is maintained to the required quality. The Oil Analysis Program monitors and controls abnormal levels of contaminants (primarily water and particulates), thereby preserving an environment that is not conducive to loss of material, cracking, or fouling.

Aging Management Program Elements

<u>Scope</u>

This program samples lubricating oil from key plant components on a periodic basis. The components are maintained in a list of plant equipment included in the Oil Analysis Program.

The Oil Analysis Program will manage aging effects on the following components:

- ECCS components wetted by lubricating oil
- RCP bearing oil coolers
- EDG lube oil system components
- Fire pump diesel engine lube oil system components
- Security diesel engine lube oil system components
- Auxiliary feedwater pump turbine lube oil components

<u>Preventive Actions</u>

The Oil Analysis Program monitors oil systems to detect and control abnormal levels of contaminants (primarily water and particulates), thereby preserving an environment that is not conducive to corrosion.

<u>Parameters Monitored or Inspected</u>

This program monitors oil quality parameters such as particle contaminants and water content.

Detection of Aging Effects

Periodic sampling and compliance to recommended levels of contaminants provide assurance that lube oil contaminants do not exceed acceptable levels. This manages the aging effects of cracking, loss of material, and fouling.

Routine oil sampling is scheduled. Scheduled sampling dates and intervals may be adjusted according to recommendations from the analysis laboratory, plant management, and engineering personnel.

Monitoring and Trending

The oi1 trending database contains the data obtained through the implementation of this program.

Acceptance Criteria

Data received from the testing laboratories is reviewed. Evaluations of reports indicating an adverse trend or significant exception are documented.

Alert levels to initiate corrective action have been set based on wear particle count, viscosity, and water content. Appropriate corrective actions are initiated when concerns regarding equipment or lubricant conditions are indicated.

Corrective Actions

Appropriate corrective actions are initiated when concerns regarding equipment or lubrication conditions are indicated. Corrective actions are documented with follow-up sampling and analysis to monitor the effectiveness of the corrective actions.

Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

<u>Operating Experience</u>

A review of operating experience pertaining to the Oil Analysis Program determined that program enhancements have been made based on industry and plant-specific operating experience. For example, the potential for possible incompatibility between emergency diesel generator fuel oil and lube oil identified at Calvert Cliffs Nuclear Power Plant was evaluated and a program change was made to ensure the problem was addressed at CNP. The review of condition reports indicates that the program has detected conditions at levels below which aging degradation is expected to occur.

Conclusion

The Oil Analysis Program effectively manages aging effects. Oil Analysis Program activities are preventive aging management activities that assure potentially detrimental concentrations of water and particulates are not present in equipment lubricating oil. Continued implementation of this program provides reasonable assurance that the aging effects will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.24 Pressurizer Examinations

Program Description

The Pressurizer Examinations Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

As discussed in WCAP-14574-A, "License Renewal Evaluation: Aging Management for Pressurizers" (Reference B.3-18), cracking of the pressurizer cladding (and items attached to the cladding) may propagate into the underlying ferritic steel. In addition, the pressurizer spray head is susceptible to cracking and reduction of fracture toughness. The purpose of the pressurizer examinations is to identify degradation that could potentially cause loss of intended function of these pressurizer components.

Aging Management Program Elements

Scope

The pressurizer examinations assess the cladding and attachment welds to the cladding of the pressurizer. Examinations of the condition of the pressurizer spray head, spray head locking bar, and coupling will be added as an enhancement to the scope of this program.

Preventive Actions

This is an examination program; no actions are taken as part of this program to prevent aging effects or mitigate aging degradation.

Parameters Monitored or Inspected

Any cracking of the pressurizer cladding would most likely be the result of thermal fatigue. In order to provide assurance that cracking of the cladding and attachment welds to the cladding has not propagated into the underlying base metal of the pressurizer, volumetric examinations of pressurizer items that are most susceptible to thermal fatigue are performed.

The stainless steel clad item with the highest fatigue cumulative usage factor is the circumferential weld at the shell-to-head junction. In accordance with the ASME B&PV Code, Section XI, Examination Category B-B, volumetric examination of essentially 100 percent of the circumferential shell-to-head weld is performed each inspection interval. In addition, the weld metal between the surge nozzle and the vessel lower head is subjected to high stress cycles. This area is periodically monitored for cracking of the cladding.

The weld that connects the surge nozzle to the lower head receives volumetric examination each inspection interval in accordance with ASME Section XI, Examination Category B-D. These examinations will continue through the period of extended operation to manage any cracking of cladding that may extend into the base metal at the locations most susceptible to thermal fatigue.

As an enhancement to this program, the condition of the spray head, spray head locking bar, and coupling will be assessed to ensure that degradation of these items has not occurred.

Detection of Aging Effects

Detection of cracking in the pressurizer cladding as specified above is achieved through periodic volumetric inspection procedures that satisfy ASME Section XI requirements. Inspection of these items bounds the remaining stainless steel clad items in the pressurizer.

As an enhancement to this program, the condition of the internal spray head, spray head locking bar, and coupling will be determined by a one-time visual examination (VT-3) of these components in either Unit 1 or Unit 2. This examination will be performed prior to the period of extended operation to accepted ASME Section XI methods and standards.

Monitoring and Trending

During the course of the inspections, the extent of surface or volumetric flaws is characterized through non-destructive examinations (NDE). Anomalous indications that are signs of degradation are recorded on NDE reports in accordance with plant procedures.

As the inspection of the pressurizer spray head, spray head locking bar, and coupling is a one-time inspection, no monitoring or trending will be completed for this activity. However, the need for subsequent inspections will be determined after the results of the inspection are evaluated.

Acceptance Criteria

The acceptance criteria are those for volumetric examinations in accordance with ASME B&PV Code Section XI, Paragraphs IWB-3510 and IWB-3512. The acceptance standards for the visual examinations will be in accordance with ASME Section XI VT-3 examinations.

Corrective Actions

Specific corrective actions will be implemented in accordance with the Corrective Action Program and ASME Section XI. In accordance with Subsection IWB, components containing relevant conditions shall be evaluated, repaired, or replaced prior to returning to service.

If flaws are detected in the spray head, spray head locking bar, or coupling during the one-time inspection, engineering analysis will be performed to determine corrective actions, which could include replacement of the spray head. The need for subsequent inspections will be determined after the results of the inspection are evaluated.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The Pressurizer Examinations Program, which is based on proven inservice inspection techniques, will effectively manage degradation of the pressurizer cladding and spray head items. The pressurizer examinations include multiple volumetric examinations of pressurizer components having the highest fatigue usage factors. Any cracking of the cladding that extends into the base metal would be detected by ASME Section XI volumetric examinations at these locations. The volumetric inspections are performed with inservice inspection techniques that have been proven effective within the industry at detecting cracking before loss of function occurs. Operating experience for the CNP inservice inspection program is discussed in Section B.1.14.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope	The condition of the internal spray head, spray head locking bar, and coupling will be determined by a one-time visual examination (VT-3) of these components in one CNP unit. This examination will be performed prior to the period of extended operation to accepted ASME Section XI methods and standards.
3. Parameters Monitored	The condition of the spray head, spray head locking bar, and coupling will be assessed to ensure that degradation of these items has not occurred.

Element Affected	Enhancement
4. Detection of Aging Effects	The condition of the internal spray head, spray head locking bar, and coupling will be determined by a one-time visual examination (VT-3) of these components in one CNP unit. This examination will be performed prior to the period of extended operation to accepted ASME Section XI methods and standards.
7. Corrective Action	If flaws are detected in the spray head, spray head locking bar, or coupling, engineering analysis will be completed to determine corrective actions, which could include replacement of the spray head. The need for subsequent inspections will be determined after the results of the initial inspection are evaluated.

Conclusion

The Pressurizer Examinations Program effectively manages degradation of pressurizer cladding. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Pressurizer Examinations Program will provide reasonable assurance that the aging effects associated with the cladding, ferritic base material, spray heads, and associated components will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.25 Preventive Maintenance

Program Description

The Preventive Maintenance (PM) Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The purpose of the PM Program is to maintain plant structures, systems, and components at the quality level required for the safe and reliable operation of the plant. The program comprises those preventive maintenance tasks that are intended to sustain plant equipment within design parameters and maintain the equipment's intrinsic reliability.

Aging Management Program Elements

Scope

The scope of the PM Program, with regard to license renewal, is those preventive maintenance tasks credited with managing the aging effects identified in this application. Specific preventive maintenance activities credited for license renewal are discussed below under the heading, "Detection of Aging Effects."

