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APPENDIX 19A

LICENSE RENEWAL COMMITMENTS

19A.0 INTRODUCTION

This appendix provides the information in support of the STP Renewed License received September 28, 2017. (Ref. AE-NOC-18003178). Section 19A.1 of this appendix contains summary descriptions of the programs used to manage the effects of aging during the period of extended operation. Section 19A.2 contains summary descriptions of programs used for management of time-limited aging analyses during the period of extended operation. Section 19A.3 contains evaluation summaries of time-limited aging analyses (TLAAs) for the period of extended operation. Section 19A.4 contains a summary descriptions of license renewal commitments. Included in Section 19A.4, Table 19A.4-1, “License Renewal Commitments,” are commitments for license renewal and an associated schedule for completion of the commitments. Unless noted otherwise, the following implementation schedule will apply for new programs, enhanced programs, and specific activities to be completed prior to the period of extended operation (PEO).

a. Implement new programs and enhancements to existing programs no later than 6 months prior to PEO.

b. Complete inspection and testing activities by the 6-month date prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

c. Notify the NRC in writing within 30 days after having accomplished item (a) above and include the status of those activities that have been or remain to be completed in item (b) above.

19A.1 SUMMARY DESCRIPTIONS OF AGING MANAGEMENT PROGRAMS

The integrated plant assessment and evaluation of time-limited aging analyses (TLAA) identified existing and new aging management programs necessary to provide reasonable assurance that 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. Sections 19A.1 and 19A.2 describe the programs and their implementation activities.

Three elements common to all aging management programs discussed in Sections 19A.1 and 19A.2 are corrective actions, confirmation process, and administrative controls. The STP Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and non-safety-related systems, structures, and components that are subject to aging management activities.

Operating experience from plant specific and industry sources is captured and systematically reviewed on an ongoing basis in accordance with the quality assurance program, which meets the requirements of 10 CFR Part 50, Appendix B, and the operating experience program, which meets the requirements of NUREG-0737, “Clarification of TMI Action Plan Requirements,” Item I.C.5, “Procedures for Feedback of Operating Experience to Plant Staff.” The operating experience program interfaces with and relies on active participation in the Institute of Nuclear Power Operations' operating experience program, as endorsed by the NRC. In accordance with these programs, all incoming operating experience items are screened to determine whether they may involve age-related degradation or aging management impacts. Items so identified are further evaluated and the aging management programs (AMP) are either enhanced or new AMPs are developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed. Training on age-related degradation and aging management is provided to those personnel responsible for implementing the AMPs and who may submit, screen, assign, evaluate, or otherwise process plant-specific and industry operating experience. Plant-specific operating experience associated with aging management and age-related degradation is reported to the industry in accordance with guidelines established in the operating experience program.

Results of inspections, tests, analyses, etc. conducted through the implementation of aging management programs are considered as operating experience on an ongoing basis. When applicable acceptance criteria are met, results are retained for future use and evaluation to determine whether it is necessary to adjust the frequency for future inspections, establish new inspections, and ensure an adequate depth and breadth of component, material, environment, and aging effect combinations. When applicable acceptance criteria are not met, corrective actions are initiated in accordance with the quality assurance program.

A systematic review of operating experience related to aging management ensures that license renewal aging management programs are effective in managing the aging effects for which they are credited. Processes gather information on license renewal structures and components identified in the integrated plant assessment, and their materials, environments, aging effects, and aging mechanisms. Programs and procedures specify reviews of sources of information related to aging effects. Formal evaluations related to aging effects are completed and prioritized commensurate with the potential significance on the issue. The evaluations are documented and retained in an auditable and retrievable form. Enhancements to programs and procedures to adequately manage the effects of aging are entered into and implemented consistent with the plant corrective action program. Aging management programs are administratively controlled to include a formal review and approval process and periodic audits.

The required training on age-related operating experience for individuals who screen, assign, evaluate, implement, and submit plant-specific and industry operating experience for age-related effects, including AMP owners, are determined by a training "needs analysis" – see the description of program enhancements below. Training records are maintained for auditable purposes. Training requirements on age-related operating experience are maintained in appropriate plant procedures.

The following enhancements will be made to the STP Operating Experience Program and Corrective Action Program for managing the effects of aging.

- The OEP procedure will be revised to add License Renewal Interim Staff Guidance and revisions to NUREG-1801, "Generic Aging Lessons Learned (GALL) Report", as source documents applicable for review.

- The OEP procedure will be revised to include "aging effects" to the list of characteristics for determining applicability of an OE document that may require further evaluation. A screened-in evaluation should consider (a) systems, structures, or components, (b) materials, (c) environments, (d) aging effects, (e) aging mechanisms, and (f) aging management programs.

- Corrective Action Program Event Codes will be reviewed to determine if additional codes are needed to ensure age-related degradation effects are identified.

- A training "needs analysis" will be performed for those plant personnel, including aging management program owners, who screen, assign, evaluate, implement, and submit plant-specific and industry operating experience information for age-related effects. The analysis will include:

  - A requirement that individuals complete training before performing tasks, and
  - A determination of the periodicity of the training.

- The OEP procedure will be revised to provide criteria for reporting plant-specific operating experience on age-related degradation.

19A.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program manages cracking, loss of fracture toughness, and loss of material in Class 1, 2, and 3 piping and components within the scope of license renewal. The program includes periodic visual, surface, volumetric examinations and leakage tests of Class 1, 2 and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting. STP inspections meet ASME Section XI requirements. STP will use the ASME Code Edition consistent with the provisions of 10 CFR 50.55a during the period of extended operation.

19A.1.2 WATER CHEMISTRY

The Water Chemistry program manages loss of material, cracking, reduction of heat transfer, and wall thinning in primary and secondary water systems. The program is a mitigation program that consists of a primary water chemistry program and a secondary water chemistry program. The program relies on monitoring and control of primary and secondary water chemistry to mitigate damage caused by loss of material and cracking. The Water Chemistry program does not provide for the detection of aging effects. The Water Chemistry program is based upon the latest EPRI PWR Primary Water Chemistry Guidelines and EPRI PWR Secondary Water Chemistry Guidelines.

The One-Time Inspection program (19A.1.16) verifies the effectiveness of the Water Chemistry program.

19A.1.3 REACTOR HEAD CLOSURE STUDS

The Reactor Head Closure Studs program manages cracking and loss of material by conducting ASME Section XI inspections of reactor vessel flange stud hole threads, reactor head closure studs, nuts, washers, and bushings. The program includes periodic visual, surface, and volumetric examinations of reactor vessel flange stud hole threads, reactor head closure studs, nuts, washers, and bushings and performs visual inspections of the reactor vessel flange closure during primary system leakage tests. The program implements recommendations in NUREG-1339 and NRC Regulatory Guide 1.65 to address reactor head stud bolting degradation except for yield strength of existing bolting materials. The program implements ASME Section XI code, Subsection IWB, and detects reactor vessel stud, nut, washer, and bushing cracking, loss of material due to wear and corrosion, and reactor coolant leakage from the reactor vessel flange. STP will use the ASME Code edition consistent with the provisions of 10 CFR 50.55a during the period of extended operation.

19A.1.4 BORIC ACID CORROSION

The Boric Acid Corrosion program manages loss of material due to boric acid leakage. The program includes provisions to identify, inspect, examine and evaluate leakage, and initiate corrective actions. Long-term corrective actions to control boric acid leakage, to impede boric acid leakage, to impede boric acid attack, and to prevent recurrence of previous problems include operating changes and design changes such as the use of suitable materials, protective coatings and cladding. Any increases of RCS leakage during RCS leakage surveillances require the investigation of potential RCS leakage sources. The principal industry guidance document used is WCAP-15988-NP, Generic Guidance for an effective Boric Acid Inspection Program for Pressurized Water Reactors. The program relies in part on implementation of recommendations of NRC Generic Letter 88-05, Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants. Additionally, the program includes examinations conducted during ISI pressure tests performed in accordance with ASME Section XI requirements. The Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors program (19A.1.5) and the Nickel-Alloy Aging Management program (19A.1.34), as well as the Boric Acid Corrosion control program, implement inspections of reactor coolant pressure boundary components to identify degradation.

19A.1.5 NICKEL-ALLOY PENETRATION NOZZLES WELDED TO THE UPPER REACTOR VESSEL CLOSURE HEADS OF PRESSURIZED WATER REACTORS

The Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors program manages cracking due to primary water stress corrosion in nickel-alloy vessel head penetration nozzles and associated welds as well as loss of material in the reactor vessel closure head. This program was developed in response to NRC Order EA-03-009. ASME Code Case N-729-1, subject to the conditions specified in 10 CFR 50.55a(g)(6)(ii), has superseded NRC Order EA-03-009.

Detection of leaking is accomplished through bare metal visual examinations (external surface of head). Detection of cracking is accomplished through surface and volumetric examination (underside of head) techniques.

The Unit 1 RPV head was replaced during 1RE15 (October 2009). The Unit 2 RPV head was replaced during 2RE14 (April 2010). Components penetrating the new reactor vessel closure heads and components welded to the inner surfaces of the reactor vessel closure heads are fabricated and welded using PWSCC resistant materials.

19A.1.6 FLOW-ACCELERATED CORROSION

The Flow-Accelerated Corrosion (FAC) program manages wall thinning due to flow-accelerated corrosion on the internal surfaces of carbon or low alloy steel piping and system components which contain high energy fluids (both single phase and two phase). The FAC program also manages wall thinning due to other causes, such as erosion/corrosion, cavitation, flashing, and impingement damage.

The objectives of the FAC program are achieved by:

(a) identifying system components susceptible to wall thinning due to FAC or causes such as erosion/corrosion, cavitation, flashing, and impingement damage,

(b) performing an analysis using a predictive code such as CHECWORKS to determine critical locations for inspection and evaluation of components that can be modeled,

(c) using operating experience and engineering evaluation to determine inspection locations for components which cannot be modeled by the predictive code, including components susceptible to wall thinning due to causes such as erosion/corrosion, cavitation, flashing, and impingement damage;

(d) providing guidance for follow-up inspections,

(e) repairing or replacing components, as determined by the guidance provided by the program, and

(f) continual evaluation and incorporation of the latest technologies, industry and plant in-house operating experience.

Procedures and methods used by the FAC program are consistent with STP commitments to NRC Bulletin 87-01, Thinning of Pipe Wall in Nuclear Power Plants, and NRC Generic Letter 89-08, Erosion/Corrosion-Induced Pipe Wall Thinning. The program relies on implementation of the EPRI guidelines of NSAC-202L, Recommendations for an Effective Flow Accelerated Corrosion Program.

19A.1.7 BOLTING INTEGRITY

The Bolting Integrity program manages cracking, loss of material, and loss of preload for pressure retaining bolting and ASME component support bolting. The program includes preload control, selection of bolting material, use of lubricants/sealants consistent with EPRI NP-5067, Good Bolting Practices, and performance of periodic inspections for indication of aging effects. The program also includes inservice inspection requirements established in accordance with ASME Section XI, Subsections IWB, IWC, IWD, and IWF for ASME Class bolting. All ASME pressure boundary bolted connections where the internal environment consists of dry gas or compressed air will be leak checked using a method that detects leakage. Bolted connections where the internal environment consists of air at atmospheric pressure, connections will be checked for tightness.

STP good bolting practices are established in accordance with plant procedures. These procedures include requirements for proper disassembling, inspecting, and assembling of connections with threaded fasteners. In addition to the inspection activities noted above, the Bolting Integrity program includes activities for preload control, material selection and control, and use of lubricants/sealants. The general practices that are established in this program are consistent with EPRI TR-104213, Bolted Joint Maintenance and Applications Guide, EPRI NP-5769, Degradation and Failure of Bolting in Nuclear Power Plants, Volume 1 and 2, and the recommendations delineated in NUREG-1339.

The Essential Cooling Water (ECW) Pump column closure bolts, submerged in raw water, are managed for loss of preload using good bolting practices in accordance with plant procedures. The ECW pump column closure bolts are inspected during ECW pump refurbishment nominally every 10 years. The ECW pumps are performance tested quarterly, pump parameters such as pressure and flow are trended to identify any potential leakage before the leakage could affect the ECW system from performing its intended functions.

19A.1.8 STEAM GENERATOR TUBE INTEGRITY

The Steam Generator Tube Integrity program is applicable to managing the aging of steam generator tubes, plugs, sleeves, divider plate assemblies, tube-to-tubesheet welds, primary head (interior surfaces), tubesheet(s) (primary side), and secondary side components that are contained within the steam generator. The program also manages the wall thinning of the following component types: upper steam drum internals, moisture separators, feedwater rings, and AFW spray pipes.

The program ensures the integrity of the primary to secondary pressure boundary through preventive measures, inspections, degradation assessments, condition monitoring, operational assessments, tube plugging, and leakage monitoring activities necessary to manage potential steam generator tube degradation, including mechanically induced phenomena, such as wear and impingement damage.

The aging management measures employed includes nondestructive examinations, visual inspection, sludge removal, tube plugging, in-situ pressure testing and maintaining the chemistry environment by removal of impurities and addition of chemicals to control pH and oxygen. NDE inspection and primary to secondary leak rate monitoring are conducted consistent with the requirements of STP Units 1 and 2 Technical Specifications, NEI 97-06, *Steam Generator Program Guidelines* and the latest (i.e. implemented within the approved implementation period) EPRI Steam Generator Integrity Assessment Guidelines, EPRI PWR Primary-to-Secondary Leak Guidelines, EPRI Steam Generator In-Situ Pressure Test Guidelines, and EPRI PWR Steam Generator Examination Guidelines.

Performance criteria are maintained for operational leakage, accident induced leakage and structural integrity as prescribed in the Technical Specifications. Tube structural integrity limits consistent with Regulatory Guide 1.121 are applied.

Visual inspection are performed of the divider plates assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) for signs of cracking and loss of material are performed at least every 72 effective full power months or every third refueling outage, whichever results in more frequent inspections.

19A.1.9 OPEN-CYCLE COOLING WATER SYSTEM

The Open-Cycle Cooling Water System program manages loss of material and reduction of heat transfer for components within the scope of license renewal and exposed to the raw water of the essential cooling water system. Included are components of the essential cooling water (ECW) system that are within the scope of license renewal, the component cooling water heat exchangers and the other safety related heat exchangers cooled by the essential cooling water system. The program includes chemical treatment and control of biofouling, periodic inspections, flushes and physical and chemical cleaning, and heat exchanger performance testing/ inspections to ensure that the effects of aging will be managed during the period of extended operation. The program also includes inspections of a sample of ECW piping for wall thickness prior to the period of extended operation. Subsequent inspections will be scheduled based on the results of the initial inspections. The plant specific configuration of the aluminum-bronze piping inserted inside the slip-on flange downstream of the Component Cooling Water (CCW) heat exchanger is inspected at a nominal 216 week interval. An engineering evaluation is performed after each inspection. Corrective action in accordance with the corrective action program will be initiated if the calculated wear over the next inspection interval indicates that the aluminum-bronze piping wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate). The program is consistent with STP commitments as established in responses to NRC Generic Letter 89-13, Service Water System Problems Affecting Safety-Related Components.

100 percent of internal coating installed on the essential chiller water box covers, standby diesel generator (SDG) jacket water coolers, SDG lube oil coolers, SDG intercooler water boxes and interconnection piping are inspected and tested to assure coating integrity. The coatings are inspected every six years, and tested after 12 years of service at a six year frequency. The coating tests performed are low voltage holiday test, dry film thickness test and pull off adhesion test. Coating inspections and tests are performed by a qualified Nuclear Coating Specialist (NCS) as defined by ASTM D7108 endorsed in RG 1.54. Coatings not meeting the acceptance criteria are considered degraded, removed to sound material and replaced with new coating. Physical testing is performed where physically possible in conjunction with repair or replacement of coatings. Monitoring and trending of coatings is based on a pre-inspection review of the previous inspections results including any subsequent replacement activities.
(Note: the following train/trains of SDG intercooler's interconnection piping changed material to AL-6XN Stainless Steel UNS N08367 without internal coating and is/are excluded from internal coating inspection scope: 1B, 2A)

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19A.1.10 CLOSED-CYCLE COOLING WATER SYSTEM

The Closed-Cycle Cooling Water (CCCW) System program manages loss of material, cracking, and reduction in heat transfer for components within the scope of license renewal in closed-cycle cooling water systems. The program includes (1) preventive measures to minimize corrosion including maintenance of corrosion inhibitor and biocide concentrations, and (2) periodic system and component testing and inspection. Preventive measures include the monitoring and control of chemistry parameters following the guidance of the latest revision of the EPRI Closed Cooling Water Chemistry Guideline. Periodic inspection and testing to minimize aging and evaluate system and component performance are performed in accordance with EPRI Closed Cooling Water Chemistry Guideline and industry and plant operating experience.