Preventive Actions

The PM Program as credited for license renewal does not include preventive actions as described in NUREG-1800 Appendix A for the Preventive Action element of a license renewal program. Implementation of these activities enables the inspectors to detect aging effects and allow for corrective actions before loss of intended function.

Parameters Monitored or Inspected

Inspection and testing activities monitor various parameters, including surface condition, presence of corrosion products, and signs of cracking.

Detection of Aging Effects

Preventive maintenance activities provide for periodic component inspections and testing to detect aging effects. Inspection and testing intervals are established to provide for timely detection of component degradation. The prescribed intervals take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

The extent and schedule of the inspections and testing assure detection of component degradation prior to the loss of intended functions. Established techniques such as visual inspections are used.

Centrifugal Charging Pump Casing Cracking PM Activities

The PM Program includes inspections of the centrifugal charging pump casing cladding, as was identified in NRC Information Notice 80-38, to manage the component-specific aging effect of cladding cracking due to high localized stresses. After locations of rust or boric acid deposits are mapped, liquid penetrant examinations are used to identify indications. Damaged areas are excavated and re-clad with stainless steel. Base metal is repaired if necessary.

Emergency Diesel Generator System PM Activities

The PM Program includes inspections of numerous emergency diesel generator (EDG) components. The PM activities are general inspections rather than specific component-by-component listings. This program ensures that loss of material, cracking, fouling, and change in material properties are managed for EDG subsystem components. The PM Program will be enhanced to manage the aging effects of cracking and change of material properties for the emergency diesel engine elastomer flex hoses or tubing. The PM activity will include visual inspection and replacement as needed.

Heating, Ventilation, and Air Conditioning System PM Activities

The PM Program performs inspections of control room ventilation air handler unit components. The PM tasks for the control room ventilation air handler packages will be enhanced to include inspection of the heat exchanger tubes and flex joints. These inspections will ensure that loss of material and fouling are managed for the stainless steel heat exchanger tubes, and that changes in material properties and cracking are managed for the elastomer flex joints. Thus, the heat transfer and pressure boundary intended functions will be maintained for the period of extended operation. Acceptance criteria and corrective actions will be specified.

The PM Program performs inspections of auxiliary feedwater pump room cooling unit components. The PM tasks for the auxiliary feedwater pump room cooling units will be enhanced to include inspection of the internal evaporator tubes, valves and tubing. These inspections will ensure that loss of material and fouling are managed for the copper alloy components within these units. Thus, the intended functions of heat transfer and pressure boundary will be maintained for the period of extended operation. Acceptance criteria and corrective actions will be specified.

The PM tasks for the EDG ventilation system will be enhanced to include inspection of the flex joints. Acceptance criteria and corrective actions will be specified. These inspections will ensure that the effects of aging are managed and that the intended function of pressure boundary is maintained for the period of extended operation.

Fire Protection System PM Activities

The PM Program will be enhanced to perform inspections of reactor coolant pump lube oil leakage collection components. If damaged components are found, they will be replaced. This program will ensure that loss of material is managed and that the intended function of pressure boundary is maintained for the period of extended operation.

Compressed Air System PM Activities

The PM Program will be enhanced to manage cracking and change in material properties for the rubber hoses in the compressed air system that require aging management review. This PM activity will include visual inspection and replacement as needed.

Post-Accident Hydrogen Monitoring System PM Activities

The PM Program will be enhanced to manage cracking and change of material properties for the rubber hoses for the post-accident containment hydrogen monitoring system (PACHMS) reagent gas supply. This PM activity will include visual inspection and replacement as needed.

Security Diesel PM Activities

The PM Program will be enhanced to manage cracking and change of material properties for the security diesel engine elastomer flex hoses or tubing. This PM activity will include visual inspection and replacement as needed.

Auxiliary Feedwater PM Activities

The PM Program will be enhanced to manage cracking and change in material properties of the elastomer condensate storage tanks floating head seals. This PM activity will include visual inspection and replacement as needed.

<u>Monitoring and Trending</u>

The PM Program administrative controls reference activities for monitoring systems and components to permit early detection of degradation. These activities include visual examinations for corrosion, cracking, fouling, leaking and physical condition, mechanical damage, and loose or missing hardware, as appropriate.

The CNP Corrective Action Program is applicable to this program. This provides reasonable assurance that trends entailing repeat failures to meet acceptance criteria will be identified and addressed with appropriate corrective actions.

Acceptance Criteria

PM Program acceptance criteria are defined in the specific inspection and testing procedures. They confirm component integrity by verifying the absence of the aging effect. Unacceptable degradation will be identified and evaluated under the Corrective Action Program.

Corrective Actions

Identified deviations are evaluated within the Corrective Action Program, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

CNP operating experience reviewed relative to the PM Program included condition reports, program health reports, assessment reports, NRC inspection reports and licensee event reports.

The overhaul of the program conducted as part of the 1997-2000 plant restart effort has significantly improved the PM Program. Program improvements incorporated proven industry practices and addressed self-identified issues. In 1999, benchmarking was conducted by visiting three other plants with programs considered to be among the best in the industry. The NRC conducted a special inspection in 1999 and concluded that the PM Programs were adequate to support restart of the plant. To maintain the program, the PM group reviews industry operating experience via the Corrective Action Program. This operating experience can be factored into existing or new PM tasks.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
4. Detection of Aging Effects	PM tasks for the EDG ventilation system will be revised to include inspection of the flex joints. Acceptance criteria and corrective actions will be specified.
	PM tasks for the control room ventilation air handler packages will be revised to include inspection of the heat exchanger tubes and flex joints. Acceptance criteria and corrective actions will be specified.
	PM tasks for the auxiliary feedwater pump room cooling units will be revised to include inspection of the internal evaporator tubes, valves and tubing. Acceptance criteria and corrective actions will be specified.
	The PM Program will manage the aging effects of cracking and change of material properties for the emergency diesel engine elastomer flex hoses or tubing. This PM activity will include visual inspection and replacement as needed.
	The PM Program will perform inspections of reactor coolant pump lube oil leakage collection components.
	The PM Program will manage the aging effects of cracking and change in material properties for the rubber hoses in the compressed air system requiring aging management review. This PM activity will include visual inspection and replacement as needed.

Element Affected	Enhancement
4. Detection of Aging Effects (continued)	The PM Program will manage the aging effects of cracking and change of material properties for the rubber hoses for the PACHMS reagent gas supply. This PM activity will include visual inspection and replacement as needed.
	The PM Program will manage the aging effects of cracking and change of material properties for the security diesel engine elastomer flex hoses or tubing. This PM activity will include visual inspection and replacement as needed.
	The PM Program will manage cracking and change in material properties of the elastomer condensate storage tanks floating head seals. This PM activity will include visual inspection and replacement as needed.

Conclusion

The Preventive Maintenance Program effectively manages aging effects, since it consists of proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls. CNP's past operation demonstrates that typical PM activities, such as visual inspections, have been effective in managing the effects of aging on components. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Preventive Maintenance Program will provide reasonable assurance that the effects of aging will be managed such that components within the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.26 Reactor Vessel Integrity

Program Description

The Reactor Vessel Integrity Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M31, Reactor Vessel Surveillance.

The purpose of the Reactor Vessel Integrity Program is to manage reduction of fracture toughness of reactor vessel beltline materials to ensure that the pressure boundary function of the reactor vessel beltline is maintained for the period of extended operation. The program is based on ASTM E-185-82, *Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels*, and includes an evaluation of radiation damage based on pre-irradiation and post-irradiation testing of Charpy V-notch and tensile specimens. Eight specimen capsules were inserted into each CNP reactor vessel prior to initial startup. The capsules contain reactor vessel steel specimens from the limiting shell plate surrounding the core region of the reactor and associated weld metal and heat-affected zone metal. The capsules also contain dosimeters and thermal monitors.

As surveillance capsules are withdrawn and either tested or stored, documentation is updated accordingly and submitted to the NRC in accordance with 10 CFR 50, Appendix H. These reports include:

- a capsule withdrawal schedule;
- a summary report of capsule withdrawal and test results; and
- if needed, the expected date for submittal of the revised technical specifications to account for changes to the pressure-temperature limits.

The Reactor Vessel Integrity Program also encompasses other activities associated with managing the integrity of the reactor vessel, including updating the RT_{PTS} analysis, as required by 10 CFR 50.61, and maintenance of the pressure-temperature curves, as required by 10 CFR 50, Appendix G.