19A.1.11 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program manages loss of material for all cranes, trolley and hoist structural components, fuel handling equipment and applicable rails within the scope of license renewal. Program inspection activities verify the structural integrity of the components required to maintain their intended function. The inspection requirements are consistent with the guidance provided NUREG-0612, Control of Heavy Loads at Nuclear Power Plants, for load handling systems that handle heavy loads which can directly or indirectly cause a release of radioactive material, applicable industry standards (such as CMAA Spec 70) for other components within the scope of license renewal in the program, and applicable OSHA regulations (such as 29 CFR Volume XVII, Part 1910 and Section 1910.179).

19A.1.12 FIRE PROTECTION

The Fire Protection program manages loss of material of fire rated doors, fire dampers and the Halon fire suppression system, concrete cracking, spalling, and loss of material of fire barrier walls, ceilings and floors and increased hardness, shrinkage, and loss of strength of fire barrier penetration seals. The Fire Protection program is a condition and performance monitoring program comprised of tests and inspections that follow the applicable National Fire Protection Association (NFPA) recommendations.

Periodic visual inspections are performed on fire barrier penetration seals, fire dampers, fire barrier walls, ceilings and floors, including coating and wraps (raceway fire wrap and hatch covers). Visual inspections and functional tests are performed on fire-rated doors to verify the integrity of door surfaces and to check clearances. Visual inspections are performed to identify conditions of corrosion and mechanical damage in the Halon flow path. The Halon fire suppression system is functionally tested on a periodic basis.

19A.1.13 FIRE WATER SYSTEM

The Fire Water System program manages loss of material, fouling, flow blockage and loss of coating integrity for water-based fire protection systems consisting of piping, fittings, valves, sprinklers, nozzles, hydrants, hose stations, standpipes and fire water storage tanks. The internal surfaces of water-based fire protection system piping that is normally drained, such as dry-pipe sprinkler system piping, are included within the scope of the program. Periodic inspections, testing, and cleaning are performed on the following.

- Sprinkler inspections every 24 months per NFPA 25, 2011 Edition Section 5.2.1.1
- 50-year sprinkler replacement or testing per NFPA 25, 2011 Edition Section 5.3.1
- Standpipe and hose systems flow tests every 5 years on hose stations located below the level of the fire main, located nearest to where the fire main enters the building or in buildings with multiple fire main supplies would require multiple lowest level hose stations to be tested.
- Underground and exposed piping flow tests every 5 years per NFPA 25, 2011 Edition Section 7.3.1
- Hydrants flow testing and visually inspection annually per NFPA 25, 2011 Edition Section 7.3.2
- Fire pumps suction screens cleaning and inspections per NFPA 25, 2011 Edition Section 8.3.3.7
- Fire water storage tank exterior inspections annually per NFPA 25, 2011 Edition Section 9.2.5.5
- Fire water storage tank coated interior surfaces are inspected every 5 years per NFPA 25, 2011 Edition Sections 9.2.6. Testing is performed in accordance with NFPA 25,

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2011 Edition Section 9.2.7 whenever there is evidence of pitting and corrosion below nominal wall depth or failure of tanks coatings. Additionally, bottom thickness ultrasonic tests are done at least once every 10 years.

- Main drain testing every 18 months per NFPA 25, 2011 Edition Section 13.2.5
- Deluge Valve testing every 24 months per NFPA 25, 2011 Edition Sections 13.4.3.2.2 through 13.4.3.2.5 | CN-3294
- Water Spray Fixed System strainers cleaning and inspections per NFPA 25, 2011 Edition Section 10.2.1.6, 10.2.1.7, 10.2.7
- Spray/sprinkler nozzles full flow test every 18 months per NFPA 25, 2011 Edition Section 10.3.4.3
- Foam water sprinkler systems spray nozzle strainers per NFPA 25, 2011 Edition Section 11.2.7.1
- Foam water sprinkler systems operational test discharge patterns annually per NFPA 25, 2011 Edition Section 11.3.2.6
- Foam water sprinkler systems storage tank visual inspection for internal corrosion once every 10 years
- Internal surface of piping and branch lines obstruction inspections every 5 years per NFPA 25, 2011 Edition Sections 14.2 and 14.3

The fire water system pressure is continuously monitored such that loss of system pressure is immediately detected and corrective actions are initiated.

Internal and external visual inspections are performed on accessible exposed portions of fire water piping during plant maintenance activities. The inspections detect loss of material due to corrosion, ensure that aging effects are managed, and detect surface irregularities that could indicate wall loss below nominal pipe wall thickness. When surface irregularities are detected, follow-up volumetric wall thickness examinations are performed.

Augmented inspections are performed on the portions of water-based fire protection components that have been wetted but are normally dry or piping segments that cannot be drained or segments that allow water to collect. The augmented inspections are either flow tested or flushed sufficient to detect flow blockage or 100 percent visually inspected in each 5-year interval, beginning 5 years prior to the period of extended operation.

Augmented volumetric wall thickness inspections are performed on 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect in each 5-year interval of the prior to the period of extended operation. The 20 percent of piping inspected in each 5-year interval shall be in different location than previously inspected piping.

100 percent of the coatings installed on the internals of in-scope fire water components are inspected and tested to assure coating integrity. The coatings are inspected every six years, and tested after 12 years of service at a six-year frequency. The coating tests performed are low voltage holiday test, dry film thickness test and pull off adhesion test. Coatings not meeting the acceptance criteria are considered degraded, removed to sound material and replaced with new coating. Physical testing

where physically possible is performed in conjunction with replacement of coatings. Replaced coatings are inspected every four years until there are three consecutive inspections with no change in the coating condition. Following three consecutive inspections with no change in the coating condition the 6 year inspection interval can be restored. Coating inspections and tests will be performed by a qualified Nuclear Coating Specialist (NCS) as defined by ASTM D7108 endorsed in RG 1.54. Monitoring and trending of coatings is based on a pre-inspection review of the previous inspections results including any subsequent replacement activities.

19A.1.14 FUEL OIL CHEMISTRY

The Fuel Oil Chemistry program manages loss of material on the internal surface of components in the standby diesel generator (SDG) fuel oil storage and transfer system, diesel fire pump fuel oil system, lighting diesel generator system, and balance of plant (BOP) fuel oil system. The program includes (a) surveillance and monitoring procedures for maintaining fuel oil quality by controlling contaminants in accordance with the Technical Specifications and ASTM Standards D1796 or D4176, D6217 or D7321, and sampled in accordance with D4057, (b) periodic draining of water from fuel oil tanks, (c) visual inspection of internal surfaces during periodic draining and cleaning, (d) ultrasonic wall thickness measurement or pulsed eddy current wall thickness measurement of fuel oil tank bottoms during periodic draining and cleaning, and (e) inspections of new fuel oil before it is introduced into the fuel oil tanks. Specifically addressing the Standby Diesel Generator, only the safety related fuel oil storage and transfer system will be included in the one-time inspections, i.e. the SDG FOST tanks and associated safety related piping.

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The effectiveness of the program is verified under the One-Time Inspection program (9.1.16).

19A.1.15 REACTOR VESSEL SURVEILLANCE

The Reactor Vessel Surveillance program manages loss of fracture toughness of the reactor vessel beltline material. The Reactor Vessel Surveillance program for STP is designed to ASTM E 185 and complies with 10 CFR 50 Appendix H. Actual reactor vessel coupons are used. The surveillance coupons are tested by a qualified offsite vendor, to its procedures. The testing program and reporting conform to the requirements of ASTM E 185-82.
The removal schedule of the surveillance coupons will yield data with exposures greater than that expected in 60 years of operation. This withdraw schedule therefore meets the ASTM E 185-82 criterion which states that capsules may be removed when the capsule neuron fluence is between one and two times the limiting fluence calculated for the vessel at the end of expected life.

Vessel fluence for both units will be determined by ex-vessel dosimetry after the capsules with a fluence greater than 60 years have been removed.

19A.1.16 ONE-TIME INSPECTION

The One-Time Inspection program conducts one-time inspections of plant system piping and components to verify the effectiveness of the Water Chemistry program (19A.1.2), Fuel Oil Chemistry program (19A.1.14), and Lubricating Oil Analysis program (19A.1.23). The aging effects to be evaluated by the One-Time Inspection program are loss of material, cracking, and reduction of heat transfer. The One-Time Inspection program determines non-destructive examination (NDE) sample sizes based on the population of components in a group sharing the same material,

environment and aging effects. For each population, a representative sample size of 20 percent of the population is selected up to a maximum of 25 components. The components making up the sample are those determined to be most susceptible to degradation based on a review of environment, condition and operating experience. The sample population includes eddy current testing of the tubes in one non-regenerative heat exchanger. The program will focus on bounding or lead components most susceptible to aging due to time in service, and severity of operating conditions. Inspections will be performed using a variety of NDE methods, including visual, volumetric, and surface techniques by qualified inspectors. The program will not be used for component inspections with known age-related degradation mechanisms, or when the environment in the period of extended operation is not equivalent to that in the prior 40 years. The One-Time Inspection program specifies corrective actions if aging effects are found. The corrective action program may specify follow-up inspections for confirmation of aging effects at the same or different locations. If aging effects are detected, a plant-specific program will be developed for the material, environment, and aging effect combination that has produced the aging effects.
This new program will be implemented and completed within the 10 year period prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

19A.1.17 SELECTIVE LEACHING OF MATERIALS

The Selective Leaching of Materials program manages loss of material due to selective leaching for copper alloys with greater than 15 percent zinc and gray cast iron components exposed to treated water, raw water, and groundwater (buried) within the scope of license renewal.

The Selective Leaching of Materials program will be implemented during the five years prior to the period of extended operation. The procedure will include a one-time inspection of a sample of components made from gray cast iron and copper alloys with greater than 15 percent zinc. This procedure will provide for visual and mechanical inspections for each system/material/environment combination, with exception of buried fire water piping. An engineering evaluation is performed if graphitization of gray cast iron or dezincification of copper alloy with greater than 15 percent zinc components is detected.

19A.1.18 BURIED PIPING AND TANKS INSPECTION

The Buried Piping and Tanks Inspection program manages the loss of material on external surfaces of buried and underground components. Preventive and mitigative measures, including verification of coatings quality, backfill requirements, and cathodic protection, are employed to manage aging of buried components. Underground components are protectively coated where required.

The cathodic protection system is operated consistent with the guidance of NACE SP0169-2007 for piping and is monitored to ensure that protection is being provided. The cathodic protection system is operational (available) at least 85 percent of the time and provides effective protection for buried piping as evidenced by meeting the acceptance criteria at least 80 percent of the time since either 10 years prior to the period of extended operation or since installation or refurbishment, whichever is shorter. An annual cathodic protection survey is performed consistent with NACE SP0169-2007. If the cathodic protection system fails to meet the acceptance criteria of -850 mV relative to copper/copper sulfate reference electrode (CSE) instant off for steel components alternatives of -750 mV or -650 mV may be used, means to verify the effectiveness of the protection are used, loss of material rates are measured and soil testing will be conducted at a minimum of once in each 10-year period starting 10 years prior to the period of extended operation. The acceptance criterion for copper components is 100 mV minimum polarization.

Opportunistic and directed visual inspections will monitor the condition of external surfaces, protective coatings and wrappings found on steel, stainless steel and copper alloy components. The number of inspections is based on the effectiveness of the preventive and mitigative actions. Any evidence of damaged wrapping or coating defects will be an indicator of possible corrosion damage to the external surface of the components. Inspections are conducted by qualified individuals.

Where the coatings, backfill or the condition of exposed piping does not meet acceptance criteria such that the depth or extent of degradation of the base metal could have resulted in a loss of pressure boundary function when the loss of material rate is extrapolated to the next inspection for that pipe section or to the end of the period of extended operation, an increase in the sample size is conducted.

Where coatings, backfill, or the condition of exposed piping that does not meet acceptance criteria, the degraded condition is repaired or the affected component is replaced. In addition, an expansion of sample size is conducted.

Hydrostatic tests of 25 percent of the subject piping will be performed on an interval not to exceed 5 years, or an internal inspection of 25 percent of the subject piping by a method capable of accurately determining pipe wall thickness every 10 years may be performed as an alternate to directed inspections. Flow testing of the fire mains as described in Section 7.3 of NFPA 25, 2011 Edition is credited in lieu of visual inspections.

19A.1.19 ONE-TIME INSPECTION OF ASME CODE CLASS 1 SMALL-BORE PIPING

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping program manages cracking of ASME Code Class 1 piping less than or equal to four inches nominal pipe size (NPS 4). This program is implemented as part of the fourth interval of the STP Inservice Inspection (ISI) program.

For ASME Code Class 1 small-bore piping, the ISI program requires volumetric examinations on selected butt weld locations to detect cracking. Weld locations are selected based on the guidelines provided In EPRI TR-112657, *Revised Risk-Informed Inservice Inspection Evaluation Procedure*. Volumetric examinations of butt welds are conducted in accordance with ASME Section XI with acceptance criteria from Paragraph IWB-3000 and IWB-2430. Unit 1 has 182 Class 1 small-bore butt welds and 49 Class 1 small-bore socket welds. The inspection sample for the Unit 1 Class 1 small-bore butt welds is 19 and the inspection sample for the Unit 1 Class 1 small-bore socket welds is 5, which is 10 percent of each population. In Unit 2, there are 190 Class 1 small-bore butt welds and 59 Class 1 small-bore socket welds. The inspection sample size for the Unit 2 Class 1 small-bore butt welds is 19 and the inspection sample size for Unit 2 Class 1 small-bore socket welds is 6, which is 10 percent for each population.

Socket welds that fall within the weld examination sample will be examined following ASME Section XI Code requirements. If a qualified volumetric examination procedure for socket welds endorsed by the industry and the NRC is available and incorporated into the ASME Section XI Code at the time of STP small-bore socket weld inspections, then this will be used for the volumetric examinations. If no volumetric examination procedure for ASME Code Class 1 small bore socket welds has been endorsed by the industry and the NRC and incorporated into ASME Section XI at the time STP performs inspections of small-bore piping, a plant procedure for volumetric examination of ASME Code Class 1 small-bore piping with socket welds will be used.

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping program is a new program and inspections will be completed and evaluated within six years prior to the period of extended operation.

Should evidence of cracking be revealed by the One-Time Inspection of ASME Code Class 1 Small-Bore Piping program, periodic inspection will be proposed, as managed by a plant-specific aging management program.

19A.1.20 EXTERNAL SURFACES MONITORING PROGRAM

The External Surfaces Monitoring program manages loss of material for external surfaces of steel, stainless steel, aluminum, copper alloy components and elastomers, including protective paints, coatings, caulking, sealants, , and insulation for reduced thermal insulation resistance. The program also manages loss of preload for non-ASME pressure boundary bolting, hardening and loss of strength for elastomers and cracking of stainless steel. The program includes those systems and components within the scope of license renewal that require external surface monitoring. Visual inspections of external surfaces conducted during engineering walkdowns will be used to identify aging effects and leakage. . All non-ASME pressure boundary bolted connections where the internal environment consists of dry gas, compressed air or diesel exhaust will be leak checked using a method that detects leakage. Bolted connections where the internal environment consists of air at atmospheric pressure, connections will be checked for tightness. When appropriate for the component configuration and material, physical manipulation of at least 10 percent of the available surface area will be used to augment visual inspection to confirm the absence of elastomer hardening and loss of strength.

Visual inspections are conducted on insulation jacketing, outdoor insulated components, and indoor insulated components exposed to condensation. A minimum of 20 percent of the in scope piping length or 20 percent of the surface area whose configuration does not conform to a 1-foot axial length determination is inspected every 10 years during the period of extended operation after the insulation is removed. As an alternate any combination of a minimum 25 1-foot axial length sections and components are inspected for each material type. For each insulated tank, the exterior surface is inspected after the removal of insulation from 25 1- square-foot sections or 20 percent of the surface area.

Where inspection determine that there is no loss of material or evidence of stress corrosion cracking (SCC), subsequent inspection may consists of visual inspection of the exterior surface of the insulation jacketing material or protective outer layer for evidence of damage that could allow in-leakage of moisture. If insulation jacket or protective outer layer damage is observed, the insulation will be removed for inspection of the component exterior surface. Removal of tightly adhering insulation that is impermeable to moisture is not required unless there is evidence of damage.

Periodic monitoring of the stainless steel external surfaces of Refueling Water Storage Tanks will include visual inspection for leakage to detect cracks. Loss of material for external surfaces is managed by the Boric Acid Corrosion program (19A.1.4) for components in a system with treated borated water or reactor coolant environment on which boric acid corrosion may occur, Buried Piping and Tanks Inspection program (19A.1.18) for buried components, Fire Water System Program (19A.1.13) for components in the fire protection system, and Structures Monitoring Program (19A.1.32) for civil structures, and other structural items which support and contain mechanical and electrical components.

The External Surfaces Monitoring program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

19A.1.21 FLUX THIMBLE TUBE INSPECTION

The Flux Thimble Tube Inspection program manages loss of material by performing wall thickness eddy current inspection of all flux thimble tubes that form part of the reactor coolant system pressure boundary. The pressure boundary includes the length of the tube inside the reactor vessel out to the seal fittings outside the reactor vessel. Eddy current inspection is performed on the portion of the tubes inside the reactor vessel. The program implements the recommendations of NRC Bulletin 88-09, Thimble Tube Thinning in Westinghouse Reactors.

The flux thimble tubes are currently scheduled to be inspected each refueling outage. The inspection may be deferred by using an evaluation that considers the actual wear rate. Wall thickness measurements are trended and wear rates are calculated. If the current measured wear exceeds the acceptance criteria or if the predicted wear (as a measure of percent through wall) for a given flux thimble tube is projected to exceed the established acceptance criteria prior to the next refueling outage, corrective actions are taken to reposition, cap or replace the tube. The inspection frequency may be revised as appropriate based upon items such as operating experience and recommendations from the PWR Owner's Group.

19A.1.22 INSPECTION OF INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program manages cracking, loss of material, and hardening and loss of strength of the internal surfaces of piping, piping components, ducting, tanks, and other components that are not inspected by other aging management programs.

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new program that uses the work control process for preventive maintenance and surveillance to conduct and document inspections. The program performs visual inspections to detect aging effects that could result in a loss of component intended function. Visual inspections of internal surfaces of plant components are performed by qualified personnel during the conduct of periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance. Opportunistic inspections will be supplemented with scheduled inspections if at a minimum in each 10-year period during the period of extended operation 20 percent up to a maximum of 25 components with the same combination of material, environment and aging effect are not opportunistically inspected. Where practical, the locations for these supplemental inspections will be selected from components most susceptible to aging. Opportunistic inspections will continue to be performed when the minimum sample size is reached.

Visual inspections of flexible polymeric components are performed whenever the component surface is accessible. Visual inspections are augmented by physical manipulation of at least 10 percent of accessible surface area of elastomers within the scope of the program, when appropriate for the component configuration and material, to detect hardening and loss of strength of internal surfaces of elastomers. In cases where internal surfaces are not available for visual inspection, an internal visual inspection may be substituted with a volumetric examination.

The program also includes the following:

Volumetric examination of the tank bottoms of the auxiliary feedwater storage tanks, the reactor makeup-water storage tanks, and the safety injection refueling water storage tanks from inside each 10-year period starting 10 years before entering the period of extended operation, to confirm the absence of loss of material due to corrosion.

Volumetric examination of a minimum of 20 percent of the auxiliary feedwater storage tank sidewalls from inside the tank each 10-year period starting 10 years before entering the period of extended operation.

Volumetric evaluation to detect stress corrosion cracking of the internal surfaces of stainless steel components exposed to diesel exhaust.

Visual inspections of the floating seals in the reactor makeup water storage tanks.

100 percent of the coatings installed on the internals of in-scope components are inspected and tested to assure coating integrity. The coatings are inspected every six years, and tested after 12 years of service at a six-year frequency.

The coating tests performed are low voltage holiday test, dry film thickness test and pull off adhesion test. Coatings not meeting the acceptance criteria are considered degraded, removed to sound material and replaced with new coating. Physical testing where physically possible is performed in conjunction with replacement of coatings. Replaced coatings are inspected every four years until there are three consecutive inspections with no change in the coating condition. Following three consecutive inspections with no change in the coating condition the 6 year inspection interval can be restored. Coating inspections and tests will be performed by a qualified Nuclear Coating Specialist (NCS) as defined by ASTM D7108 endorsed in RG 1.54. Monitoring and trending of the coatings are to be based on a pre-inspection review of the previous inspections results including any subsequent replacement activities.

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

19A.1.23 LUBRICATING OIL ANALYSIS

The Lubricating Oil Analysis program manages loss of material and reduction of heat transfer for components within the scope of license renewal that are exposed to lubricating and hydraulic oil. Acceptance criteria are based upon vendor and industry guidelines for oil chemical and physical properties and for foreign material such as water contamination. Increased contamination and degradation of oil properties provide an indication of aging of the lubricating or hydraulic oil. Monitoring and trending of lubricating and hydraulic oil properties and particles found within the oil identifies risk to components due to aging prior to loss of intended function.

The effectiveness of this program is verified under the One-Time Inspection program (19A.1.16).

19A.1.24 ELECTRICAL CABLES AND CONNECTIONS NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program manages embrittlement, melting, cracking, swelling, discoloration, electrical failure, and loss of dielectric strength leading to reduced insulation resistance (IR) to ensure that electrical cables, connections, and terminal blocks not subject to the environmental qualification (EQ) requirements of 10 CFR 50.49 and within the scope of license renewal are capable of performing their intended functions.

Non-EQ cables, connections and terminal blocks within the scope of license renewal in accessible areas with an adverse localized environment are inspected. The inspections of Non-EQ cables, connectors and terminal blocks in accessible areas are representative, with reasonable assurance, of cables, connections and terminal blocks in inaccessible areas with an adverse localized environment. At least once every ten years, Non-EQ cables, connections and terminal blocks within the scope of license renewal in accessible areas with an adverse localized environment are visually inspected for embrittlement, melting, cracking, swelling, surface contamination, or discoloration.

The acceptance criterion for visual inspection of accessible non-EQ cable jacket, connection, and terminal blocks insulating material is the absence of anomalous indications that are signs of degradation. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action program as part of the QA program.

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

19A.1.25 INACCESSIBLE MEDIUM VOLTAGE CABLES NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program manages localized damage and breakdown of insulation leading to electrical failure of inaccessible or underground medium and low voltage (>400 volts) power cables exposed to adverse localized environments caused by significant moisture (periodic exposures to moisture that lasts more than a few days) not subject to the environmental qualification (EQ) requirements of 10 CFR 50.49, and within the scope of license renewal.

All manholes and trenches that contain in-scope Non-EQ inaccessible medium or low voltage power cables are being inspected for water collection. Collected water is being removed as required. This inspection and water removal is being performed based on actual plant experience with inspection frequency being at least annually. Event-driven inspections are performed as an on-demand activity based on actual plant experience. Test frequency may be adjusted based on test results and operating experience.

The program provides for testing of in-scope Non-EQ inaccessible medium and low voltage (>400 volts) power cables to provide an indication of the conductor insulation condition. At least once every six years, a dielectric loss (dissipation factor/power factor), AC voltage withstand, partial discharge, step voltage, time domain reflectometry, insulation resistance, polarization index, line resonance analysis, or other testing that is state-of-the-art at the time of the testing is performed. The first test will be completed prior to the period of extended operation.

19A.1.26 METAL ENCLOSED BUS

The Metal Enclosed Bus program manages aging of in-scope non-segregated phase and isolated phase bus.

The non-segregated phase portion of the program manages loosening of bolted connections, embrittlement, cracking, melting, swelling, discoloration of insulation, electrical failure, loss of dielectric strength leading to reduced insulation resistance (IR), loss of material, and hardening and loss of strength to ensure that non-segregated phase buses within the scope of license renewal are capable of performing their intended function. Internal portions of non-segregated phase buses are visually inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulation is inspected for signs of embrittlement, cracking, melting, swelling, hardening or discoloration, which may indicate overheating or aging degradation. The internal bus supports are inspected for structural integrity and signs of cracks. The bus enclosure assemblies are inspected for loss of material due to corrosion and hardening of boots and gaskets. A sample of the in-scope non-segregated phase bus accessible bolted connections insulation material will be inspected to detect surface anomalies.

The isolated-phase portion of the program manages the effects of cracking and loss of material of bus enclosure assemblies, hardening of boots and gaskets, and cracking of internal bus supports to ensure that isolated phase metal enclosed buses within the scope of license renewal are capable of performing their intended function. Internal portions of isolated phase buses are visually inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulators are inspected for signs of embrittlement, cracking, melting, swelling, hardening or discoloration, which may indicate overheating or aging degradation. The internal bus supports are inspected for structural integrity and signs of cracks. The bus enclosure assemblies are inspected for loss of material due to corrosion and hardening of boots and gaskets.

19A.1.27 ASME SECTION XI, SUBSECTION IWE

The ASME Section XI, Subsection IWE program manages cracking, loss of material, loss of sealing, and leakage through containment by providing aging management of the steel liner of the concrete containment building, including the containment liner plate and its integral attachments, containment hatches and airlocks, and pressure-retaining bolting. IWE inspections are performed in order to identify and manage any containment liner aging effects that could result in loss of intended function. Acceptance criteria for components subject to Subsection IWE exam requirements are specified in Article IWE-3000. The STP containment inservice inspections program meets the requirements of 2004 Edition of ASME Section XI, Subsection IWE (no addenda), supplemented with the applicable requirements of 10 CFR 50.55a(b)(2)(ix). In conformance with 10 CFR 50.55a(g)(4)(ii), the STP containment inservice inspections program will be updated during each successive 120-month inspection interval to comply with the requirements of the latest edition and addenda of the Code specified 12 months before the start of the inspection interval.

19A.1.28 ASME SECTION XI, SUBSECTION IWL

The ASME Section XI, Subsection IWL program manages the following aging effects of the concrete containment building and post-tensioned system:

- Cracking due to expansion
- Cracking, loss of bond, and loss of material (spalling, scaling)
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Increase in porosity, permeability
- Loss of material
- Loss of material (spalling, scaling) and cracking
- Inspections will be performed to identify and manage any aging effects of the containment concrete, post-tensioning tendons, tendon anchorages, and concrete surface around the anchorage that could result in loss of intended function. In conformance with 10 CFR 50.55a(g)(4)(ii), the ASME Section XI, Subsection IWL program will be updated during each successive 120-month inspection interval to comply with the requirements of the latest edition and addenda of the Code specified 12 months before the start of the inspection interval.

19A.1.29 ASME SECTION XI, SUBSECTION IWF

The ASME Section XI, Subsection IWF program manages loss of material, cracking, and loss of mechanical function for supports of Class 1, 2 and 3 piping and components. There are no Class MC supports at STP. In conformance with 10 CFR 50.55a(g)(4)(ii), the STP ISI program is updated during each successive 120 month inspection interval to comply with the requirements of the latest edition and addenda of the Code specified 12 months before the start of the inspection interval.

19A.1.30 10 CFR PART 50, APPENDIX J

The 10 CFR 50, Appendix J program manages cracking, loss of material, loss of leak tightness, loss of sealing, and leakage through containment. The program monitors leakage rates through the containment pressure boundary, including the penetrations and access openings, in order to detect degradation of containment pressure boundary. Seals, gaskets, and bolted connections are also monitored under the program. Containment leak rate tests are performed in accordance with

10 CFR 50 Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors (Option B); Regulatory Guide 1.163, Performance-Based Containment Leak-Testing Program, NEI 94-01, Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50 Appendix J.

Containment leak rate tests are performed to assure that leakage through the primary containment, and systems and components penetrating primary containment does not exceed allowable leakage limits specified in the Technical Specifications. Corrective actions are taken if leakage rates exceed established administrative limits for individual penetrations or the overall containment pressure boundary.

19A.1.31 MASONRY WALL PROGRAM

The Masonry Wall Program manages cracking of masonry walls, as well as degradation of the structural steel restraint systems of the masonry walls. The Masonry Wall Program, administered as part of the Structures Monitoring Program (19A.1.32), is based on guidance provided in IE Bulletin 80-11, Masonry Wall Design and NRC Information Notice 87-67, Lessons Learned from Regional Inspections of Licensee Actions in Response to NRC IE Bulletin 80-11. The Masonry Wall Program contains inspection guidelines and lists attributes that cause aging of masonry walls, which are to be monitored during structural monitoring inspections, as well as establishes examination criteria, evaluation requirements, and acceptance criteria.

19A.1.32 STRUCTURES MONITORING PROGRAM

The Structures Monitoring Program manages the following aging effects of structures and structural supports in scope of License Renewal:

- Concrete cracking and spalling
- Cracking
- Cracking due to expansion
- Cracking, loss of bond, and loss of material (spalling, scaling)
- Cracks and distortion
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Increase in porosity and permeability, loss of strength
- Loss of material
- Loss of material (spalling, scaling) and cracking
- Loss of mechanical function
- Loss of sealing
- Reduction of concrete anchor capacity

The Structures Monitoring Program implements the requirements of 10 CFR 50.65, The Maintenance Rule, consistent with guidance of NUMARC 93-01, Revision 2 and Regulatory Guide 1.160 Revision 2.

The Structures Monitoring Program provides inspection guidelines for concrete elements, structural steel, roof systems, masonry walls and metal siding, including all masonry walls and water control structures within the scope of license renewal. The Structures Monitoring Program also monitors settlement for each major structure and inspects non-ASME mechanical and electrical supports.

19A.1.33 RG 1.127, INSPECTION OF WATER-CONTROL STRUCTURES ASSOCIATED WITH NUCLEAR POWER PLANTS

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program manages cracking, loss of bond, loss of material (spalling, scaling), cracking due to expansion, increase in porosity and permeability, loss of strength, and loss of form by performing inspection and surveillance activities for the Essential Cooling Water (ECW) Intake, and Discharge water control structures associated with emergency cooling water systems. STP is committed to conform to the intent of RG 1.127 with respect to the essential cooling pond (ultimate heat sink). The Structures Monitoring Program includes the ECW Intake and Discharge structures, which are within the scope of RG 1.127, as evaluated in NUREG-1801. The essential cooling pond, the ECW Intake structure, and the ECW Discharge structure are within the scope of license renewal and are monitored by this aging management program. Monitoring of structure settlement includes measurements of benchmark elevations on the ECW Intake and Discharge structures and elevations along the route of the buried portion of the Essential Cooling Water pipes. The essential cooling pond (ultimate heat sink) receives periodic monitoring of its hydraulic and structural condition, which includes inspection of erosion inhibiting structures, monitoring of sediment accumulation, and seepage rate evaluation. Inspections of the essential cooling pond and ECW Intake and Discharge structures are performed every five years. Sediment monitoring using soundings is performed every ten years.

19A.1.34 NICKEL-ALLOY AGING MANAGEMENT PROGRAM

The Nickel-Alloy Aging Management program manages cracking due to primary water stress corrosion cracking in all plant reactor coolant system pressure boundary locations that contain Alloy 600. Aging management requirements for nickel alloy penetration nozzles welded to the upper reactor vessel closure head are detailed in the STP Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors program (19A.1.5).

The STP Nickel-Alloy Aging Management program uses inspections, mitigation techniques, repair/replace activities, and monitoring of operating experience to manage the aging of Alloy 600 at STP. Detection of indications is accomplished through a variety of examinations consistent with ASME Section XI Subsection IWB, ASME Code Case N-722, and MRP-139 (EPRI Report 1010087) issued under the NEI 03-08 protocol. Mitigation techniques are implemented, when appropriate, to preemptively remove conditions that contribute to primary water stress corrosion cracking. Repair/replacement activities are performed to proactively remove or overlay Alloy 600 material, or as a corrective measure in response to an unacceptable flaw.

19A.1.35 PWR REACTOR INTERNALS

The PWR Reactor Internals program manages cracking, loss of material, loss of fracture toughness, dimensional changes, and loss of preload for reactor vessel components that provide a core structural support intended function. The program implements the guidance of EPRI 1022863, PWR Internals Inspection and Evaluation Guideline (MRP-227-A) and EPRI 1016609, Inspection Standard for PWR Internals (MRP-228). The program manages aging consistent with the inspection guidance for Westinghouse designated primary components in Table 4-3 of MRP-227-A and Westinghouse designated expansion components in Table 4-6 of MRP-227-A. The expansion components are specified to expand the primary component sample should the indications of the sample be more severe than anticipated. The aging effects of a third set of MRP-227-A internals locations are deemed to be adequately managed by existing program components whose aging is managed consistent with ASME Section XI Table IWB-2500-1, Examination Category B-N-3.