NUREG-1801 Consistency

With the inclusion of program enhancements, the Reactor Vessel Integrity Program will be consistent with the program described in NUREG-1801, Section XI.M31.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
5. Monitoring and Trending	I&M will pull and test one additional standby capsule for each unit between 32 EFPY and 48 EFPY to address the peak fluence expected at 60 years. A fluence update will be performed at approximately 32 EFPY when Capsules W (Unit 1) and S (Unit 2) are pulled and tested. A subsequent fluence update will be performed when the standby capsules are pulled and tested between 32 EFPY and 48 EFPY.
6. Acceptance Criteria	Modifications to design and operation that result in changes to the neutron energy spectrum or operating temperatures will be compared to the original environment in which the capsules were irradiated. For example, changes in operating temperatures may occur during the period of extended operation due to power uprates. If appropriate, surveillance data obtained during the current term of operation will be adjusted to account for the revised neutron energy spectrums or vessel inlet temperatures. The subsequent impact on the applicable embrittlement evaluations will be assessed.

Operating Experience

A review of CNP operating experience (including condition reports, licensee event reports, and NRC letters) did not identify adverse conditions relevant to the Reactor Vessel Integrity Program. This program is an Integrated Surveillance Program, which will be enhanced, as appropriate, based on operating experience from CNP and other Westinghouse plants. The CNP program is consistent with the corresponding program in NUREG-1801, which does not discuss operating experience as an element of the program.

Conclusion

The Reactor Vessel Integrity Program effectively manages reactor vessel degradation by identifying and taking corrective actions prior to exceeding allowable limits. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Reactor Vessel Integrity Program will provide reasonable assurance that the aging effects will be managed and the reactor vessel will continue to perform its intended function for the period of extended operation.

B.1.27 Reactor Vessel Internals Plates, Forgings, Welds, and Bolting

Program Description

The Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program is a new program that I&M will implement prior to the period of extended operation. The CNP program will be comparable to the program described in NUREG-1801, Section XI.M16, PWR Vessel Internals.

This program, which is included in the Reactor Vessel Internals Program along with the Reactor Vessel Internals CASS Program, will manage aging effects of reactor vessel internals plates, forgings, welds, and bolting. The program will supplement the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program to assure that aging effects will not result in loss of the intended functions of the reactor vessel internals during the period of extended operation. The program will manage the following aging effects:

- Crack initiation and growth due to stress corrosion cracking (SCC) or irradiation-assisted stress corrosion cracking (IASCC),
- Loss of fracture toughness due to neutron irradiation embrittlement, and
- Distortion due to void swelling.

Loss of fracture toughness is only of concern if cracks exist. Cracking is expected to initiate at the surface and is detectable by inspection.

This program will include visual inspections and non-destructive examinations of the reactor vessel internals during the period of extended operation. A visual inspection will be performed on plates, forgings, and welds to detect and monitor cracking caused by IASCC enhanced by reduction of fracture toughness by irradiation embrittlement and distortion due to void swelling. Other demonstrated acceptable inspection methods will be utilized for bolted joints (core barrel bolts and thermal shield bolts), if deemed necessary. For baffle bolts, a volumetric inspection of critical locations will be performed to assess cracking.

Characterization of the internals aging effects through the activities of EPRI and other industry groups will ensure a better understanding of the identified aging effects. Further understanding of these aging effects will provide additional bases for the inspections under this program. For instance, pending results of industry progress with regard to validation of the significance of dimensional changes due to void swelling, visual examinations may be supplemented to incorporate requirements for dimensional verification of critical reactor vessel internals. I&M will participate in industry-wide programs designed by the PWR Materials Reliability Project Issues Task Group for investigating the impacts of aging on PWR vessel internal components.

NUREG-1801 Consistency

The CNP program will be consistent with the program described in NUREG-1801, Section XI.M16.

Enhancements

In addition to the features of the program described in NUREG-1801, Section XI.M16, the CNP program will manage the aging effect of dimensional changes due to void swelling on CASS components.

Operating Experience

The Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program is a new program with no plant-specific operating experience. However, compliance with the inspection requirements of ASME Section XI has been maintained at CNP since initial operation. In general, visual examinations have proven effective to detect cracking.

I&M also participates in the Westinghouse Owners Group (WOG) program for baffle/former bolting. Most of the industry activities addressing aging effects on reactor vessel internals are conducted under the EPRI Materials Reliability Project (MRP). The MRP strategy is to evaluate potential aging mechanisms and their effects on specific reactor vessel internals parts by evaluating causal parameters such as fluence, material properties, state of stress, etc. Critical locations can be identified and tailored inspections can be conducted on an integrated industry, nuclear steam supply system vendor, or plant-specific basis. As these projects are completed, I&M will evaluate the results and factor them into the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program, as applicable.

Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

Implementation of the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program will provide reasonable assurance that the components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. This program will be implemented prior to the period of extended operation.

B.1.28 Reactor Vessel Internals Cast Austenitic Stainless Steel

Program Description

The Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Program is a new program that I&M will implement prior to the period of extended operation. The CNP program will be comparable to the program described in NUREG-1801, Section XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel.

This program, which is included in the Reactor Vessel Internals Program along with the Reactor Vessel Internals Plates, Forgings, Welds, and Bolting Program, will manage aging effects of CASS reactor vessel internals components. This program will supplement the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program to assure that aging effects will not result in loss of the intended functions of the reactor vessel internals during the period of extended operation. The program will detect and manage cracking, reduction of fracture toughness, and dimensional changes.

This program will include visual inspections and nondestructive examinations of the reactor vessel internals during the period of extended operation. The program will monitor propagation of cracks from existing flaws caused by IASCC enhanced by reduction of fracture toughness, and change of dimensions due to void swelling. Applicable components will be determined based on the neutron fluence and thermal embrittlement susceptibility of the component.

Characterization of the internals aging effects through the activities of EPRI and other industry groups will ensure a better understanding of the identified aging effects. Further understanding of these aging effects will provide additional bases for the inspections under this program. For instance, pending results of industry progress with regard to validation of the significance of dimensional changes due to void swelling, visual examinations may be supplemented to incorporate requirements for dimensional verification of critical reactor vessel internals parts. I&M will participate in industry-wide programs designed by the PWR Materials Reliability Project Issues Task Group for investigating the impacts of aging on PWR vessel internal components.

NUREG-1801 Consistency

The CNP program will be consistent with the program described in NUREG-1801, Section XI.M13.

Enhancements

In addition to the features of the program described in NUREG-1801, Section XI.M13, the CNP program will manage the aging effect of distortion due to void swelling of the reactor vessel internals.

Operating Experience

The Reactor Vessel Internals CASS Program is a new program for which there is no plant-specific operating experience. Visual examinations to be performed under this program are inspections with demonstrated capability and a proven industry record of detecting potential cracking. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

Implementation of the Reactor Vessel Internals CASS Program will provide reasonable assurance that the reactor vessel internal components fabricated from CASS will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. This program will be implemented prior to the period of extended operation.

B.1.29 Service Water System Reliability

Program Description

The Service Water System Reliability Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M20, Open-Cycle Cooling Water System.

This program relies on implementation of the recommendations of NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," (Reference B.3-8) to ensure that the effects of aging on the essential service water system (ESW) will be managed for the period of extended operation. The program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the ESW system or structures and components serviced by the ESW system.

NUREG-1801 Consistency

With the inclusion of program enhancements, the Service Water System Reliability Program will be consistent with, but include exceptions to, the program described in NUREG-1801, Section XI.M20.

Exceptions to NUREG-1801

This program includes the following exceptions to the program described in NUREG-1801, Section XI.M20.

Element Affected	Exception
1. Scope of Program	Program heat exchangers may receive a thorough visual inspection and cleaning in lieu of thermal performance testing. [1]
2. Preventive Actions	NUREG-1801 states that system components are constructed of appropriate materials and lined or coated to protect the underlying metal surfaces from being exposed to aggressive cooling water environments. Not all CNP system components are lined or coated. They are lined or coated only where necessary to protect the underlying metal surfaces.

Element Affected	Exception
5. Monitoring and Trending	NUREG-1801 requires that testing and inspections be performed annually and during refueling outages. The CNP program performs tests and inspections on a refueling outage frequency. [2]

1. Heat exchangers may receive a thorough visual inspection and cleaning in lieu of thermal performance testing. Differential pressure monitoring is also used to monitor flow through the containment spray heat exchangers. This is consistent with the I&M response to NRC GL 89-13.

2. The CNP program performs tests and inspections on a refueling outage frequency. Since aging effects are typically manifested over several years, the change in inspection and testing frequency from annually to a refueling outage frequency is insignificant.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
4. Detection of Aging Effects	The Service Water System Reliability Program will be enhanced to check for evidence of selective leaching during visual inspections.
	Develop new PM activity or revise existing PM activity to ensure the 8-inch expansion joints in the ESW supply lines to the EDG heat exchangers are inspected for evidence of loss of material, change in material properties, and cracking.

Operating Experience

CNP operating experience reviewed relative to the Service Water Reliability Program included condition reports, program health reports, procedure revisions, and licensee event reports. This program was established to meet the requirements of GL 89-13, which included recommendations based on extensive industry operating experience. Examples of aging effects noted in the GL 89-13 Program Health Report in 2002 include minor galvanic or crevice corrosion of the CCW heat exchanger tube sheets, identified by inspection and cracking of tube seam welds; and MIC pitting of the containment spray heat exchangers, identified by eddy current testing. The identification of these effects demonstrates that program activities are effective at detecting minor degradation before it becomes significant.

Inspections and tests performed in accordance with the Service Water Reliability Program have been effective in identifying degradation such as aging effects that could impact the capabilities of the ESW system. When deficiencies were identified, appropriate corrective actions have been performed. The combination of inspections and testing are adequate to ensure the aging effects from the exposure to ESW are adequately managed for this system.

Conclusion

The Service Water Reliability Program effectively manages aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Service Water Reliability Program will provide reasonable assurance that the effects of aging will be managed such that components crediting the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.30 Small Bore Piping

Program Description

The Small Bore Piping Program is a new CNP program that I&M will implement prior to the period of extended operation. The CNP program will be comparable to the program described in NUREG-1801, Section XI.M32, One-Time Inspection.

The Small Bore Piping Program is credited for managing cracking of small bore Class 1 piping (< 4 inch nominal pipe size [NPS]), including pipe, fittings, and branch connections, in the RCS. This piping does not receive volumetric inspection in accordance with ASME Section XI, Examination Category B-J or B-F. Cracking is an aging effect requiring management for RCS small bore piping for the period of extended operation. The small bore piping inspection will involve a one-time volumetric examination of susceptible items in selected locations of Class 1 small bore piping. These inspections will occur at or near the end of the initial operating period for CNP Units 1 and 2.

NUREG-1801 Consistency

The Small Bore Piping Program will be consistent with the program described in NUREG-1801, Section XI.M32. While the NUREG-1801 program encompasses a broader scope of activities other than solely small bore piping inspections, the CNP program will be consistent with the general program elements described in the NUREG-1801 One-Time Inspection Program.

Operating Experience

This one-time inspection is a new activity that will use techniques with demonstrated capability and a proven industry record to detect piping weld and base material flaws.

Conclusion

Implementation of the Small Bore Piping Program will provide reasonable assurance that the systems and components within the scope of this program will continue to perform their intended functions consistent with the CNP current licensing basis for the period of extended operation. This program will be implemented prior to the period of extended operation.

B.1.31 Steam Generator Integrity

Program Description

The Steam Generator Integrity Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M19, Steam Generator Tube Integrity.

In the nuclear industry, steam generator (SG) tubes have experienced degradation related to corrosion phenomena, such as:

- Primary water stress corrosion cracking (PWSCC),
- Outside diameter stress corrosion cracking (ODSCC),
- Intergranular attack (IGA),
- Pitting, and
- Wastage.

Tube degradation also occurs because of other mechanically-induced phenomena, such as denting, wear, impingement damage, and fatigue. Nondestructive examination (NDE) techniques are used to identify tubes that are defective and need to be removed from service or repaired in accordance with the Technical Specifications.

NUREG-1801 Consistency

The Steam Generator Integrity Program is consistent with the program described in NUREG-1801, Section XI.M19.

Operating Experience

Steam generator tube integrity issues, based on industry and site-specific operating experience, led to the replacement of Unit 2 SGs in 1988 and Unit 1 SGs in 2000.

The CNP program, which is based on NEI 97-06, *Steam Generator Program Guidelines*, (Reference B.3-15) contains a balance of prevention, inspection, evaluation, repair and leak-monitoring measures to ensure tube integrity. Self-assessments are performed on a periodic basis to identify areas for program improvement. Program “health” is documented via periodic health reports that contain performance indicators to help assess the overall status of the program in terms of site and industry expectations.

I&M incorporates operating experience into the Steam Generator Integrity Program in accordance with NEI guidelines. An assessment in 2001 determined that this adequately addresses the licensee responsibilities identified by NEI 97-06.

Conclusion

The Steam Generator Integrity Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed such that components in the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.32 Structures Monitoring – Structures Monitoring

Program Description

The Structures Monitoring Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.S6, Structures Monitoring Program.

Implementation of structures monitoring under 10 CFR 50.65 (the Maintenance Rule) (Reference B.3-1) is addressed in NRC Regulatory Guide (RG) 1.160, *Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,* Rev. 2, (Reference B.3-10), and NUMARC 93-01, *Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,* Rev. 2 (Reference B.3-14). These two documents provide guidance for development of licensee-specific programs to monitor the condition of structures and structural components within the scope of the Maintenance Rule, such that there is no loss of structure or structural component intended function. This program will be expanded to encompass structures and structural components within the scope of license renewal.

NUREG-1801 Consistency

With the inclusion of program enhancements, the CNP program will be consistent with the program described in NUREG-1801, Section XI.S6.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
1. Scope	Include equipment supports, instrument panels, racks, cable trays, conduits, cable tray supports, conduit supports, elastomers and pipe hangers/supports in the Structures Monitoring Program.

Element Affected	Enhancement
1. Scope (continued)	Include the following structures and structural components in the Structures Monitoring Program: • Fire protection pump house superstructure and walls • Gas bottle storage tank rack and foundation • Security diesel generator room • Switchyard control house • Fire protection water storage tank foundation • Primary water storage tank foundation • Roadway west of the screenhouse
4. Detection of Aging Effects	Include the roadway west of the screenhouse in the Structures Monitoring Program. The examination criteria for the roadway need to detect degradation of the roadway due to weather-related damage.

Operating Experience

CNP operating experience reviewed relative to the Structures Monitoring Program included condition reports, licensee event reports, NRC inspection reports, peer assessments, and self-assessments.

The Structures Monitoring Program was instituted at CNP in 1996 as part of the implementation of the Maintenance Rule. Improvements to the program have followed from a program peer review, self-assessments, and condition report-identified issues. The most recent NRC inspections, conducted in 2001, identified no findings of significance for the specific areas of the Maintenance Rule inspected.

Conclusion

The Structures Monitoring Program effectively manages aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Structures Monitoring Program will provide reasonable assurance that the effects of aging will be managed such that structures and structural components in the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.33 Structures Monitoring – Crane Inspection

Program Description

The Crane Inspection Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M23, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.

The program includes testing and monitoring to provide assurance that the structures, systems, and components of these cranes are capable of sustaining their rated loads. This program is primarily concerned with passive structural components that make up the bridge and trolley.

NUREG-1801 Consistency

With the inclusion of program enhancements, the CNP program will be consistent with, but include exceptions to, the program described in NUREG-1801, Section XI.M23.

Exceptions to NUREG-1801

The Crane Inspection Program includes the following exceptions to the program described in NUREG-1801, Section XI.M23.

Elements Affected	Exception
3. Parameters Monitored / Inspected	The number and magnitude of the lifts are not reviewed. [1]
4. Detection of Aging Effects	Functional tests are not performed on all in-scope cranes. [2]

1. Review of the actual number of lifts for the cranes is not necessary, since the allowable limits are expected to provide adequate margin for the period of extended operation.

2. Many cranes have only the intended function of maintaining structural integrity to prevent impacting safety-related SSCs. Functional tests involving the active components of the crane are not needed to ensure structural integrity.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
1. Scope	Develop procedures or recurring tasks to manage loss of material on the crane, rails, and supports of in-scope cranes.
3. Parameters Monitored/Inspected	Develop procedures or recurring tasks to evaluate the effectiveness of the Maintenance Monitoring Program and the effects of past and future usage on the structural reliability of in-scope cranes.
4. Detection of Aging Effects	Develop procedures or recurring tasks to verify that in-scope crane rails and structural components are visually inspected on a routine basis for loss of material.
6. Acceptance Criteria	Develop procedures or recurring tasks to verify that significant visual indications of loss of material due to corrosion or wear are evaluated according to applicable industry standards and good industry practice.

Operating Experience

CNP operating experience reviewed relative to the Crane Inspection Program included condition reports, licensee event reports, NRC inspection reports, and self-assessments. As documented in one condition report, operating experience at Wolf Creek (where crane rail studs had failed due to fatigue) prompted I&M to require an inspection of major CNP cranes by the manufacturer's representative. Consistent with general industry experience addressed in NUREG-1801, no crane-aging problems have been identified at CNP.