Program examination methods include visual examination (VT-3), enhanced visual examination (EVT-1), volumetric examination, and physical measurements. The program provides both examination acceptance criteria for conditions detected as a result of monitoring the primary components, as well as criteria for expanding examinations to the expansion components when warranted by the level of degradation detected in the primary components. Based on the identified aging effect, and supplemental examinations if required, the disposition process results in an evaluation and determination of whether to accept the condition until the next examination or implement corrective actions. Any detected conditions that do not satisfy the examination acceptance criteria are required to be dispositioned through the corrective action program, which may require repair, replacement, or analytical evaluation for continued service until the next inspection.

The PWR Reactor Internals program is a new program and has been implemented.

19A.1.36 ELECTRICAL CABLE CONNECTIONS NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS

The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program manages loosening of bolted and non-bolted external connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation to ensure that electrical cable connections not subject to the environmental qualification (EQ) requirements of 10 CFR 50.49 and within the scope of license renewal are capable of performing their intended function. As part of the STP predictive maintenance program, infrared thermography testing is being performed on Non-EQ electrical cable connections associated with active and passive components within the scope of license renewal. A representative sample will be tested once prior to the period of extended operation using infrared thermography to confirm that there are no aging effects requiring management during the period of extended operations. The selected sample (twenty percent of the population, with a maximum of 25) is based upon application (medium and low voltage), circuit loading (high or low load), and environment (temperature, high humidity, vibration, etc.). Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

19A.1.37 SELECTIVE LEACHING OF ALUMINUM BRONZE

The Selective Leaching of Aluminum Bronze program manages loss of material and cracking due to selective leaching of aluminum bronze (copper alloy with greater than 8 percent aluminum) components and welds exposed to raw water within the scope of license renewal. The program also validates phase distribution characteristics of the microstructure.

All aluminum bronze castings susceptible to selective leaching, including attachment welds related to the castings, and aluminum bronze root valves with adapter socket welds will be replaced prior to the period of extended operation with material that is not susceptible to selective leaching. Extruded piping tees with aluminum bronze weld repairs, where the repair size is such that failure of the repair would affect the structural integrity of the component, will be replaced prior to the period of extended operation.

STP uses copper alloy piping with less than 8 percent aluminum content, which is not susceptible to selective leaching. However, there are welds in which the filler metal is copper alloy with greater than 8 percent aluminum. The final composition of welds and process used to fabricate the welds results in a reduction in the susceptibility of the root pass filler material to selective leaching.

The Selective Leaching of Aluminum Bronze program directs that prior to the period of extended operation 20 percent with a maximum of 25 welds of the above ground weld population with no backing rings are examined one-time volumetrically to manage cracking. If a weld indication that does not meet the acceptance criteria is found during the one-time inspection of welds with no backing rings, periodic volumetric examinations of 20 percent with a maximum of 25 welds will be performed every 10 years thereafter.

The Selective Leaching of Aluminum Bronze program directs that 20 percent with a maximum of 25 welds of the above ground weld population with backing rings are examined volumetrically to manage cracking prior to the period of extended operation and every 10 years thereafter.

Discovery of a weld indication that does not meet the acceptance criteria requires expansion of the volumetric examination sample population. Each weld found with a weld indication not meeting the acceptance criteria requires five additional volumetric examinations to be performed until no additional weld indication not meeting the acceptance criteria is found.

The Selective Leaching of Aluminum Bronze program directs that prior to the period of extended operation 20 percent with a maximum of 25 welds of the above ground weld population with no backing rings and 20 percent with a maximum of 25 welds of the above ground weld population with backing rings be examined one-time destructively to detect loss of material due to selective leaching and verify microstructure phase distribution.
If selective leaching or microstructure phase distribution that does not meet the acceptance criteria are found the following will be performed.

Five Time-of-Flight Diffraction (TOFD) UT examinations within 60 days for each weld not meeting acceptance criteria until no additional weld not meeting the acceptance criteria is found. Welds for examination will be selected from the total population of above ground welds associated with the weld type (with or without backing ring) consider variability of construction, size distributions, structural integrity margins, and consequence of failure.

Periodic TOFD UT monitoring every 5 years on any welds not removed and previously found to not meet acceptance criterion but met structural integrity capability. These welds shall be monitored until 3 consecutive examinations identify no additional propagation of the selective leaching.

Periodic TOFD UT examinations of an additional 10% sample of the remaining above ground weld types (with or without backing ring) every 5 years. The sample will be selected from the total population of above ground welds associated with the weld type (with or without backing ring), considering variability of construction, size distributions, structural integrity margins, and consequence of failure.

Yard walkdowns are performed in the areas above the buried piping with aluminum bronze welds to look for changes in ground conditions that would indicate leakage. If a leak from a buried pipe weld is discovered by surface water monitoring or during a buried ECW piping inspection, a section of each leaking piping weld will be removed for destructive examination. Visual inspections are performed every six months of the external surfaces of the above ground welds for evidence of through wall leakage.

The Buried and Underground Piping and Tank program, B2.1.18, includes the visual inspection of the buried aluminum bronze exterior pipe coatings for visible breaks, gaps, and discontinuities which could indicate cracking of the welds and defines the acceptance criterion for buried pipe coatings.

The acceptance criterion for volumetric examination of aluminum bronze welds is no detected planar indication that is surface connected (exposed to the ECW environment) unless the depth of the indication is contained within the 80% of the weld root pass region. An indication not connected to the surface (not exposed to the ECW environment) is acceptable.

The acceptance criterion for visual inspection of the aluminum bronze welds and adjacent copper alloy piping during the walkdowns is no through wall leakage.

The acceptance criteria for destructive examinations are:

1. No loss of material due to selective leaching penetrating 80% of the root-pass region.
2. Found selective leaching is non-propagating (surrounded by a resistant phase distribution).
3. The microstructure of the weld root region shall exhibit a resistant phase distribution consistent with the metallurgical technical basis report.

The acceptance criterion for TOFD UT examination is no loss of material due to selective leaching resulting in not meeting ASME Section XI Code required margins imposed by ASME Section XI structural factors for normal/upset and emergency/faulted conditions.

The acceptance criterion for buried aluminum bronze exterior pipe coating is defined in the Buried Piping and Tanks Inspection Aging Management Program B2.1.18. An external surface examination capable of detecting selective leaching will be performed on the buried ECW piping welds in the vicinity of degraded coatings to detect loss of material due to selective leaching. The acceptance criterion for extent of loss of material on the external surface is that upon removal of the selective leaching the minimum wall thickness is maintained. Corrective action (e.g., surface conditioning) is performed until no selective leaching is detected. If unacceptable wall thickness is found following surface conditioning, the buried ECW piping is repaired or replaced.

An aluminum bronze weld found to have an indication that does not meet the acceptance criteria or has through wall leakage is removed and destructively examined to determine the extent of cracks, extent of selective leaching and the microstructure phase distribution. The condition is documented in the corrective action program and a structural integrity analysis is performed to confirm that the load carrying capacity of the installed welds remain adequate to support the intended function of the ECW system through the period of extended operation.

Loss of material due to selective leaching resulting in a weld not meeting ASME Section XI Code required margins with the weld declared operable per station Operability, Functionality, and Reportability procedure requires:

1. An extent of condition evaluation to identify other locations requiring examination.
2. Monthly above ground walkdowns of the aluminum bronze welds.
3. Monthly yard walkdowns to verify no through-wall leakage is occurring.
4. Performing TOFD UT examination on the remaining above ground weld population using a sample with a 95/95 confidence until no additional weld indication not meeting the TOFD UT examination acceptance criteria is found. The weld population used to determine the 95/95 confidence sample will be based on the above ground weld types (with or without backing rings) and locations that would not meet code allowable margins when evaluated against the failed components degraded load carrying capability.

   The TOFD UT examinations will be prioritized by examining the weld locations with the least structural integrity margin and with the highest consequence of failure first. Planning and preparations for performing TOFD UT extent of condition examinations will commence upon discovery of the condition. The examinations will commence at the next ECW train outage and will sequence through all the ECW trains during each ECW train outage with at least 20% of the examinations being completed within 30 days and all examinations completed within 180 days. This allows for timely planning and execution of sequenced train by train examinations during first available train work windows.

If a second weld is found that does not meet TOFD UT examination acceptance criteria;

- Develop examination plan, schedule and bases for the examination of the remaining above ground welds.
- Perform TOFD UT examinations on 100 percent of the remaining above ground welds to determine extent of condition with at least 20% of the examinations being completed within 30 days and all examinations completed within 180 days of finding the second weld.
- Perform an evaluation of the below ground weld margins to identify locations requiring inspection. The evaluation will focus on below ground locations where structural integrity could be challenged based on the relative stress margins and the inspection results obtained on the above ground structurally unacceptable weld(s). All below ground welds where the evaluation shows that the structural integrity could challenge operability will be examined using TOFD UT during the next scheduled refueling outage.

5. Performing periodic 95/95 confidence sample TOFD UT examinations every 5 years on the remaining welds which have not been TOFD UT examined. The population used to determine the 95/95 confidence sample will be based on the above ground weld types (with or without backing rings). The sample will be selected from the total population of above ground welds associated with the weld type (with or without backing ring), considering construction, size distributions, structural integrity margins, and consequence of failure.

6. Repair or replacement program of the susceptible weld(s).

Loss of material due to selective leaching resulting in a weld not meeting ASME Section XI Code required margins with the weld declared inoperable per station Operability, Functionality, and Reportability procedure requires:

1. If the weld has been removed from service for examination, then the examination results will be used to determine past operability and reportability.

2. An extent of condition evaluation to determine the cause of the structural integrity evaluation failure and identify weld population requiring examination.

3. Twice a month above ground walkdowns of the aluminum bronze welds.

4. Twice a month yard walkdowns to verify no through-wall leakage is occurring.

5. Performing TOFD UT examinations on 100% of the remaining above ground weld population.

   The TOFD UT examinations will be prioritized by examining the weld locations with the least structural integrity margin and with the highest consequence of failure first. Planning and preparations for performing TOFD UT extent of condition examinations will commence upon discovery of the condition. The examinations will commence at the next ECW train outage and will sequence through all the ECW trains during each ECW train outage with at least 20% of the examinations being completed within 30 days and all examinations completed within 180 days. This allows for timely planning and execution of sequenced train by train examinations during first available train work windows.

6. An evaluation of the below ground weld margins to identify locations requiring inspection. The evaluation will focus on below ground locations where structural integrity could be challenged based on the relative stress margins and the inspection results obtained on the above ground structurally unacceptable weld(s). All below ground welds where the evaluation shows that the structural integrity could challenge operability will be examined using TOFD UT during the next scheduled refueling outage.

7. Repair or replacement of the susceptible weld(s).

19A.1.39 PROTECTIVE COATING MONITORING AND MAINTENANCE PROGRAM

The Protective Coating Monitoring and Maintenance Program manages loss of coating integrity for Service Level 1 coatings inside containment so that the intended functions of post-accident safety systems that rely on water recycled through the containment sump/drain system are maintained consistent with the current licensing basis. The program includes a visual examination of all reasonably accessible Service Level 1 coatings inside containment during every refueling outage, including those applied to the steel containment liner, structural steel, supports, penetrations, uninsulated equipment, and concrete walls and floors receiving epoxy surface systems. This program does not include coating of surfaces that are insulated or otherwise enclosed in normal service and concrete receiving a non-film forming clear sealer coat only. This program is consistent with the standards provided in ASTM D 5163-08 and Regulatory Guide 1.54, Rev. 2, as addressed in NUREG-1801, Rev. 2, XI.S8.

19A.2 SUMMARY DESCRIPTIONS OF TIME-LIMITED AGING ANALYSIS AGING MANAGEMENT PROGRAMS

19A.2.1 METAL FATIGUE OF REACTOR COOLANT PRESSURE BOUNDARY

The Metal Fatigue of Reactor Coolant Pressure Boundary program manages fatigue cracking caused by anticipated cyclic strains in metal components of the reactor coolant pressure boundary. The program ensures that actual plant experience remains bounded by the transients assumed in the design calculations, and fatigue crack growth analyses, or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The program tracks the number of transient cycles and cumulative fatigue usage at monitored locations. The program considers the effects of the reactor water environment for a set that includes the NUREG/CR-6260 sample locations for a newer-vintage Westinghouse Plant, and plant-specific bounding EAF locations. If a cycle count or cumulative usage factor value increases to a program action limit, corrective actions include fatigue reanalysis, repair, or replacement. Any re-analysis of a fatigue crack growth analysis will be consistent with or reconciled to the originally submitted analysis and will receive the same level of regulatory review as the original analysis. Action limits permit completion of corrective actions before the design basis number of events is exceeded.

19A.2.2 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRICAL COMPONENTS

The Environmental Qualification (EQ) of Electrical Components 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, environmental qualification 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. The program complies with the requirements of 10 CFR 50.49, with exemption and NUREG-0588, Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment, is consistent with the guidance of Regulatory Guide 1.89, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants, Revision 0; and conforms to the intent of Regulatory Guide 1.89 Revision 1, including the use of IEEE Standard 323-1974 for demonstrating environmental qualification.

19A.2.3 CONCRETE CONTAINMENT

The Concrete Containment Tendon Prestress program, within the STP ASME Section XI, Subsection IWL program, manages loss of tendon prestress aging effect in the post-tensioning system, and is consistent with requirements of 10 CFR 50.55a (including the 10 CFR 50.55a supplemental requirements). The program includes inspection procedures and acceptance criteria and prescribes specific corrective actions, including increased inspection scope, if inspection criteria are not met.

19A.3 EVALUATION SUMMARIES OF TIME-LIMITED AGING ANALYSES

CFR 54.21(c) requires that an applicant for a renewed license identify time-limited aging analyses (TLAAs) and evaluate them for the period of extended operation. The following TLAAs have been identified and evaluated for STP.

19A.3.1 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The following calculations of neutron fluence and of its embrittlement effects are TLAAs affected by the extended life of the plant:

- Neutron Fluence Values
- Pressurized Thermal Shock
- Charpy Upper Shelf Energy, C_V USE
- Pressure-Temperature (P-T) Limits
- Low Temperature Overpressure Protection, LTOP
- The Reactor Vessel Surveillance program is described in Section 19A.1.15.

19A.3.1.1 NEUTRON FLUENCE VALUES

Loss of fracture toughness is an aging effect caused by the neutron embrittlement aging mechanism that results from prolonged exposure to neutron radiation. This process results in increased tensile strength and hardness of the material with reduced toughness. As neutron embrittlement progresses, the toughness/temperature curve shifts down (lower fracture toughness as indicated by Charpy upper shelf energy or CV USE), and the curve shifts to the right (brittle/ductile transition temperature increases). Neutron fluence projections are made in order to estimate the effect on these reactor vessel material properties at end-of-license extended (EOLE). The EOLE is assumed to be 54 effective full power years (EFPY) based on a lifetime capacity factor of 90 percent for 60 years.

- The last capsule withdrawn from Unit 1 was Capsule V at the end of cycle (EOC) 11, which yielded a vessel equivalent exposure less than that expected at the EOLE. The last capsule withdrawn from Unit 2 was Capsule U at EOC 9, which yielded a vessel equivalent exposure less than that expected at the EOLE.
- The fluence values for EOLE were projected based on the results of the Capsule V and U analyses for Unit 1 and 2, respectively. The revised fluences were determined with transport calculations using the DORT discrete ordinates code and the BUGLE-96 cross-section library which is derived from ENDF/B-VI. The neutron transport and dosimetry evaluation methodologies follow the guidance and meet the requirements of the most recent issue of Regulatory Guide 1.190. The EOLE fluence projections include operation to 54 EFPY, the use of lower-leakage cores, and the uprate.

Fluence will be managed for the period of extended operation by the Reactor Vessel Surveillance program, which is summarized in Section 19A.1.15. The validity of these parameters and the analyses that depend upon them will be managed to the end of the period of extended operation. Therefore, this TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.1.2 PRESSURIZED THERMAL SHOCK

The most recent coupon examination results for both units show that the shift in RT_{NDT} in plate and weld materials are in good agreement with or less than the Regulatory Guide 1.99 Revision 2, predictions for Units 1 and 2. The results demonstrate that Regulatory Guide 1.99 predictions provide a conservative means to satisfy the requirement of 10 CFR 50.61; thus providing assurance of the reactor vessel integrity.

RT_{PTS} values were generated for beltline and extended beltline region materials of the Units 1 and 2 reactor vessels for fluence values at EOLE (54 EFPY). The projected RT_{PTS} values for EOLE meet the 10 CFR 50.61 screening criteria.