Conclusion

The Crane Inspection Program effectively manages aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Crane Inspection Program will provide reasonable assurance that the effects of aging will be managed such that components in the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.34 Structures Monitoring – Divider Barrier Seal Inspection

Program Description

The Divider Barrier Seal Inspection Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The divider barrier in each containment is the physical boundary that separates upper containment from lower containment. Several containment internal structures constitute the divider barrier. Elastomeric seals are provided for penetrations and openings through the divider barrier where it is necessary to limit potential ice condenser bypass leakage subsequent to a postulated pipe rupture or loss of coolant accident. Cracking and change in material properties are aging effects requiring management for the pressure seals.

Aging Management Program Elements

Scope

The scope of this program is the containment divider barrier elastomeric pressure seals around penetrations and openings through the divider barrier.

Preventive Actions

This is an inspection program; no actions are taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

Parameters monitored by this program are cracking and change in material properties of elastomeric pressure seals.

Detection of Aging Effects

This program detects cracking and change in material properties prior to loss of the pressure seals' intended functions.

The seals around penetrations and openings (including the bulkhead gate) are visually inspected to ensure the absence of apparent deterioration (cracks or defects). The frequency of inspection is at least once every 10 years.

Monitoring and Trending

This program monitors aging effects through visual examination of the seals. The Corrective Action Program provides reasonable assurance that trends entailing repeat failures to meet acceptance criteria will be identified and addressed with appropriate corrective actions.

Acceptance Criteria

The acceptance criteria for seal inspections are that seals must be free of unacceptable deterioration (excessive cracks or defects) and unacceptable misalignment.

Corrective Actions

Discrepancies noted during the inspection are documented in the Corrective Action Program in accordance with the implementing procedure. Specific corrective actions will be implemented in accordance with the Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The review of operating experience relative to the Divider Barrier Seal Inspection Program included condition reports and licensee event reports. The review revealed that the program is monitoring and detecting the aging of the elastomer seals prior to loss of intended function. The condition reports included all aspects of the divider barrier seal and indicated no pattern of repeat conditions. For example, a condition report documented adequacy of inspection and replacement criteria for seals covered by the program. Another condition report and associated licensee event reports documented correction of ice condenser bypass leakage in excess of the design basis through implementation of design changes.

The limited number of ice condenser containments has resulted in minimal industry operating experience. No examples of industry experience relative to the CNP plants were identified.

Conclusion

The Divider Barrier Seal Inspection Program effectively manages cracking and change in material property of elastomeric seals around penetrations and openings through the divider barrier. Continued implementation of this program provides reasonable assurance that aging effects will be managed such that these seals will continue to perform their intended functions consistent with the current licensing basis throughout the period of extended operation.

B.1.35 Structures Monitoring – Ice Basket Inspection

Program Description

The Ice Basket Inspection Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The Ice Basket Inspection Program provides instructions to verify that ice condenser baskets are free of detrimental structural wear, cracks, corrosion, or any other noticeable damage. The functional integrity of the ice condenser baskets ensures that the ice condenser can perform its intended safety function.

Aging Management Program Elements

Scope

The Ice Basket Inspection Program verifies that ice condenser baskets are operable as required by Technical Specification Surveillance Requirement 4.6.5.1.d.

Preventive Actions

This is an inspection program; no actions are taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

Visual checks are made of the ice basket bottom, top rim, coupling connections, stiffener rings, weld seams and ligaments. Ligaments are checked for visible pitting or surface metal wastage caused by corrosion that is significant enough to dimensionally affect the ligament.

Detection of Aging Effects

The Ice Basket Inspection Program detects loss of material of the ice baskets prior to loss of structure or component intended function.

Monitoring and Trending

Results of the ice basket inspections are retained to permit confirmation of the inspection program effectiveness.

Acceptance Criteria

The acceptance criterion for the ice basket inspections is specified in plant procedures to ensure that the ice baskets are free of detrimental structural wear, cracks, corrosion, or other damage.

Corrective Actions

Ice condenser ice baskets that are potentially degraded are evaluated by the Maintenance Supervisor with assistance from engineering personnel. Structures and components that are deemed unacceptable are documented under the Corrective Action Program. Specific corrective actions will be implemented in accordance with the Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

CNP operating experience reviewed relative to the Ice Basket Inspection Program included condition reports, licensee event reports, and NRC inspection reports.

Condition reports related to this program identified ice basket damage, flow passage problems, etc. Damage to baskets was found to be the result of improper handling of the baskets during testing (weighing) and refilling, rather than aging effects. Program enhancements were made under the corrective actions for these condition reports.

An NRC inspection of the ice condensers was performed in 1998. No aging effects were identified in the inspection report.

Conclusion

The Ice Basket Inspection Program, governed by Technical Specification Surveillance Requirement 4.6.5.1.d, effectively detects and manages loss of material. Continued implementation of this program provides reasonable assurance that loss of material will be managed such that the intended functions of the ice baskets will continue to be maintained consistent with the current licensing basis for the period of extended operation.

B.1.36 Structures Monitoring – Masonry Wall

Program Description

The Masonry Wall Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.S5, Masonry Wall Program.

The objective of the Masonry Wall Program is to manage aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation. Masonry walls are inspected as part of the Structures Monitoring Program conducted for the Maintenance Rule.

NUREG-1801 Consistency

With the inclusion of one program enhancement, the CNP program will be consistent with the program described in NUREG-1801, Section XI.S5.

Enhancements

The following enhancement will be implemented prior to the period of extended operation:

Element Affected	Enhancement
1. Scope	Include the following in the Masonry Wall Program: • 4-hour fire-rated masonry block in the turbine building and screenhouse; and • Masonry block in the auxiliary building. These were identified as performing intended functions in accordance with 10 CFR 54.4.

Operating Experience

CNP operating experience reviewed relative to the Masonry Wall Program included condition reports, NRC inspection reports, and documentation of the results of internal program assessments. At CNP, masonry walls are inspected as part of the Structures Monitoring Program conducted for the Maintenance Rule.

For example, physical degradation was identified during a walkdown in 1999. Three block walls had mortar joints that were cracked and needed to be resealed. As a result of these findings, additional inspections were conducted for loss of function (none found) and the walls were repaired. This demonstrates that activities performed under the program actively identify and manage aging effects prior to loss of function.

Conclusion

The Masonry Wall Program effectively manages aging effects. This program employs visual inspection techniques that have proven effective in the industry at detecting aging effects on masonry walls. With one enhancement to be incorporated prior to the period of extended operation, continued implementation of the Masonry Wall Program will provide reasonable assurance that the effects of aging will continue to be managed such that structures and structural components in the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.37 System Testing

Program Description

The System Testing Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The System Testing Program encompasses a number of miscellaneous system and component testing activities credited for managing the effects of aging. These activities are typically surveillance activities required by the Technical Specifications or normal monitoring of plant operation (for example, plant log readings or other normal monitoring techniques). In general, these activities are conducted on a periodic basis (surveillances) or routinely (logs) during plant operation. They are intended to verify the continuing capability of safety-related systems and components to meet established performance requirements.

Aging Management Program Elements

Scope

With respect to license renewal, this program includes the following testing activities:

- Centrifugal charging pump test
- Engineered safety features ventilation units testing
- Control room ventilation units testing
- Fuel handling area exhaust unit testing
- Security diesel test
- Letdown orifice test
- Main steam flow meter monitoring
- Blowdown system normal operation monitoring
- Spent fuel pool water level monitoring

Preventive Actions

This is a monitoring program; no actions are or will be taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

Parameters monitored or inspected during these systems tests include system flow and system pressure.

Detection of Aging Effects

Centrifugal Charging Pump Test

System testing of the centrifugal charging pumps will be enhanced to manage loss of material for the centrifugal charging pumps minimum flow orifices and the Unit 1 centrifugal charging pumps discharge orifices. The ASME Section XI pump testing will verify the orifices have not experienced loss of material to the extent of impacting the ability of a pump to provide the required flow.

Engineered Safety Features Ventilation Units Testing

System testing of the engineered safety features ventilation units will be enhanced to manage the effects of aging on the drain valves and drain piping from these units. During surveillance testing, a visual inspection of the drain valves and drain piping will be accomplished.

Control Room Ventilation Units Testing

System testing of the control room ventilation units will be enhanced to manage the effects of aging on the drain valves and drain piping from these units. During surveillance testing, a visual inspection of the drain valves and drain piping will be accomplished.

Fuel Handling Area Exhaust Unit Testing

System testing of the fuel handling area exhaust unit will be enhanced to manage the effects of aging on the drain valves and drain piping from this unit. During surveillance testing, a visual inspection of the drain valves and drain piping will be accomplished.

Security Diesel System Test

Testing requirements include periodically starting the security diesel and operating it in accordance with manufacturer's recommendations. System testing is credited for managing fouling and loss of material for the security diesel jacket water heat exchangers and lube oil heat exchanger tubes.