The RT_{PTS} values were revised with projections to the end of the period of extended operation. Therefore, these TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

19A.3.1.3 UPPER-SHELF ENERGY (USE)

The most recent coupon examination results for both units show that the decline in C_V USE in plate and weld materials are less than originally predicted by Regulatory Guide 1.99 Revision 2 for Units 1 and 2. The results demonstrate that the Regulatory Guide 1.99 predictions provide a conservative means to satisfy the requirements of 10 CFR 50, Appendix G; thus providing assurance of the reactor vessel integrity.

To support operation during the period of extended operation, the C_V USE values for Units 1 and 2 were projected to 54 EFPY of operation. The re-evaluations demonstrate that the C_V USE in the limiting material of each unit will remain above the 10 CFR 50 Appendix G acceptance criteria of 50 ft-lbf for the period of extended operation.

The C_V USE values were re-evaluated with projections to the end of the period of extended operation. Therefore, these TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

19A.3.1.4 PRESSURE-TEMPERATURE (P-T) LIMITS

Appendix G of 10 CFR 50 requires that reactor vessel boltup, hydrotest, pressure tests, normal operation, and anticipated operational occurrences be accomplished within established pressure-temperature (P-T) limits. These limits are established by calculations that utilize the material properties (adjusted reference temperature, ART), effects of fluence on material properties obtained from the reactor surveillance capsules, and methodology of Appendix G of ASME, Section III.

The current P-T limit curves and the adjusted reference temperature (ART) values are valid up to 32 EFPY. The revision necessary to extend the P-T curves beyond 32 EFPY and into the period of extended operation will consider the following in accordance with the requirements of 10 CFR 50 Appendix G.

- effects of neutron embrittlement in the ART for the reactor vessel beltline and extended-beltline locations
- the higher stresses in the inlet/outlet nozzle corner region
- the ferritic reactor coolant pressure boundary components outside the beltline and extended-beltline locations when determining the lowest service temperature

These STP P-T limits curves are required to be maintained and updated as necessary to maintain plant operation consistent with 10 CFR 50. The P-T limit curves will be managed, as required by the STP license. Therefore, this TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.1.5 LOW TEMPERATURE OVERPRESSURE PROTECTION

Low temperature overpressure protection (LTOP) is required by STP Technical Specification, Limited Condition for Operation (LCO) 3.4.9.3, and is provided by the cold overpressure mitigation system (COMS), which opens the pressurizer power operated relief valves (PORVs) at a setpoint calculated to prevent violation of the pressure-temperature limits. However, these LTOP analyses do not depend on any other time-dependent values beyond the ART at the critical locations and the P-T limits. Changes to the RCS P-T limit curves also require an evaluation of the LTOP temperature and PORV pressure setpoints, and supporting safety analyses.

The COMS setpoints are established in Technical Specification Figure 3.4-4, which will be managed in a manner consistent with the P-T limits. Therefore, these TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2 METAL FATIGUE ANALYSIS

This section describes:

ASME Section III Class 1 Fatigue Analysis of Vessels, Piping, and Components
ASME Section III Subsection NG Fatigue Analysis of Reactor Pressure Vessel Internals
Effects of the Reactor Coolant System Environment on Fatigue Life of Piping and Components (Generic Safety Issue 190)

Assumed Thermal Cycle Count for Allowable Secondary Stress Range Reduction Factor in ANSI B31.1 and ASME Section III Class 2 and 3 Piping

ASME Section III Fatigue Analysis of Metal Bellows and Expansion Joints
Basis of Fatigue Analysis

ASME III Class 1 design specifications define a set of static and transient load conditions for which components are to be designed. The STP operating licenses are for 40 years. The STP design specifications state that the transient conditions are for a 40 year design life. However, the fatigue analyses are based on a specified number of occurrences of each transient rather than on the design or licensed life. The design number of occurrences of each transient for use in the fatigue analyses was specified to be larger than the number of occurrences expected during the 40 year design life of the plant.

Operating experience at STP and at other similar units has demonstrated that the assumed frequencies of design transients, and therefore, the number of transient cycles assumed for a 40 year life, were conservative; and that with few exceptions the design numbers are not expected to be exceeded during a 60-year life.

The Metal Fatigue of Reactor Coolant Pressure Boundary program described in Section 19A.2.1 ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means.

ASME Section III Class 1 Fatigue Analysis of Vessels, Piping, and Components
Fatigue analyses are performed for ASME III Division 1 Class 1 vessels, pumps, valves, piping, piping nozzles, and other components subject to fatigue analyses. ASME Section III requires no fatigue analysis for Class 2 components however, the entire pressure boundary of the STP replacement steam generators are constructed in accordance with ASME Section III requirements. The Class 1 analyses have been updated to incorporate redefinitions of loads and design basis events, operating changes, power uprate, reactor vessel head replacement, and steam generator replacement.

19A.3.2.1.1 REACTOR PRESSURE VESSEL, NOZZLES, HEAD AND STUDS

The STP Units 1 and 2 reactor pressure vessels (RPVs) are designed to ASME Section III 1971 Edition with addenda through Summer 1973. The STP vessels were built and analyzed for the assumed 40-year number of transient cycles.

Pressure-retaining and support components of the reactor pressure vessel are subject to an ASME Boiler and Pressure Vessel Code Section III fatigue analysis. This analysis has been updated to incorporate redefinitions of loads and design basis events, operating changes, power uprate, replacement steam generators, and minor modifications. The limiting component for fatigue in the reactor pressure vessel pressure boundary and its supports is the control rod drive housing.

The Metal Fatigue of Reactor Coolant Pressure Boundary program described in Section 19A.2.1 ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

The STP Unit 1 and 2 RPV heads were replaced in 2009 and 2010, respectively. The replacement reactor vessel closure heads were designed to ASME Code, Section III, 1989 Edition (no addendum). The fatigue analyses for the heads and any similarly-replaced-and-analyzed appurtenances are analyzed for the design number of transient cycles starting from the time of installation. Therefore, these analyses are TLAAs valid through the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

Unit 1 Reactor Vessel Bottom-Mounted Instrument Nozzle (BMI) Half-Nozzle Repairs
The STP Unit 1 bottom-mounted instrument (BMI) nozzles are Alloy 600, attached to the clad inner surface of the reactor vessel bottom head by Alloy 182 J-groove welds. During Refuel 11 (1RE11, Spring 2003) a boric acid control program inspection discovered leaks at Unit 1 BMI Nozzles 1 and 46. The nozzles were repaired by the "half-nozzle" method. These repairs are the only Alloy 600 half-nozzle repairs at STP.

These repairs were evaluated for growth of postulate residual flaws, fatigue, and corrosion. These analyses qualify the repair for operation from the time of the repair through the period of extended operation, and therefore, are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.2.1.2 CONTROL ROD DRIVE MECHANISM (CRDM) PRESSURE HOUSINGS AND CORE EXIT THERMOCOUPLE NOZZLE ASSEMBLIES (CETNAS)

The STP Unit 1 and 2 control rod drive mechanism (CRDM) pressure housings, the core exit thermocouple nozzle assemblies (CETNAs), and the internal disconnect devices (IDDs) were replaced with the replacement reactor vessel closure heads (RRVCHs). The CRDM pressure housings and CETNAs were designed to the Class 1 requirements of the ASME Code, Section III, 1989 Edition (no addendum)The CRDM pressure housings and CETNAs were designed to the Class 1 requirements of the ASME Code, Section III, 1989 Edition (no addendum). The new CRDMs and CETNAs were qualified for 40 years, which extends the design lives beyond the period of extended operation. Therefore, these TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.2.1.3 REACTOR COOLANT PUMP PRESSURE BOUNDARY COMPONENTS

There are four Model 100 reactor coolant pumps (RCPs) for each reactor. The RCPs for both units were designed to the Class 1 requirements of ASME Section III, 1971, with addenda through the Summer 1973. The design code requires a fatigue analysis per NB-3222.4(e) or a fatigue waiver per NB-3222.4(d). The fatigue and fatigue waiver analyses depend in part on the assumed numbers of design basis normal and upset transient cycles.

Fatigue Waivers

The analyses demonstrated code compliance for most RCP components by satisfying the six criteria for a fatigue waiver. The Metal Fatigue of Reactor Coolant Pressure Boundary program described in Section 19A.2.1 ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

Fatigue Analyses

Components qualified with a fatigue analysis are the RCP casing, thermal barrier flange, cooling coils, seal injection nozzle, and thermal barrier cooling water nozzle with CUFs of 0.4, 0.8287, 0.25, 0.85, and 0.4525, respectively.

The fatigue analyses of the RCP casing, thermal barrier cooling coils, and the thermal barrier water nozzles demonstrate a low CUF based on 40-year design transients. The results extrapolated to 60 years by multiplying the CUFs by 1.5 still satisfy the design requirement of less than 1.0. Therefore, these fatigue analysis are valid for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

The fatigue analyses for the thermal barrier flange at the holes and seal injection nozzles include step changes in the seal injection water temperature. The transient accounts for switching the charging pump suction from the volume control tank to the refueling water storage tank and back. STP does not operate in this manner and there have been no events of this transient in the history of STP operation. Therefore, the fatigue analyses, which account for this transient, are valid for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.2.1.4 PRESSURIZER AND PRESSURIZER NOZZLES

The Westinghouse Series 100 pressurizers are vertical cylindrical vessels with hemispherical top and bottom heads, constructed of carbon steel, with austenitic stainless steel cladding on all surfaces exposed to the reactor coolant. The pressurizers and their integral support skirts are Code Class 1, designed to ASME Section III, 1974 Edition.

Pressure-retaining and support components of the pressurizer are subject to an ASME Section III fatigue analysis. This analysis has been revised for plant modifications with redefined loads, and for newly-identified design basis events not included in the original analyses.

The effects of insurge-outsurge transients were evaluated for license renewal. The design transients incorporate heatups and cooldowns which represent pressurizer insurge-outsurge and surge line stratification activity. All components were qualified using the 40-year current licensing basis cycles.

The fatigue analyses of the safety and relief nozzles, and the seismic support lugs demonstrate worst-case 40-year usage factors less than 0.4. When multiplied by 1.5 (60/40) to account for the 60-year period of extended operation, these results do not exceed 0.6, providing a large margin to the code acceptance criterion of 1.0. The analyses of these subcomponents are therefore projected through the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

The fatigue analyses of the remaining subcomponents have been found acceptable for a limiting number of transient events. The Metal Fatigue of Reactor Coolant Pressure Boundary program described in Section 19A.2.1 ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.5 Steam Generator ASME Section III Class 1, Class 2 Secondary Side, and Feedwater Nozzle Fatigue Analyses

The Units 1 and 2 steam generators at STP were replaced (in 2000 and 2002, respectively) with Westinghouse Model Delta 94 steam generators and are designed for 40 years of operation (2040 and 2042, respectively), based on design transients. The RSGs are designed and fabricated to the requirements of ASME Boiler and Pressure Vessel Code Section III, 1998 Edition with no Addenda. The primary side of each RSG is ASME Class 1, and the secondary side of each RSG is ASME Class 2. However, the entire pressure boundary of the component is constructed in accordance with ASME Boiler and Pressure Vessel Code Section III Class 1 requirements.

The analyses of the RSGs show that the usage factors of the steam generator components are less than the allowable 1.0, except the manway studs which are qualified by fatigue tests. The fatigue usage factors in the replacement steam generator components do not depend on effects that are time dependent at steady-state conditions, but depend only on effects of operational, abnormal, and upset transient events specified in the design specification.
The Metal Fatigue of Reactor Coolant Pressure Boundary program described in Section 19A.2.1 ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.6 ASME III Class 1 Valves

STP Class 1 valves are designed to ASME III, Subsection NB, 1974 Edition with Summer 1975 addenda (pressurizer safety and control valves) or the 1974 Edition with Winter 1975 addendum (motor-operated, manual valves 3” and larger, and all valves 2” and smaller). ASME Section III requires a fatigue analysis only for Class 1 valves with an inlet piping connection greater than four inches nominal pipe size.

The calculated worst-case usage factors for the following valves indicate that the pressure boundaries would withstand fatigue effects for at least 1.5 times the original design lifetimes:

- 6” pressurizer safety relief valves,
- 6” hi-head safety injection pump discharge check valves,
- 8” hi-head safety injection pump discharge check valves,
- 8” lo-head safety injection to hot leg check valves,
- 8” lo-head safety injection to cold leg check valves,
- 12” safety injection to cold leg injection check valves,

- 12” safety injection accumulator outlet valves,
- 2” CVCS auxiliary spray check valves,
- 2” RCP seal injection first check valves, and
- 2” RCP seal injection second check valves, and
- 3” X 6” pressurizer power operated relief valve.

The design of these valves for fatigue effects is therefore valid for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).
The fatigue usage factors in the RHR pump suction isolation valves do not depend on effects that are time-dependent at steady-state conditions, but depend only on effects of operational, abnormal, and upset transient events. Therefore, the increase in operating life to 60 years will not have a significant effect on these fatigue usage factors so long as the number of transient cycles remains within the 40-year numbers of cycles assumed by the analysis.

The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section 19A.2.1, ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. This TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.7 ASME III Class 1 Piping and Piping Nozzles

STP Class 1 reactor coolant main loop piping, surge line piping and other ASME III Class 1 piping is designed to ASME Section III, Subsection NB, 1974 Edition with addenda through Winter 1975. The Class 1 piping fatigue analyses were performed to the ASME III, Subsection NB-3600 and 3200, 1974 Edition with addenda through Winter 1975.

The most limiting calculated design basis usage factors occur in the pressurizer safety lines and approach the limit of 1.0. However, fatigue usage factors in these components do not depend on effects that are time dependent at steady-state conditions, but depend only on effects of normal, upset, and emergency transient events. Therefore, the increase in operating life to 60 years will not have a significant effect on these fatigue usage factors so long as the number of transient cycles remains within the 40-year numbers of cycles assumed by the analysis.

The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section 19A.2.1, ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.8 Response to Bulletin 88-08: Intermittent Thermal Cycles Due to Thermal-Cycle-Driven Interface Valve Leaks and Similar Cyclic Phenomena

NRC Bulletin 88-08 describes the mechanism of thermal cycles in normally-isolated, dead-end branches, due to leaking interface valves. Under these conditions, thermal fatigue of the un-isolable piping can result in crack initiation. Three systems for STP Units 1 and 2 could be subjected to the phenomena described in NRC Bulletin 88-08: normal charging, alternate charging, and auxiliary spray.

The NRC staff safety evaluation of the STP lines concluded that the normal charging, alternate charging, and the auxiliary spray lines at STP are not susceptible to the thermal cycling phenomenon described in NRC Bulletin 88-08.

Evaluations of the charging, alternate charging, and auxiliary spray lines for thermal stratification determined incremental fatigue usage increase of less than 0.001 for the charging and alternate charging lines, and less than 0.03 for of the auxiliary spray lines. These low usage factors demonstrate that this analysis can be projected for the period of extended operation. Therefore, these TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

19A.3.2.1.9 Response to Bulletin 88-11: Revised Fatigue Analysis of the Pressurizer Surge Line for Thermal Cycling and Stratification

The purpose of NRC Bulletin 88-11 is to request that addressees establish and implement a program to confirm pressurizer surge line integrity in view of the occurrence of thermal stratification and require addressees to inform the staff of the actions taken to resolve this issue.

The surge line was originally designed to ASME Section III, Subsection NB, 1974 Edition with addenda through Winter 1975. The surge line design was reevaluated to the 1986 Code in response to NRC Bulletin 88-11 thermal stratification concerns.

The surge line stratification program for STP Units 1 and 2 performed ASME III stress, fatigue cumulative usage factor, fatigue crack growth, and leak before break analyses. New fatigue usage factors were calculated with thermal transients redefined to account for thermal stratification. The design basis number of cyclic events was unchanged; however a simplified elastic-plastic analysis was performed per NB-3653.6, which resulted in a lower CUF than previous evaluations.

The revised fatigue analyses do not depend on effects that are time-dependent at steady-state operation, but depend only on effects of operational, abnormal, and upset transient conditions. The increase in operating life to 60 years will not have a significant effect on these fatigue analyses so long as the number of cycles remains within the 40-year numbers of cycles assumed by the analysis.

The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section A2.1, ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.10 High Energy Line Break Postulation Based On Fatigue Cumulative Usage Factor

With the exception of the reactor coolant system primary loops, to which a leak-before-break (LBB) analysis applies, breaks in piping with ASME Section III Class 1 fatigue analyses are identified based on a limiting stress criterion; and on a cumulative usage factor criterion. No additional break locations will result from license renewal as long as the current design basis cumulative usage factor analyses remain valid.