Since periodic engine testing and inspections are performed on the security diesel, system testing is also credited for managing loss of material for the following:

- Buried fuel oil storage tank,
- Pipe,
- Tubing/fittings,
- Starting air components, and
- Exhaust gas components.

Fuel oil level indication and periodic pressure testing with use of the spectacle flange manage the aging effects on the buried fuel oil storage tank. During engine operation, monitoring engine parameters and performing visual inspections manage the aging effects by verifying the pressure boundary of engine components. Also, six-month and annual inspections are performed on the security diesel to manage the aging effects on security diesel passive mechanical components.

Letdown Orifices Test

The letdown orifices reduce the pressure in the letdown line from RCS pressure to the lower pressure allowed for the demineralizers and other CVCS components. Normal plant operation will verify the ability of the letdown orifices to control flow. CVCS letdown flow is recorded hourly on the Unit 1 or Unit 2 Critical Parameters Log.

Main Steam System Testing

System testing includes the monitoring of components during normal plant operation. For the main steam system, this monitoring manages the aging effect of loss of material from the main steam flow restrictors. A material loss from the internal surface of the flow restrictors significant enough to impact its flow control function would be detected by changes in the flow reading.

Blowdown System Testing

System testing includes the system monitoring performed during normal operation. This monitoring is credited with ensuring the restricting orifices are performing their flow control (pressure breakdown) function, and managing the aging effect of loss of material from erosion for the internal surfaces of the orifices.

Spent Fuel Pool Water Level Monitoring

System testing includes the monitoring of components during normal plant operation. The spent fuel pool water level is monitored and recorded once per shift. Monitoring the spent fuel pool level allows early detection of leakage through the spent fuel pool liner. This program manages the aging effect of loss of material and cracking for the spent fuel pool liner.

Monitoring and Trending

The surveillance and monitoring activities associated with this program are performed on a specific frequency as listed in the Site Surveillance Tracking Database and the results of these activities are documented. The program includes various frequencies, depending upon the specific component or system being tested.

Acceptance Criteria

Acceptance criteria and guidelines for the surveillances and normal log readings are provided in the governing procedures. Acceptance criteria are tailored for each individual system or component test.

Corrective Actions

Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

A review of operating experience, including condition reports and interviews with the system managers, related to the various tests and inspections that constitute the System Testing Program found that testing procedure issues have been identified and corrected. Although typical component problems have been identified, system testing has not identified aging-related problems for monitored components.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
4. Detection of Aging Effects	Develop a PM to inspect the centrifugal charging pumps minimum flow orifices and the Unit 1 centrifugal charging pumps discharge orifices.
	Ensure procedures for engineered safety features ventilation unit, the fuel handling area exhaust unit, and control room ventilation unit surveillance testing include visual verification that the drain valves and drain piping have not experienced loss of material to the extent that their pressure boundary function is compromised.

Conclusion

The System Testing Program effectively manages aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the System Testing Program will provide reasonable assurance that systems and components within the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.38 System Walkdown

Program Description

The System Walkdown Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

System walkdowns are conducted to manage aging effects of systems and components within the scope of license renewal and subject to aging management review.

Aging Management Program Elements

Scope

This program includes inspections of external surfaces of CNP structures and components within the scope of license renewal. The program is also credited with managing loss of material from internal surfaces, for situations where the external surface condition is considered representative of the internal surface condition and both have the same environment.

Preventive Actions

For carbon steel components with coatings, this program manages loss of material due to corrosion of the carbon steel surfaces by ensuring the coating integrity is maintained.

Parameters Monitored or Inspected

The following parameters are inspected during the system walkdowns:

- Condition and placement of coatings
- Indications of leakage

The program will be enhanced to ensure that evidence of corrosion is adequately monitored.

Detection of Aging Effects

General visual inspections are conducted on readily accessible system and component surfaces during walkdowns. This program is credited with managing the following aging effects:

- Loss of material for external carbon steel surfaces
- Loss of mechanical closure integrity for bolted closures that may be exposed to borated water leakage
- Loss of material for internal carbon steel surfaces

- Loss of material (including that due to selective leaching) for copper alloy and cast iron surfaces
- Cracking of stainless steel surfaces

Monitoring and Trending

Observations are documented in quarterly walkdown reports. Walkdown reports are reviewed by the System Engineering Supervisor and included in the system notebooks.

Acceptance Criteria

Walkdown reports document safety or operability concerns and provide an overall assessment of the system condition, based on observations. Specific needs for improvement and follow-up actions are summarized. Condition reports are generated, as required.

Corrective Actions

Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls will be enhanced to be consistent with those discussed in Section B.0.3.

Operating Experience

A review of relevant condition reports indicated that aging of components was being identified by system walkdowns. Conditions such as boric acid leakage at a valve flange, corrosion on anchor bolts and tank surface pitting have been identified by system walkdowns.

Not only have aging effects like corrosion been noted and corrected, but aging management conditions that promote these aging effects have been noted and corrected as well. Among the conditions noted during a walkdown of the control room ventilation system in 1999 was corrosion of the inside of the ductwork believed to be caused by clogged drains, which was in turn caused by inadequate surveillance activities and insufficient housekeeping. The control room ventilation system was cleaned monthly for six months until the condition of the system was such that a return to normal housekeeping was considered adequate.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
1. Scope	Enhance the System Walkdown Program to ensure that BOP systems, such as the following, are adequately addressed with regard to license renewal considerations: • Fire protection system, • Security diesel, and • Nonsafety-related systems and components affecting safety-related systems.
3. Parameters Monitored / Inspected	Enhance the System Walkdown Program to ensure that evidence of corrosion is monitored adequately.
6. Acceptance Criteria	Enhance the System Walkdown Program acceptance criteria to ensure adequate detection of aging effects.
10.Administrative Controls	Develop and implement enhanced administrative controls for the System Walkdown Program.

Conclusion

The System Walkdown Program effectively manages aging effects. The program uses visual inspections to identify aging effects and aging mechanisms that could cause aging effects, including corrosion and indications of leakage. Visual inspections have proven effective throughout the industry in managing aging effects on plant equipment. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the System Walkdown Program will provide reasonable assurance that the effects of aging will be managed such that components within the scope of the program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.39 Wall Thinning Monitoring

Program Description

The Wall Thinning Monitoring Program is a new, plant-specific program that I&M will implement prior to the period of extended operation. There is no comparable NUREG-1801 program. A similar wall thinning program has previously been evaluated and approved by the NRC in NUREG-1743 (Reference B.3-13).

The Wall Thinning Monitoring Program inspections will be performed to ensure piping wall thickness is above the minimum required in order to avoid failures under normal conditions and postulated transient and accident conditions, including seismic events.

Aging Management Program Elements

Scope

Wall Thinning Monitoring inspections will include carbon steel piping and valves in the containment isolation system and the auxiliary feedwater system to ensure piping wall thickness is above the minimum required.

Preventive Actions

This will be an inspection program; no actions will be taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

Non-destructive examinations will be performed on susceptible component locations to determine wall thickness.

Detection of Aging Effects

The aging effect to be managed by this program is loss of material from the internal surfaces of carbon steel piping and valves in the containment isolation and auxiliary feedwater systems. An appropriate sample size will be determined based on operating experience prior to these inspection activities. The extent and schedule of the inspection and test techniques prescribed by this program will be designed to ensure that aging effects will be discovered and repaired before the loss of intended function. Inspections will be performed periodically, at a frequency to be determined prior to implementation. The frequency of inspections will depend upon results of previous inspections, calculated rate of material loss, and industry and plant operating experience.

Monitoring and Trending

Wall thickness will be trended and projected to the next inspection. Corrective actions will be taken if the projections indicate that the acceptance criteria may not be met at the next inspection.

Acceptance Criteria

Wall thickness measurements greater than minimum wall thickness values for the component's design code of record will be acceptable.

Corrective Actions

Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

The Wall Thinning Monitoring Program is a new program for which there is no operating experience to report. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

The Wall Thinning Monitoring Program will be effective for managing aging effects, since it incorporates proven monitoring techniques, acceptance criteria, corrective actions, and administrative controls from existing programs and procedures. Implementation of the Wall Thinning Monitoring Program will provide reasonable assurance that the effects of aging will be managed such that components within the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation. This inspection will be implemented prior to the period of extended operation.

B.1.40 Water Chemistry Control

The Water Chemistry Control Program consists of three programs: Primary and Secondary Water Chemistry Control, Closed Cooling Water Chemistry Control, and Auxiliary Systems Water Chemistry Control.

B.1.40.1 Water Chemistry Control – Primary and Secondary Water Chemistry Control

Program Description

The Primary and Secondary Water Chemistry Control Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M2, Water Chemistry.