Westinghouse justified elimination of break locations in the accumulator safety injection lines and the pressurizer surge line based on increasing the CUF for break consideration from 0.1 to 0.4.

In response to NRC Regulatory Issue Summary (RIS) 2010-07 Westinghouse performed a plant specific evaluation of STP Units 1 and 2 pressurizer surge line analyses for the effects of PWSCC. The evaluation determined that the original analysis conclusions remain valid and the pressurizer surge line pipe breaks should not be considered in the structural basis of STP Units 1 and 2 after weld overlay application.

The NRC also approved the elimination of arbitrary intermediate breaks requiring a commitment by STP to consider fatigue effects in welded integral attachments to Class 2 and 3 piping. STP performed an analysis in accordance with paragraph NC/ND-3645 of the ASME code for five integral pipe supports that were determined to be bounding.

The Class 1 break locations, the fatigue crack growth analyses, which support the increase in the CUF for break considerations in the pressurizer surge and accumulator lines, and welded attachments to charging and the main feedwater systems which depend on usage factor will remain valid as long as the numbers of cycles assumed by the analysis are not exceeded. The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section 19A.2.1, ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The program also ensures that the charging line weld attachments CUF will be below the Code allowable. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

Other than those for the charging system and the main feedwater system, the fatigue analyses for the welded attachments to Class 2 and 3 piping which support the elimination of arbitrary intermediate break locations demonstrate a CUF less than 1.0 during the period of extended operation. Therefore, these TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

19A.3.2.1.11 Fatigue Crack Growth Assessments and Fracture Mechanics Stability Analyses for Leak-Before-Break (LBB) Elimination of Dynamic Effects of Primary Loop Piping Failures

A leak-before-break analysis eliminated the need to postulate longitudinal and circumferential breaks in the reactor coolant system primary loop piping. Elimination of these breaks omitted the need to install pipe whip restraints in the primary loop and eliminated the requirement to design for dynamic (jet and whip) effects of primary loop breaks. The containment pressurization, emergency core cooling system, and environmental qualification large-break design bases were not affected.

Aging Management of the Fatigue Crack Growth Analysis

The final LBB submittal for STP included a fatigue crack growth assessment for a range of materials at a high stress location bounding the primary coolant system. The LBB analysis found that fatigue crack growth effects will be negligible. The basis for evaluation of fatigue crack growth effects in the LBB analysis will remain unchanged so long as the number of transient occurrences remains below the number assumed for the analysis of fatigue crack growth effects.

The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section 19A.2.1, ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. This TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.12 Validation of the Fracture Mechanics Evaluation

The STP leak-before-break analysis for the primary loop, includes a fracture mechanics evaluation which depends on the crack initiation energy integral, J_{IN}. The material fracture toughness properties selected for use in the LBB analysis are sufficiently embrittled that they bound the amount of thermal embrittlement that will occur in 60 years. Therefore this TLAA is valid for the period of extended operation and is dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.2.1.13 Class 1 Design of Class 3 Feedwater Control Valves

The STP feedwater control valves were purchased as ASME III, Class 3 valves. STP UFSAR Table 3.2.B-1 identifies the safety class as non-nuclear safety (NNS). Neither of these classifications indicates a TLAA. However the STP UFSAR associates a limiting number of occurrences of unit loading and unloading at 5 percent full power for these valves, and the methods and acceptance criteria for the evaluation of the valves for these occurrences were based on Class 1 methods of paragraph NB-3545 of ASME III, 1977 Edition through the Winter 1978 Addenda.

The STP units do not operate in a load following mode and therefore the expected number of loading and unloading occurrences is only a small fraction of the design number of occurrences, resulting in a large margin between the analyzed value, 10,300 cycles, and the number projected, 3,366 cycles. Therefore, the fatigue analysis for the STP feedwater control valves is valid for the period of extended operation. This TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.2.1.14 ASME Section III Subsection NG Fatigue Analysis of Reactor Pressure Vessel Internals

The STP reactor vessel internals were designed to meet the intent of the 1974 Edition of Section III of the ASME Boiler and Pressure Vessel Code, Subsection NG, paragraph NG-3311(c); that is, design and construction of core support structures meet Subsection NG in full, and other internals are designed and constructed to ensure that their effects on the core support structures remain within the core support structure limits.

The Subsection NG fatigue usage factors for reactor vessel internals do not depend on effects that are time-dependent at steady-state conditions, but depend only on effects of normal and upset transient events. Therefore, the increase in operating life to 60 years will not have an effect on these fatigue usage factors so long as the number of transient cycles remains within the 40-year numbers of cycles assumed by the analysis.

The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section 19A.2.1, ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.15 Effects of the Reactor Coolant System Environment on Fatigue Life of Piping and Components (Generic Safety Issue 190)

STP addressed GSI-190 review requirements by assessing the environmental effect on fatigue at the seven sample locations identified by NUREG/CR-6260 for newer vintage Westinghouse Plants.

- Reactor vessel lower head to shell juncture
- Reactor vessel inlet nozzle
- Reactor vessel outlet nozzle
- Surge line hot leg nozzle
- Charging nozzle
- Safety injection nozzle
- Residual heat removal line inlet transition

The Metal Fatigue of Reactor Coolant Pressure Boundary program includes cycle counting of transients affecting all of the NUREG/CR-6260 specified locations. In addition, the Metal Fatigue of Reactor Coolant Pressure Boundary program calculates the usage factors from actual plant transient accumulation in all of the NUREG/CR-6260 locations based on the cycle-based fatigue (CBF) methodology.

The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section 19A.2.1, ensures that the fatigue usage factors, including the effects of the reactor coolant environment, remain within the code limit of 1.0 for the period of extended operation; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of the reactor coolant environment on fatigue usage factors in the NUREG/CR-6260 locations will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.2.1.16 Assumed Thermal Cycle Count for Allowable Secondary Stress Range Reduction Factor in ANSI B31.1 and ASME Section III Class 2 and 3 Piping

STP ASME Section III Class 2 and 3 piping is designed to the 1974 Edition, including Winter 1975 addenda; plus later editions and addenda for certain requirements. STP ANSI B31.1 piping is designed to the 1973 Edition, including Winter 1975 addenda, plus paragraphs from later editions for certain requirements. A review of ASME Section III Class 2 and 3 and B31.1 piping specifications found no indication of a number of expected lifetime full-range or equivalent full-range thermal cycles greater than 7,000 during the original 40-year plant life.

The total count of design basis events significant to fatigue is only about 3,500. The total number of these actually expected in a 60-year life is about 1,040. The total count of expected full-range thermal cycles for most of these systems is less than 1,500 for a 60-year plant life, which is a fraction of the 7,000 cycle threshold for which a stress range reduction factor is required in the applicable piping codes. Therefore, the existing analyses of piping for which the allowable range of secondary stresses depends on the number of assumed thermal cycles and that are within the scope of license renewal are valid for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.2.1.17 ASME Section III Fatigue Analysis of Metal Bellows and Expansion Joints

The STP diesel generator cooling water metal and essential cooling water (ECW) expansion joints were designed in accordance with Section ND of the ASME Section III 1977 Code, including Summer 1977 addenda; and have a minimum design life of 40 years. The fatigue analyses for the metal expansion joints verify the 40 year design requirement for the diesel generator cooling water and ECW expansion joints by satisfying ASME Section III, Subsection ND-3649.4(d), which limits the component’s lifetime cyclical loading.

The analyzed numbers of cycles for all but seven of the diesel generator cooling water and ECW expansion joints are greater than the specified numbers of cycles extrapolated to 60 years. Therefore, the analyses are valid for these bellows through the period of extended operation. These diesel generator cooling water expansion joint TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

STP has committed to replace, prior to the period of extended operation, the seven diesel generator cooling water expansion joints that are projected to exceed the analyzed number of cycles during the period of extended operation. The analyses for the replacement expansion joints will include the period of extended operation. Therefore, these seven diesel generator cooling water expansion joint TLAAs will be dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.3 ENVIRONMENTAL QUALIFICATION OF ELECTRIC EQUIPMENT

10 CFR 50.49 requires that certain electrical and instrument and control (I&C) equipment, important to safety, located in harsh environments, be qualified to perform their safety-related functions in those harsh environments after the effects of in-service aging.
The STP Environmental Qualification program is consistent with the guidance of NUREG-0588, Category I, and the requirements of 10 CFR 50.49, with exemption from the environmental qualification scope for certain low-safety/risk significant (LSS) and non-risk significant (NRS) components. These components remain within the scope of equipment qualification.

The STP Environmental Qualification program outlines the methodology for performing activities required to establish, maintain, and document the environmental qualification of electrical equipment important to safety. The current list of equipment requiring environmental qualification is maintained in accordance with plant procedures and the Equipment Qualification Database.

Safety-related electrical equipment and components located in a harsh environment are qualified by test or combination of test and analysis in accordance with the requirements of 10 CFR 50.49 and NUREG-0588, Revision 1. Detailed qualification results for electrical equipment located in a harsh environment are maintained in the station files.

The Environmental Qualification (EQ) of Electric Equipment program, described in Section A2.2, ensures that the aging effects will be managed and that the environmental qualification components continue to perform their intended functions for the period of extended operation. Aging effects addressed by the Environmental Qualification program will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.4 CONCRETE CONTAINMENT TENDON PRESTRESS

The STP containments are prestressed concrete, hemispherical dome on a cylinder structures with a steel membrane liner and a flat basemat. Post-tensioned tendons compress the concrete and permit the structures to withstand design basis accident internal pressures.

The Concrete Containment Tendon Prestress program, described in Section A2.3, periodically measures the prestress load on a defined sample of tendons; and examines the condition of tendons and supporting structures, materials, and components. From the data, the program periodically reconfirms that the expected tendon prestress loads will remain within design limits to at least the next inspection or if the relaxation is not acceptable, prescribes retensioning or other corrective measures to ensure that at no time will the average prestress in a tendon group fall below the minimum required prestress.

In accordance with 10 CFR 50.55a(g)(4)(ii), the third interval inservice inspection program for Subsection IWL will be conducted in accordance with the requirements of the 2004 Edition no addenda of ASME Section XI. The design acceptance criterion is that the measured losses must come close enough to predicted values to provide high confidence that the design value for minimum prestress force will be exceeded throughout the life of the plant. The design acceptance criterion is ensured by surveillance program acceptance criteria that are consistent with ASME XI Subsection IWL-3221.1.

The program inspects a random sample of tendons from each group (vertical and hoop) in each inspection interval to confirm that acceptance criteria are met, and therefore that tendon prestresses remain above minimum required values (MRVs, or minimum required prestress in ASME XI Subsection IWL-3221.1) for the succeeding inspection interval. At each inspection the program also recalculates the regression analysis trend lines of these two groups, based on individual tendon forces, to confirm whether average prestresses will remain above their MRVs for the remainder of the licensed operating period.

The surveillance calculation estimates the 40-year loss and lists the predicted and measured lift-off forces in individual tendons selected for surveillance. Predicted tendon lift-off values are calculated for each individual tendon selected. The measured force trend lines, when projected past 60 years, remain above the minimum required design prestress values. The surveillance data trend line regression analyses are consistent with the methodology presented in NRC Information Notice 99-10, Attachment 3. The calculations of predicted force are consistent with NRC Regulatory Guide 1.35.1.

The recent surveillance data for individual tendons have all fallen above the first action limit at 95 percent of the predicted force line; and the regression analysis of surveillance lift-off data has extended the trend lines for both the vertical and horizontal tendons to 100 years. Both trend lines remain well above their minimum required values for the period of extended operation.
The Concrete Containment Tendon Prestress program, described in Section 19A.2.3, continues to manage loss of tendon prestress for the period of extended operation by confirming that the average lift-off forces of both tendon groups remain above their minimum required values (MRVs), as required by the design basis of the containment building and of its post-tensioning system. Therefore, tendon prestress will be managed for the period of extended operation. This TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.5 CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATIONS FATIGUE ANALYSIS

The STP post-tensioned concrete containment vessels are poured against steel membrane liners. No credit is taken for the liner for the pressure design of the containment vessel, but the liner and penetrations ensure the vessel is leak-tight, and its electrical, process, personnel airlock, and equipment hatch penetrations are part of the containment pressure boundary.
The liner specification also states that fatigue will be evaluated per NE-3222.4 and NE-3131(d) of ASME Section III. ASME Section III Division 1, Subsection NE, 1974 and later, Subparagraph NE-3222.4, provides rules for a fatigue analysis of MC components for specified operating conditions involving cyclic application of loads and thermal conditions. NE-3222.4(d) provides rules for waiver of a fatigue analysis.

19A.3.5.1 Fatigue Waivers for the Personnel Airlocks and Emergency Airlocks

The design of the personnel and emergency airlocks included an ASME Section III NE-3222.4(d) fatigue waiver analysis.

The fatigue waivers remain valid if the number of operating temperature cycles assumed for evaluation are each increased by a factor of 1.5 to account for the period of extended operation. Therefore, the fatigue waiver will remain valid for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

19A.3.5.2 Fatigue Design of Containment Penetrations

STP evaluated the criteria in ASME III NC-3219.2(a) to determine whether fatigue analyses of penetrations are required. The calculation determined that fatigue analyses are necessary for main steam (M-1 through M-4), feedwater (M-5 through M-8), auxiliary feedwater (M-83, M-84, M-94, and M-95), and steam generator blowdown (M-62 through M-65) penetrations. Further examination of the design reports and calculations for each penetration type identified an additional fatigue analysis of sample line penetrations M-85 and M-86. The penetration fatigue analyses were calculated in accordance with ASME Boiler and Pressure Vessel Code NC-3200.

The fatigue analyses of the containment penetration pressure boundaries are dependent on the assumed 40-year number of transient cycles. The Metal Fatigue of Reactor Coolant Pressure Boundary program, described in Section 19A.2.1, ensures that the numbers of transients actually experienced during the period of extended operation remain below the assumed number; or that appropriate corrective actions maintain the design and licensing basis by other acceptable means. The effects of fatigue will therefore be managed for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

The fuel transfer tube bellows were designed for 1,000 cycles of expansion and contraction. In order to determine if the design analyses remain valid for 60 years of operation, the number of cycles for 60 years has been conservatively projected. For each of these components, one thermal cycle occurs during each refueling operation. The design number of refueling operations is 80 cycles (120 cycles when multiplied by 1.5 for 60 years). In addition to these cycles, the fuel transfer canal penetration assembly is exposed to pressurization cycles during Integrated Leak Rate Tests, conservatively projected to occur once every 5 years. This contributes 12 cycles in 60 years. These penetrations would also be exposed to up to 1 Safe Shutdown Earthquake cycle. Therefore, the total cycles projected for 60 years are a fraction of the design cycles analyzed for these bellows. Therefore, the analyses of all of these penetrations remain valid for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.6 PLANT-SPECIFIC TIME-LIMITED AGING ANALYSES

19A.3.6.1 Load Cycle Limits of Cranes, Lifts, and Fuel Handling Equipment Designed to CMAA-70

The new fuel handling area overhead crane, cask handling overhead area crane, fuel handling building overhead crane, containment polar crane, fuel handling machines, refueling machine, new fuel elevator, and the fuel transfer system will experience only a fraction of their rated lifetime number of lifts over 60 years. Therefore, the designs of these machines remain valid for the period of extended operation. These TLAAs are dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.6.2 In-Service Flaw Growth Analyses that Demonstrate Structural Stability for 40 Years

A search of the CLB did not identify any flaws evaluated which resulted in TLAAs for the remaining life of the plant other than the flaw growth analyses of the half nozzle repair on the Unit 1 bottom mounted instrumentation (BMI) nozzle. As discussed in 19A.3.2.1.1 this analyses will remain valid for the period of extended operation and the TLAA was dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.6.3 TLAA for the Corrosion Effects in the Essential Cooling Water (ECW) System

In response to NRC Generic Letter 89-13, STP committed to implementation and maintenance of a surveillance and control program to significantly reduce the incidence of flow blockage problems as a result of biofouling. Included in this response is a statement that “Scaling and corrosion inhibitors are also added to the ECW.” This commitment was subsequently revised, and the use of corrosion inhibitors was discontinued at STP, based on the following:

Without the inhibitors, the corrosion rate is 0.6 mil/year compared to less than 0.1 mil/year with the inhibitor. Assuming 40 years of service life, this will not result in corrosion exceeding the design level of 40 mils. This conclusion is based on a 40-year plant life.

Corrosion effects in the essential cooling water system are managed by the Open-Cycle Cooling Water System program discussed in 19A.1.9. Therefore, corrosion effects will be managed during the period of extended operation. This TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

19A.3.6.4 Reactor Coolant Pump Flywheel Fatigue Crack Growth Analysis

The aging effect of concern for the reactor coolant pump flywheel is fatigue crack initiation in the flywheel bore keyway. Flywheel inspections are included in the STP In-service Inspection (ISI) Program and are required by STP Technical Specification 4.4.10. To reduce the inspection frequency and scope, STP implemented a Westinghouse Topical Report on Reactor Coolant Pump Motor Flywheel Inspection Elimination, which supports relaxation of inspections required by Regulatory Guide 1.14 Position C.4.b(1) and (2).

The topical report demonstrated that the flywheel design has a high structural reliability with a very high flaw tolerance and negligible flaw crack extension over a 60-year service life (assumed 6000 pump starts). The evaluation is therefore valid for the period of extended operation. This TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

19A.3.6.5 Reactor Vessel Underclad Cracking Analyses

Reactor vessel underclad cracking has been addressed in the STP vessel low-alloy steel (SA-508, Class 2) forgings by weld cladding processes designed to avoid these defects, consistent with Regulatory Guide 1.43. WCAP-15338-A found that the maximum flaw predicted by the crack growth analysis is less than the ASME Section XI allowable flaw size and does not represent a challenge to reactor vessel integrity for an operating term of 60 years. WCAP-15338-A assumes 1.5 times the numbers of cyclic and transient loads assumed for the original 40-year life which bounds the numbers of cycles projected in 60 years. This TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

TABLE 19A.4-1

LICENSE RENEWAL COMMITMENTS

STPNOC will utilize the STP commitment tracking system to track regulatory commitments.

Item #	Commitment	LRA Section	Implementation Schedule
1	Enhance the Water Chemistry program procedures to: • include a statement that the sampling frequency for the primary and secondary water systems is temporarily increased whenever corrective actions are taken to address an abnormal chemistry condition for action level parameters, and that this increased sampling is utilized to verify that the desired condition has been achieved, and when it is achieved the sampling frequencies are returned to the EPRI recommended frequencies.	B2.1.2	Completed CR 10-23251
2	Enhance the Boric Acid Corrosion program procedures to: • state that susceptible components adjacent to potential leakage sources include electrical components and connectors. The program will also state that it is applicable to other materials (such as aluminum and copper alloy) that are susceptible to boric acid corrosion.	B2.1.4	Completed CR 10-23254

LICENSE RENEWAL COMMITMENTS

Item #	Commitment	LRA Section	Implementation Schedule
3	• Enhance the Bolting Integrity program procedures to: • conform to the guidance contained in EPRI TR-104213 • evaluate loss of preload of the joint connection, including bolt stress, gasket stress, flange alignment, and operating condition to determine the corrective actions consistent with EPRI TR-104213. • Require a leak check of ASME pressure boundary bolted connections where the internal environment consists of dry gas, or compressed air using a method that detects leakage such as a visual inspection for discoloration, monitoring and trending for pressure decay, leak fluid detection, or when the temperature of the system is higher than ambient conditions thermography testing. • ASME pressure boundary bolted connections where the internal environment consists of air at atmospheric pressure are checked for tightness prior to the period of extended operation and once every six years thereafter.	B2.1.7	Complete no later than six months prior to the period of extended operation CR 10-23255-1
4	Enhance the Open-Cycle Cooling Water System program procedures to: • include visual inspection of the strainer inlet area and the interior surfaces of the adjacent upstream and downstream piping. Material wastage, dimensional change, discoloration, and discontinuities in surface texture will be identified. These inspections will provide visual evidence of loss of material and fouling in the ECW system and serve as an indicator of the condition of the interior of ECW system piping components otherwise inaccessible for visual inspection. • include the acceptance criteria for this visual inspection, • require a minimum of 25 ECW piping locations be measured for wall thickness prior to the period of extended operation. Selected areas will include locations considered to have the highest corrosion rates, such as areas with stagnant flow, • require an engineering evaluation after each inspection of the aluminum-bronze piping inserted inside the slip-on flange downstream of the CCW heat exchanger,	B2.1.9	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23256

Item #	Commitment	LRA Section	Implementation Schedule
	• require the engineering evaluation calculated wear over the next inspection interval using a margin of four years of wear at the actual yearly wear rate, require corrective action in accordance with the corrective action program be initiated If the calculated wear indicates that the aluminum-bronze piping wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate),require loss of material in piping and protective coating failures be documented in the corrective action program, and require an engineering evaluation be performed when loss of material in piping or protective coating failures is identified. Enhance the Open-Cycle Cooling Water System program procedures to: • inspect every six years, and test after 12 years of service at a six year frequency 100 percent of the coating applied on the essential chiller water box covers, standby diesel generator (SDG) jacket water coolers, SDG lube oil coolers, SDG intercoolers and interconnection piping. The coating test performed are low voltage holiday test per ASTM D5162-08, dry film thickness test per ASTM D7091-13 and Steel Structures Painting Council (SSPC) PA-2 January 2015, and pull off adhesion test per ASTM D4541-09, (Note: the following train/trains of SDG intercooler's interconnection piping changed material to AL-6XN Stainless Steel UNS N08367 without internal coating and is/are excluded from internal coating inspection scope: 1B, 2A) • require coating inspections and tests be performed by a qualified Nuclear Coating Specialist (NCS) as defined by ASTM D7108 endorsed in RG 1.54 • require monitoring and trending of coatings installed on the internals of in-scope components. • require coatings specialist prepare a post-inspection report that includes a list and location of all areas of deterioration that were remediated. • specify the acceptance criteria for coatings as no blistering, cracking, erosion, cavitation erosion, flaking, peeling, delamination, rusting or physical damage of		Complete no later than the date the renewed operating license is issued

CN-3289 and CN-3316

Item #	Commitment	LRA Section	Implementation Schedule
	the coatings installed on the internals of in-scope components is observed. • require coatings not meeting these criteria be considered degraded and a condition report be initiated to document and resolve the concern; and • require degraded coating be removed to sound material and replaced with new coating; • require physical testing where physically possible be performed in conjunction with repair or replacement of coatings.		
5	Enhance the Closed-Cycle Cooling Water System program procedures to: • include visual inspection of representative samples of each combination of material and water treatment program at least every ten years and opportunistically, and include acceptance criteria.	B2.1.10	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23257-1
6	Enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program procedures to: • inspect crane structural members for loss of material due to corrosion and rail wear.	B2.1.11	Completed CR 10-23258
7	Enhance the Fire Protection program procedures to:	B2.1.12	Complete no later

Item #	Commitment	LRA Section	Implementation Schedule
	• provide inspections to detect the following penetration seal deficiencies: signs of degradation such as cracking, seal separation from walls and components, separation of layers of material, rupture and puncture of seals, • include qualification criteria for individuals performing inspections of fire doors, fire barrier penetration seals, fire barrier walls, ceilings and floors in accordance with NUREG-1801, • include the following fire barrier inspection acceptance criteria: no cracks, spalling, or loss of material that would prevent the barrier from performing its design function, and • provide visual inspection for degradation, corrosion and mechanical damage on Halon system components at least once every six months.		than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23259
8	Enhance the Fire Water System program procedures to perform periodic inspections, testing, and cleaning on the following: • include volumetric examinations or direct measurement on representative locations of the fire water system to determine pipe wall thickness, • replace sprinklers prior to 50 years in service or field service test a representative sample and test every 10 years thereafter to ensure signs of degradation are detected in a timely manner, and • trending of fire water piping flow parameters recorded during fire water flow tests. • Sprinkler inspections every 24 months per NFPA 25, 2011 Edition Section 5.2.1.1, • 50-year sprinkler replacement or testing per NFPA 25, 2011 Edition Section 5.3.1,	B2.1.13	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23260

CN-3294

CN-3294

TABLE 19A.4-1 (Continued)

LICENSE RENEWAL COMMITMENTS

Item #	Commitment	LRA Section	Implementation Schedule
	• Standpipe and hose systems flow tests every 5 years on hose stations located below the level of the fire main, located nearest to where the fire main enters the building or in buildings with multiple fire main supplies would require multiple lowest level hose stations to be tested. • Underground and exposed piping flow tests every 5 years per NFPA 25, 2011 Edition Section 7.3.1, • Hydrants flow testing and visually inspection annually per NFPA 25, 2011 Edition Section 7.3.2, • Fire pumps suction screens cleaning and inspections per NFPA 25, 2011 Edition Section 8.3.3.7, • Fire water storage tank exterior inspections annually per NFPA 25, 2011 Edition Section 9.2.5.5, • Fire water storage tank coated interior surfaces are inspected every 5 years per NFPA 25, 2011 Edition Section 9.2.6. Testing is performed in accordance with NFPA 25, 2011 Edition Section 9.2.7 whenever there is evidence of pitting and corrosion below nominal wall depth or failure of tank coatings. Additionally, bottom thickness ultrasonic tests are done at least once every 10 years. • Main drain testing every 18 months per NFPA 25, 2011 Edition Section 13.2.5, • Deluge Valve testing every 24 months per NFPA 25 Sections 13.4.3.2.2 through 13.4.3.2.5, • Water Spray Fixed System strainers cleaning and inspections per NFPA 25, 2011 Edition Section 10.2.1.6, 10.2.1.7, 10.2.7, • Spray/sprinkler nozzles full flow test every 18 months per NFPA 25, 2011 Edition Section 10.3.4.3,		

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Item #	Commitment	LRA Section	Implementation Schedule
	• Foam water sprinkler systems spray nozzle strainers per NFPA 25, 2011 Edition Section 11.2.7.1, • Foam water sprinkler systems operational test discharge patterns annually per NFPA 25 Section 11.3.2.6, • Foam water sprinkler systems storage tank visual inspection for internal corrosion once every 10 years, and • Internal surface of piping and branch lines obstruction inspections every 5 years per NFPA 25 Sections 14.2 and 14.3. Procedures will be enhanced to: • perform follow-up volumetric wall thickness examinations when surface irregularities are detected; • perform either flow testing or flushing sufficient to detect flow blockage or 100 percent visually inspection in each 5-year interval, beginning 5 years prior to the period of extended operation on portions of water-based fire protection components that have been wetted but are normally dry or piping segments that cannot be drained or segments that allow water to collect; • perform volumetric wall thickness inspection are performed on 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect in each 5-year interval of the prior to the period of extended operation. The 20 percent of piping inspected in each 5-year interval shall be in different location than previously inspected piping; • monitor and trend fire water piping flow parameters recorded during fire water flow tests;		

Item #	Commitment	LRA Section	Implementation Schedule
	• specify the acceptance criteria to be: ○ Minimum design fire water piping wall thickness is maintained. ○ Fouling shall not be observed during inspections of sprinklers and associated piping in the sprinkler system that could cause flow blockage. ○ Sprinklers that show signs of leakage or corrosion shall be replaced. If any sprinklers fails the representative sample testing required for sprinkler in service for 50 years, all sprinklers within the are represented by the sample will be replaced. ○ Sufficient foreign organic or inorganic material obstructing pipe or sprinklers is removed and its source is determined and corrected; • manage coatings installed on the internals of in-scope fire water components for loss of coating integrity; • visually inspect the coatings on fire water storage tank every 5 years as outlined by NFPA-25, 2011 Edition; • inspect 100 percent of the coatings installed on the internals of non-tank in-scope fire water components every six years, and tested after 12 years of service at a six-year frequency. Replaced coatings are inspected every 4 years until there are three consecutive inspections with no change in the coating condition. Following three consecutive inspections with no change in the coating condition the 6 year inspection interval can be restored. The coating tests performed are low voltage holiday test per ASTM D5162-08, dry film thickness test per ASTM D7091-13 and Steel Structures Painting Council (SSPC) PA-2 January 2015, and pull off adhesion test per ASTM		

Item #	Commitment	LRA Section	Implementation Schedule
	D4541-09. Coating inspections and tests are performed by a qualified Nuclear Coating Specialist (NCS) as defined by ASTM D7108 endorsed in RG 1.54; • monitor and trend coatings installed on the internals of in-scope fire water components; • require coatings specialist prepare a post-inspection report that includes a list and location of all areas of deterioration that were remediated. • specify the acceptance criteria for coatings as no blistering, cracking, erosion, cavitation erosion, flaking, peeling , delamination, rusting or physical damage of the coatings installed on the internals of in-scope fire water components is observed; • require coatings not meeting the acceptance criteria be considered degraded and a condition report be initiated to document and resolve the concern and, • require degraded coating be removed to sound material and replaced with new coating; • require physical testing where physically possible in conjunction with repair or replacement of coatings.		
9	Enhance the Fuel Oil Chemistry program procedures to: • check and remove the accumulated water from the SBDG DGFOST tanks, and storage tanks associated with the BOP, lighting diesel generator, and fire water pump diesel generators. A minimum frequency of water removal from the fuel oil tanks will be included in the procedure, • include 10-year periodic draining, cleaning, and inspection for corrosion of the lighting diesel generator fuel oil tank, BOP diesel generator fuel oil day tanks, and diesel fire pump fuel oil storage tanks,	B2.1.14	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO,

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	• require periodic testing of the lighting diesel generator fuel oil tank and the SDG and diesel fire pump fuel oil storage tanks for microbiological organisms, • require analysis for water, biological activity, sediment, and particulate contamination of the diesel fire pump fuel oil storage tanks, lighting diesel generator fuel oil tank, and the BOP diesel generator fuel oil day tanks on a quarterly basis, • conduct ultrasonic testing or pulsed eddy current thickness examination to detect corrosion-related wall thinning once on the FOST tank bottoms for the SDG, diesel fire pump fuel oil storage tanks, and the BOP diesel generator fuel oil day tanks, and • incorporate the sampling and testing of the diesel fire pump fuel oil storage tanks for particulate contamination and water to incorporate the trending of water, particulate contamination, and microbiological activity in the SDG and diesel fire pump fuel oil storage tanks, lighting diesel generator fuel oil tank, and the BOP diesel generator fuel oil day tanks.		whichever occurs later. CR-10-23261
10	Enhance the Reactor Vessel Surveillance program procedures to: • include the withdrawal schedule and analysis of the ex-vessel dosimetry chain, • demonstrate that the reactor vessel inlet and out nozzles are exposed to a fluence of less than 10^{17} n/cm^2, or will incorporate the adjusted reference temperature (ART) for the inlet and outlet nozzles with bounding chemistry and fluence values into the P-T limit curves, • enhance the program to include the Unit 2 bottom head torus in the Reactor Vessel Surveillance program.	B2.1.15	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

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			CR-10-23262
11	Implement the One-Time Inspection (OTI) program as described in LRA Section B2.1.16.	B2.1.16	Start implementation during the 10 years prior to the period of extended operation. . Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR-10-23263
12	Implement the Selective Leaching of Materials program as described in LRA Section B2.1.17.	B2.1.17	Start implementation during the five years prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23267
13	Enhance plant specifications to:	B2.1.18	

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	• Lower coated piping carefully into a trench to avoid external coating damage. • Use proper storage and handling practices to prevent damage to pipe coating prior to installation. These practices include padded storage, use of proper slings for installation and ultraviolet light resistant topcoats. • Over excavate trenches and use qualified backfill for bedding piping. Take care during backfilling to prevent rocks and debris from striking and damaging the pipe coating. • Include the coating used for copper alloy buried piping in the coating database. The coating system must be in accordance with NACE SP0169-2007, and will be used for repair or for new coatings of the buried copper alloy piping in the essential cooling water system. • Coat the portion of the essential cooling water system copper alloy piping directly embedded in backfill or directly encased in concrete, extending the coating 2 feet or more above grade. • Enhance the Buried Piping and Tanks Inspection program procedures to: • Specify that in lieu of visual inspections of the fire protection system (FP), this program credits flow testing of the fire mains as described in Section 7.3 of NFPA 25, 2011 Edition. • Consider backfill located within 6 inches of the pipe, and consistent with ASTM D 448-08 size number 67, acceptable. Backfill quality is determined through examination during the inspections conducted by the program. Backfill that does not meet the ASTM criteria, during the initial and subsequent inspections of the program, is considered acceptable if the inspections of buried piping do not reveal evidence of mechanical damage to the pipe coatings due to the backfill. • Ensure the cathodic protection system survey is performed annually. • Monitor the output of the cathodic protection system rectifiers every 2 months.		Start implementation during the 10 years prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23268