The main objective of this program is to mitigate damage caused by corrosion and stress corrosion cracking. This Water Chemistry Program relies on monitoring and control of water chemistry based on EPRI guidelines.

NUREG-1801 Consistency

With the inclusion of program enhancements, the CNP Program will be consistent with the program described in NUREG-1801, Section XI.M2.

Enhancements

The following enhancements will be implemented prior to the period of extended operation:

Element Affected	Enhancement
3. Parameters Monitored/Inspected	Revise program controlling procedures to require individual implementing procedures to identify and prescribe any special collection and preservation needs of a sample.
	Bring the parameters monitored/inspected into clear alignment with the EPRI water chemistry guidelines.

Element Affected	Enhancement
6. Acceptance Criteria	Bring the acceptance criteria into clear alignment with the EPRI water chemistry guidelines.
	Include sulfate monitoring criteria for the refueling water storage tank (RWST) that are consistent with: • the EPRI guidelines, and • the sulfate criteria for other systems impacted by RWST chemistry (e.g., RCS and spent fuel pool).

Operating Experience

The Primary and Secondary Water Chemistry Control Program is based on the EPRI water chemistry guidelines. The EPRI guidelines reflect chemistry practices based on extensive operating experience in the nuclear industry. The guidelines are updated as appropriate based on continuing operating experience.

A 2002 Primary Chemistry Program self-assessment focused on critical Primary Chemistry Program attributes. Selected attributes established in EPRI PWR Primary Water Guidelines were evaluated. The assessment team included an industry peer and obtained benchmarking information from two other plants. The assessment team concluded that the essential program attributes assessed are adequately described and effectively implemented.

A self-assessment of the Secondary Chemistry Program in 2002, including peer review with staff from another station, was performed to identify program deficiencies and establish corrective actions. Industry operating experience was examined by the assessment team in order to improve startup contaminant control. The team concluded that the essential program attributes assessed are adequately described and effectively implemented.

Conclusion

The Primary and Secondary Water Chemistry Control Program effectively mitigates aging effects. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Primary and Secondary Water Chemistry Control Program will provide reasonable assurance that the aging effects will be managed such that systems and components in the scope of the program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.40.2 Water Chemistry Control – Closed Cooling Water Chemistry Control

Program Description

The Closed Cooling Water Chemistry Control Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water System.

This CNP program includes preventive measures that manage loss of material (including that due to selective leaching, where applicable), cracking, and fouling, as applicable, for closed cooling water system components. These chemistry activities provide for monitoring and controlling closed cooling water chemistry using CNP procedures and processes that are based on EPRI guidelines.

NUREG-1801 Consistency

The CNP program is consistent with, but includes exceptions to, the program described in NUREG-1801, Section XI.M21.

Exceptions to NUREG-1801

The CNP program includes the following exceptions to the program described in NUREG-1801, Section XI.M21.

Element Affected	Exception
3. Parameters Monitored/Inspected	The CNP parameters monitored and inspected are chemistry parameters only. [1, 2]
4. Detection of Aging Effects	The CNP program is a preventive program that claims no credit for the detection of aging effects through performance and functional testing. [3]
5. Monitoring and Trending	The CNP monitoring and trending address chemistry parameters only. [1, 2]

Element Affected	Exception
6. Acceptance Criteria	The CNP acceptance criteria consider chemistry parameters only. [1, 2]
	The nitrite corrosion inhibitor concentrations are maintained within limits that allow for larger variance than recommended in EPRI guidelines (250 ppm to 1200 ppm at CNP vs. EPRI variances of 500 ppm to 1000 ppm). The concentrations of other corrosion inhibitors, such as molybdate, are maintained within EPRI-specified concentration recommendations. [2]

1. While the EPRI guidance mentions that heat transfer testing can be used, it does not suggest monitoring pump performance parameters. The CNP program monitors the chemistry parameters recommended in EPRI guidelines.
2. Based on industry guidelines and CNP operating experience, there is reasonable assurance that monitoring these parameters will adequately manage aging effects on the closed cooling water systems.
3. Aging effects on passive mechanical components in closed cooling water systems are adequately managed without reliance on performance and functional testing.

Operating Experience

The CNP Closed Cooling Water Chemistry Control Program reflects chemistry practices based on extensive operating experience in the nuclear industry. The guidelines are updated, as appropriate, based on continuing operating experience.

An independent assessment of the component cooling water system chemistry in 1999 included a detailed review of the program chemical selection, control, monitoring, and record keeping; and provided an examination of the fidelity of the CNP processes with industry guidance documents. The independent review provided evaluations of plant-specific operating experience and recommendations based on that experience. Documentation of the chemical treatment processes was found to be exemplary, while the overall program was found to be comparable to industry best practice.

A review of representative condition reports relevant to the program found that the chemistry program monitors and corrects out-of-specification readings before they contribute to the aging of components.

Conclusion

The Closed Cooling Water Chemistry Control Program effectively manages aging effects. Continued implementation of this program provides reasonable assurance that the aging effects will be managed such that systems and components in the scope of the program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.40.3 Water Chemistry Control – Auxiliary Systems Water Chemistry Control

Program Description

The Auxiliary Systems Water Chemistry Control Program is an existing plant-specific program. There is no comparable NUREG-1801 program.

The purpose of the Auxiliary Systems Water Chemistry Control Program is to manage loss of material and fouling, as applicable, of components exposed to treated water environments.

Aging Management Program Elements

Scope

The Auxiliary Systems Water Chemistry Control Program, with respect to license renewal, is limited to sampling activities and analyses on the following systems:

- Demineralized water supply penetrations and nonsafety-related components affecting safety-related systems
- Control room ventilation liquid chiller components
- Glycol / ice condenser penetrations
- Glycol / ice condenser nonsafety-related components affecting safety-related systems
- Primary water supply to pressurizer relief tank penetrations
- Primary water system nonsafety-related components affecting safety-related systems
- Emergency diesel generator jacket cooling water
- Security diesel jacket cooling water

Preventive Actions

This program monitors and controls relevant conditions such as dissolved oxygen, conductivity, and corrosion inhibitor concentrations to manage loss of material and fouling, as applicable.

These corrosive contaminants are either removed, their concentrations minimized, or treatments are provided to limit their corrosive effects.

Parameters Monitored or Inspected

This program monitors specific parameters such as dissolved oxygen, conductivity, and corrosion inhibitor concentrations. Other typical parameters that are monitored include pH, iron, copper, hardness, and nitrite. The specific parameters monitored vary depending on the system.

Detection of Aging Effects

This is a mitigation program and does not provide for detection of aging effects, such as loss of material and cracking.

This program is credited with managing the following aging effects:

- Loss of material for the demineralized water, glycol/ice condenser, and primary water containment penetrations;
- Loss of material (including that due to selective leaching) and fouling in the EDG cooling water system;
- Loss of material (including that due to selective leaching) and fouling from the internal wetted surfaces of the control room ventilation liquid chiller components;
- Loss of material (including that due to selective leaching) for the security diesel engine cooling water;
- Loss of material (including that due to selective leaching) for the demineralized water, ice condenser, and primary water nonsafety-related components affecting safety-related systems.

Monitoring and Trending

This program is implemented through various plant procedures. The applicable procedure identifies the sampling schedule, the critical parameters, and the location of the sample points. Parameters are monitored and corrective actions are taken if the parameters are outside the acceptable range.

Acceptance Criteria

The acceptance criteria for this program are in site procedures and are established based on the sampled parameter, the sample location, and the plant operating conditions. These criteria have been established based on equipment specification requirements, EPRI guidelines, or CNP-specific experience.

Corrective Actions

When measured water chemistry parameters are outside the specified range, corrective actions are taken to bring the parameter back within the acceptable range within the time period specified in the procedure. Specific corrective actions will be implemented in accordance with the CNP Corrective Action Program.

Confirmation Process

The confirmation process is discussed in Section B.0.3.

Administrative Controls

Administrative controls are discussed in Section B.0.3.

Operating Experience

A review of representative condition reports relevant to the program found that the program identifies out-of-specification values and corrects them before they lead to equipment degradation. Examples of conditions that were identified and corrected include:

- Excessive sodium in the borated water inventories,
- Nitrites below the minimum limit for the diesel jacket cooling water, and
- Low pH in the alternate heating boiler.

Conclusion

The Auxiliary Systems Water Chemistry Control Program effectively manages loss of material for components exposed to treated water. Continued implementation of this program provides reasonable assurance that the effects of aging will be managed such that components within the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.1.41 Water Chemistry Control – Chemistry One-Time Inspection

Program Description

The Chemistry One-Time Inspection Program is a new program that I&M will implement and complete prior to the period of extended operation. The program will be comparable to the program described in NUREG-1801, Section XI.M32, One-Time Inspection. While the NUREG-1801 program encompasses a broader scope than the chemistry one-time inspections included in the CNP Chemistry One-Time Inspection Program, the CNP program will be consistent with the general program elements described in NUREG-1801.

The water chemistry programs are generally effective in removing impurities from intermediate and high-flow areas; however, they may not be as effective in low-flow areas. Accordingly, verification of the effectiveness of the chemistry control programs will be undertaken to ensure that aging effects are effectively managed during the period of extended operation.

Combinations of nondestructive examinations (including visual, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures that are consistent with the Section XI of the ASME B&PV Code and 10 CFR 50, Appendix B. Follow-up of unacceptable inspection findings may include expansion of the inspection sample size and locations.

NUREG-1801 Consistency

The CNP Chemistry One-Time Inspection Program will be consistent with the program described in NUREG-1801, Section XI.M32. While the NUREG-1801 program encompasses a broader scope than chemistry one-time inspections, the CNP Chemistry One-Time Inspection Program will be consistent with the general program elements described in the NUREG-1801 program.

Operating Experience

The Chemistry One-Time Inspection Program is a new program for which there is no CNP-specific operating experience. Industry and plant-specific operating experience will be considered in the development of this program, as appropriate.

Conclusion

Implementation of the Chemistry One-Time Inspection Program will provide reasonable assurance that the effects of aging will be managed such that components within the scope of this program will perform their intended functions consistent with the current licensing basis for the period of extended operation. The program will be implemented prior to the period of extended operation.

B.2 TLAA EVALUATION OF AGING MANAGEMENT PROGRAMS UNDER 10 CFR 54.21(C)(1)(III)

B.2.1 Environmental Qualification of Electric Components

Program Description

The Environmental Qualification of Electric Components Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section X.E1, Environmental Qualification (EQ) of Electric Components.

The CNP program manages component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished or replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered time-limited aging analyses (TLAAs) for license renewal.

NUREG-1801 Consistency

The CNP program is consistent with the program described in NUREG-1801, Section X.E1.

Operating Experience

The Environmental Qualification of Electric Components Program has been effective at managing aging effects. Operating experience has identified no aging effects that the program is intended to prevent. The program is continuing to be improved as a result of ongoing program assessments.

As stated in NUREG-1801, EQ programs include consideration of operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended functions during accident conditions after experiencing the effects of inservice aging.

Conclusion

The overall effectiveness of the Environmental Qualification of Electric Components Program is demonstrated by the excellent operating experience for systems and components in the program. The program has been subject to periodic internal and external assessments that facilitate continuous improvement. Continued implementation of this program provides reasonable assurance that components within the scope of the program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.2 Fatigue Monitoring

Program Description

The Fatigue Monitoring Program is an existing CNP program. It is comparable to the program described in NUREG-1801, Section X.M1, Metal Fatigue of Reactor Coolant Pressure Boundary.

In order to remain within fatigue usage design limits, the Fatigue Monitoring Program monitors and tracks the number of critical thermal and pressure transients for selected RCS components. The program maintains the basis for component analyses containing explicit thermal cycle count assumptions. Components managed by this program are those shown to be acceptable by analyses explicitly based on a limiting number of thermal or pressure fatigue transient cycles.

NUREG-1801 Consistency

With the inclusion of program enhancements, the CNP program will be consistent with, but include an exception to, the program described in NUREG-1801, Section X.M1.

Exceptions to NUREG-1801

The CNP program includes the following exception to the program described in NUREG-1801, Section X.M1:

Element Affected	Exception
4. Detection of Aging Effects	The CNP program does not provide for periodic update of the fatigue usage calculations. CNP initiates corrective actions when the accumulated cycle count reaches 80% of the design cycles. [1]

1. Updates of fatigue usage calculations are not necessary unless the number of accumulated fatigue cycles approaches the number of assumed design cycles. I&M initiates corrective actions when the accumulated cycle count reaches 80 percent of the number of assumed design cycles.

Enhancements

The following enhancements will be implemented prior to the period of extended operation.

Element Affected	Enhancement
7. Corrective Actions	I&M will perform one or more of the following prior to the period of extended operation for the pressurizer surge line: 1) Further refine the fatigue analysis to lower the pressurizer surge line cumulative usage factors to below 1.0; 2) Repair the affected locations; 3) Replace the affected locations; 4) Manage the effects of fatigue of the pressurizer surge line by an NRC-approved inspection program (e.g., periodic non-destructive examination of the affected locations at inspection intervals to be determined by a method accepted by the NRC). The inspections are expected to be capable of detecting cracking due to thermal fatigue prior to loss of function. Replacement or repair will then be implemented such that the intended function will be maintained for the period of extended operation. Inspection details such as scope, qualification, method, and frequency will be provided to the NRC prior to entering the period of extended operation; and/or 5) Review changes to ASME B&PV Code actions relating to environmental fatigue. Any refined analysis will use the methodology approved by the ASME Code Committee and NRC.

Operating Experience

A self-assessment of the Fatigue Monitoring Program in 1999 provided findings and recommendations that were addressed with condition reports. These condition reports led to enhancements of the implementing procedure, even though the procedure met the intent of the program requirements. A follow-up self-assessment was performed in 2002 to review the program improvements. This assessment concluded the program will adequately and accurately track design basis plant transients. This assessment also provided findings and recommendations that were addressed by corrective actions, which demonstrates that the program continues to be monitored and improved.

Thermal fatigue transients have been tracked since the initial hydrostatic tests and commercial operation of both CNP units. A review of the number of design transients documented to date was performed. Based on the rate of occurrence, the numbers of the various transients were projected to 60 years of operation. It was demonstrated that the numbers of design transients projected for the period of extended operation associated with license renewal are less than the numbers of transients considered in the CNP fatigue analyses.

Conclusion

The Fatigue Monitoring Program effectively maintains the validity of the fatigue design basis for RCS components designed to withstand the effects of cyclic loads due to RCS temperature and pressure changes. This program includes the effects of environmental conditions upon critical, fatigue-sensitive Class 1 components. With enhancements to be incorporated prior to the period of extended operation, continued implementation of the Fatigue Monitoring Program will provide reasonable assurance that RCS components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3 REFERENCES

B.3-1 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants."

B.3-2 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."

B.3-3 NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors," July 26, 1988.

B.3-4 NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," March 18, 2001.

B.3-5 NRC Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," August 9, 2002.

B.3-6 NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988.

B.3-7 NRC Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety-Related Equipment," August 8, 1988.

B.3-8 NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," July 18, 1989.

B.3-9 NRC Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," April 1, 1997.

B.3-10 NRC Regulatory Guide 1.160, *Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,* Revision 2, March 1997.

B.3-11 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, U.S. Nuclear Regulatory Commission, July 2001.

B.3-12 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, U.S. Nuclear Regulatory Commission, July 2001.

B.3-13 NUREG-1743, *Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 1*, U.S. Nuclear Regulatory Commission, April 2001.

B.3-14 NUMARC 93-01, Nuclear Energy Institute, *Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, Revision 2, April 1996.

B.3-15 NEI 97-06, *Steam Generator Program Guidelines*, Revision 1, January 2001

B.3-16 NFPA 25, *Inspection, Testing, & Maintenance of Water-Based Fire Protection Systems*, National Fire Protection Association, 2002 Edition.

B.3-17 WCAP-12866, “Bottom Mounted Instrumentation Flux Thimble Wear,” January 1991.

B.3-18 WCAP-14574-A, “License Renewal Evaluation: Aging Management Evaluation for Pressurizers,” December 2000.

B.3-19 Meeting summary with NEI, “Summary of Meeting with the Nuclear Energy Institute (NEI) on: (1) NEI’s Proposed Revision to Generic Aging Lessons Learned (GALL) Aging Management Program (AMP) XI.E2 for Non-Environmental Qualification Cables and (2) Interim Staff Guidance (ISG) of Fuse Holders,” April 7, 2003 (ML030970594).

B.3-20 Donald C. Cook Nuclear Plant Quality Assurance Program Description, Revision 17, January 13, 2003.

APPENDIX C - COMMODITY GROUPS

Appendix C is not used in this application.

APPENDIX D - TECHNICAL SPECIFICATION CHANGES

10 CFR 54.22 requires that an application for license renewal include any technical specification changes or additions necessary to manage the effects of aging during the period of extended operation. A review of the information in this License Renewal Application and the Donald C. Cook Nuclear Plant Technical Specifications determined that no changes to the Technical Specifications are required.