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	The measured current at each rectifier is recorded and compared against a target value. Following the completion of the plant yard cathodic protection system annual survey, record the current of the rectifier used to achieve an acceptable pipe/soil potential. That current will be the target current for the rectifier until the next annual survey. If the current measured at the rectifier during the bimonthly monitoring deviates significantly from the target value, a condition report should be created. The rectifier current should be adjusted to an acceptable value. The results of the survey will be documented and trended to identify degrading conditions. When degraded rectifier performance is identified, documentation is required in accordance with the corrective action program. The system should not be operated outside of established acceptable limits for longer than 90 days. • Recommend increased monitoring of the cathodic protection system and/or additional inspections if adverse indications are discovered during the monitoring of the cathodic protection system. • Evaluate the effectiveness of isolating fittings, continuity bonds and casing isolation, during the plant yard cathodic protection system annual survey. This may be accomplished through electrical measurements. • The personnel performing the plant yard cathodic protection system annual survey must be NACE-certified, certified by a site-approved training procedure consistent with the NACE requirements, or supervised by a NACE-certified inspector. • Use of excessive cathodic protection polarized potential on coated piping should be avoided. The limiting critical potential should not be more negative than 1200 mV relative to a CSE. • Visually inspect buried piping and, if significant indications of degradation are observed, the visual inspections are supplemented by surface and/or volumetric non-destructive testing. • Specify uncoated stainless steel piping and coated stainless steel piping where		

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	the coating is not well-adhered be inspected using a surface examination or other method capable of detecting cracking. Coatings that are intact, well-adhered, and otherwise sound for the remaining inspection interval, and coatings exhibiting small blisters that are few in number and completely surrounded by sound coating bonded to the substrate do not have to be removed. • Define the inspection interval for the program directed inspections as every 10 years, beginning the 10 year interval prior to the period of extended operation. • Select the buried and underground piping inspection locations based on risk, considering susceptibility to degradation and consequences of failure. • The risk ranking for buried piping should consider characteristics such as coating type, coating condition, cathodic protection efficiency, backfill characteristics, soil resistivity, pipe contents, and pipe function. • The risk ranking for underground piping should consider characteristics such as coating type, coating condition, exact external environment, pipe contents, pipe function, and flow characteristics within the pipe. • The risk ranking should generally give piping systems that are backfilled using compacted aggregate a higher inspection priority than comparable systems that are completely backfilled using controlled low strength material. • External Corrosion Direct Assessment, as described in NACE Standard Practice SP0502-2010, will be considered for use in identifying inspection locations. • Credit opportunistic examinations of non-leaking pipes toward required examinations, only if they meet the risk ranking selection criteria. • Guided wave ultrasonic, or other advanced inspection techniques should be used, if practical, for the purpose of determining piping locations that should be inspected. These inspections may not be used as substitutes for inspections required by the program. • Credit an inspection of piping shared between Units 1 and 2 toward the required		

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	inspections and inspections are distributed evenly among the units. • Examine any piping, valves and closure bolting exposed during inspections. • Examine bolting for loss of material and loose or missing fasteners. • Include two alternatives to directed inspections of the buried or underground piping that is within the scope of license renewal. The first alternative is to hydrostatically test 25 percent of the subject piping to 110 percent of the design pressure of any component within the boundary with test pressure being held for eight hours on an interval not to exceed 5 years. The second is an internal inspection of 25 percent of the subject piping by a method capable of accurately determining pipe wall thickness on an interval of every 10 years. • Flow testing of the fire mains, as described in NFPA 25, 2011 Edition, to detect degradation of the buried pipe in lieu of visual inspections of the fire protection system buried and underground piping. • Specify that each inspection will examine either the entire length of a run of pipe, or a minimum of 10 feet. If the entire run of pipe of that material type is less than 10 feet in total length, then the entire run of pipe should be inspected. The inspection consists of a 100 percent visual inspection of the exposed pipe. • Specify that if a transition from Category C to Category E or from Category E to Category F occurs in the latter half of the current 10-year interval, the timing of the additional examinations is based on the severity of the degradation identified and is commensurate with the consequences of a leak or loss of function. In all cases, the examinations are completed within 4 years after the end of the particular 10-year interval. These additional inspection conducted in an inspection interval cannot be credited towards the base number of inspections required for the 10-year interval. • Specify where steel or copper alloy piping has been coated with the same coating system and the backfill has the same requirements, the total inspections for this piping may be combined to satisfy the recommended inspection quantity. For example, for Category F, 10 percent of the total of the associated		

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	steel or copper alloy is inspected; or 9 10-foot segments of steel or copper alloy piping are inspected. • Specify that Category C inspections be used when the external cathodic protection system for buried steel or copper alloy pipe meets the acceptance criteria. Category C inspections are 0.5 percent Not-to-Exceed (NTE) two inspections of that piping per inspection period performed. • Specify that Category E inspections be used when the cathodic protection system has been installed but the portions of the piping covered by that system fail to meet the acceptance criteria. Category E inspections are 5 percent, NTE 5. The following condition must be present. • Coatings and backfill are provided in accordance with STP backfill specification. • There have been no leaks in buried piping due to external corrosion and no significant coating degradation or metal loss in more than 10 percent of inspections conducted. • Soil has been demonstrated to be not corrosive for the material type using the following. • A minimum of three sets of soil samples will be obtained in the vicinity where the cathodic protection system fails to meet the acceptance criteria. • The soil will be tested for soil resistivity, corrosion accelerating bacteria, pH, moisture, chlorides, sulfates, and redox potential. • The potential soil corrosivity will be determined for each material type of buried in-scope piping in the vicinity of the failed cathodic protection system. In addition to evaluating each individual parameter, the overall soil corrosivity will be determined. • If portions of the installed cathodic protection system fail to meet the acceptance criteria, soil testing will be conducted at a minimum of once in each 10-year period starting at the time when it was determined that the cathodic protection		

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	system failed to meet the acceptance. • Specify that inspection scope for piping that does not meet Category C or E inspection schedule requirements is 10 percent, NTE 9 inspections. • Specify that the AF system underground uncoated stainless steel piping located in a vault and buried coated stainless steel piping will undergo two inspections each 10-year inspection period. • Specify that the OW system underground piping will undergo 2% NTE 3 inspection each 10-year inspection period. • Include acceptance criteria for the cathodic protection to be operational (available) at least 85 percent of the time since either 10 years prior to the period of extended operation or since installation or refurbishment, whichever is shorter. • Include acceptance criteria for the cathodic protection system to provide protection for buried piping at least 80 percent of the time since either 10 years prior to the period of extended operation or since installation or refurbishment, whichever is shorter. • Include examples of adverse indications discovered during piping inspections. • Repair or replacement of the affected component when adverse indications failing to meet the acceptance criteria described in the program are discovered. • Specify that if adverse indications are detected, an expansion of the sample size is conducted. The number of inspections within the affected piping categories is doubled or increased by 5, whichever is smaller. If adverse indications are found in the expanded sample, an analysis is conducted to determine the extent of condition and extent of cause. The size of the follow-on inspections will be determined based on the extent of condition and extent of cause. The timing of the additional examinations should be based on the severity of the degradation identified and should be commensurate with the consequences of a leak or loss of function. However, in all cases, the expanded sample inspections should be		

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	completed within the 10-year interval in which the original inspection was conducted or, if identified in the latter half of the current 10-year interval, within 4 years after the end of the 10-year interval. If adverse conditions are extensive within the 10-year interval in which the inspections were conducted or, if identified in the latter half of the current 10-year interval, within 4 years after the end of the 10-year interval, inspections may be halted in an area of concern that is planned for replacement, provided continued operation does not pose a significant hazard. Expansion of sample size may be limited to the piping subject to the observed degradation mechanism. • Observe for brittle failure at flanges, connections, and joints due to frost heaving, soil stresses, or ground water effects during inspection of buried piping. • Require trending cathodic protection system annual surveys results. • Where wall thickness measurements are conducted, the results should be trended if follow-up examinations are conducted. • Specify that the cathodic protection system pipe-to-soil potential when using a saturated copper/copper sulfate reference electrode must be at least -850 mV relative to a CSE, instant off for steel piping. 100 mV minimum polarizations is required for copper alloy piping. • Specify that if the cathodic protection system fails to meet the acceptance criteria of at least -850 mV relative to a CSE instant off for steel components the following alternatives may be used. • 100 mV minimum polarization • -750 mV relative to a CSE, instant off where soil resistivity is greater than 10,000 ohm-cm to less than 100,000 ohm-cm • -650 mV relative to a CSE, instant off where soil resistivity is greater than 100,000 ohm-cm • Verify less than 1 mil/year (mpy) loss of material.		

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	• Specify means to verify the effectiveness of the protection of the most anodic metal when alternatives are used are incorporated into the program. The external loss of material rate is verified by: • Every year when verifying the effectiveness of the cathodic protection system by measuring the loss of material rate. • Every 2 years when using the 100 mV minimum polarization. • Every 5 years when using the -750 mV or -650 mV criteria associated with higher resistivity soils. The soil resistivity is verified every 5 years. • Specify where electrical resistance corrosion rate probes are used the installation locations of the probes and the methods of use will be determined by qualified NACE CP4 Cathodic Protection Specialist. • Require the impact of significant site features (e.g., large cathodic protection current collectors, shielding due to large objects located in the vicinity of the protected piping) and local soil conditions be factored into placement of the probes and use of probe data. • Indicate that for coated piping, there should be no evidence of coating degradation. If coating degradation is present, it may be considered acceptable if it is determined to be insignificant by an individual possessing a NACE Coating Inspector Program Level 2 or 3 inspector qualification, or an individual has attended the Electric Power Research Institute (EPRI) Comprehensive Coatings Course and completed the EPRI Buried Pipe Condition Assessment and Repair Training Computer Based Training Course. • Specify where damage to the coating has been evaluated as significant and the damage was caused by non-conforming backfill, an extent of condition evaluation should be conducted to ensure that the as-left condition of backfill in the vicinity of observed damage will not lead to further degradation. • Specify that backfill is acceptable if the inspections do not reveal evidence that the backfill caused damage to the component's coatings or the surface of the		

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	component. • Indicate that for any hydrostatic tests credited by the program, the condition acceptance criteria is no visible indications of leakage and no drop in pressure within the isolated portion of the piping that is not accounted for by a temperature change in the test media or quantified leakage across test boundary valves. • Specify that if coated or uncoated metallic piping show evidence of corrosion, the remaining wall thickness in the affected area is determined to ensure that the minimum wall thickness is maintained. • Indicate that wall thickness will be extrapolated to next inspection for that pipe section or to the end of the period of extended operation in order for the component to meet acceptance criteria and to not conduct expanded inspections. • • Specify where wall thickness meets minimum wall thickness requirements, recommendations for expansion of sample size does not apply. • Require unacceptable cathodic protection survey results be entered into the plant corrective action program. • Specify that sources of leakage detected during pressure tests be identified and corrected. • Specify that indications of cracking are evaluated in accordance with applicable codes and plant-specific design criteria.		
14	• Implement the One-Time Inspection of ASME Code Class 1 Small-Bore Piping program as described in LRA Section B2.1.19.	B2.1.19	Start implementation during the 6 years prior to the period of extended operation. Inspections to be complete no later than six months prior

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			to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23270
15	Implement the External Surfaces Monitoring Program as described in LRA Section B2.1.20. Existing plant procedures will be enhanced to include the following: • Require a leak check of non-ASME pressure boundary bolted connections where the internal environment consists of dry gas, compressed air, or diesel exhaust using a method that detects leakage such as a visual inspection for discoloration, monitoring and trending for pressure decay, leak fluid detection, or when the temperature of the system is higher than ambient conditions thermography testing. • Require bolted connections where the internal environment consists of air at atmospheric pressure be checked for tightness prior to the period of extended operation and once every six years thereafter.	B2.1.20	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23272
16	Enhance the Flux Thimble Tube Inspection program to generate a new procedure that includes provisions to: • Perform a wall thickness eddy current inspection of all flux thimble tubes that form part of the reactor coolant system pressure boundary. The inspections are scheduled for each outage, and may be deferred by using an evaluation that considers the actual wear rate. • Evaluate flux thimble tube wear by design engineering personnel and perform	B2.1.21	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior

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	corrective actions based on evaluation results after each inspection. • Trend wall thickness measurements and calculate wear rates by design engineering personnel after each inspection. • Take corrective actions to reposition, cap or replace the tube, if the predicted wear (as a measure of percent through wall) for a given flux thimble tube is projected to exceed the established acceptance criterion prior to the next outage. Include a description of the testing and analysis methodology and percent through wall acceptance criteria of a maximum of 80 percent through wall loss. • Remove flux thimbles from service to ensure the integrity of the reactor coolant system pressure boundary for flux thimble tubes that cannot be inspected over the tube length, that are subject to wear due to restriction or other defect, and that can not be shown by analysis to be satisfactory for continued service.		to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23273
17	Implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program as described in LRA Section B2.1.22.	B2.1.22	Start implementation during the five year period prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23274
18	Enhance the Lubricating Oil Analysis program procedures to:	B2.1.23	Complete no later

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	• require analysis for particle count of the lubricating oil for the centrifugal charging pump, and • require that sample analysis data results, for which no acceptance criteria is specified, be evaluated and trended against baseline data and data from previous samples to determine the acceptability of oil for continued use.		than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23276
19	Implement the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as described in LRA Section B2.1.24.	B2.1.24	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23279
20	Enhance the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program procedures to:	B2.1.25	Complete no later than six months prior

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	• identify the cables, manholes, and trenches that are within the scope of the program, • require all in-scope non-EQ inaccessible medium and low voltage power cables (>400 volts) exposed to significant moisture be tested at least once every six years with the first test being completed prior to period of extended operation, • require that the acceptance criteria be defined prior to each test for the specific type of test performed and the specific cable tested, • require an engineering evaluation that considers the age and operating environment of the cable be performed when the test acceptance criteria are not met. The engineering evaluation shall consider the significance of the test or inspection results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test or inspection acceptance criteria, the corrective actions required, and the likelihood of recurrence. • inspect in-scope manholes and trenches based on plant specific operating experience with water accumulation, • require inspections being conducted at least annually, • event-driven inspections of in-scope manholes will be performed as an on-demand activity based on actual plant experience, perform direct observation that cables are not wetted or submerged, remove collected water and verification of sump pump operability, initiate a corrective action if wetted cables or inoperable sump pumps are found, inspect cables/splices and cable support structures if wetted cables are found, take corrective actions to keep cables dry, manhole inspection results are evaluated based on actual plant experience with the inspection frequency increased based on experience with water accumulation. testing of in-scope inaccessible medium and low voltage (>400 volts) power		to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR-10-23275-1

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	cables exposed to significant moisture using a test capable of detecting reduced insulation resistance, trend inspection and test results to provide additional information on the rate of cable insulation degradation, test frequency may be adjusted based on test results or operating experience, require that the acceptance criterion for manhole and trench be, cables/splices and support structures is that they are not submerged or immersed in water, and require an extent of condition when an unacceptable condition or situation is identified.		
21	Enhance the Metal Enclosed Bus program procedures to: • Identify the metal enclosed buses that are within the scope of the program. • Inspect internal portions of all MEBs for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion every 10 years. • Inspect non-segregated phase bus insulation and isolated phase bus insulators for signs of embrittlement, cracking, melting, swelling, or discoloration every 10 years. • Inspect internal bus supports for structural integrity and signs of cracks every 10 years. • Inspect bus enclosure assemblies for loss of material due to corrosion and hardening of boots and gaskets every 10 years. • Inspect 20 percent of the population of non-segregated phase bus accessible bolted connections insulation material (with a maximum sample size of 25) for surface anomalies every five years. • Perform the first inspection of all portions of in-scope MEBs prior to the period of extended operation. • Identify acceptance criteria for non-segregated phase bus insulation and isolated phase bus insulators as no unacceptable visual indications of surface anomalies.	B2.1.26	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR-10-23280-1

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	• Identify acceptance criteria for non-segregated phase bus sections and internal portions of isolated phase bus as no unacceptable indications of corrosion, cracks, foreign debris, excessive dust buildup, loss of material, hardening, or evidence of water intrusion. • Identify acceptance criteria for the exterior of MEBs as no unacceptable indications of general corrosion. • Identify acceptance criteria for boots and gaskets as no unacceptable indications of cracking, checkering, or discoloration. • Identify acceptance criteria for accessible bolted connection insulation material as no unacceptable evidence of embrittlement, cracking, melting, discoloration, swelling, or surface contamination. Require an engineering evaluation when acceptance criteria are not met, to include a determination of corrective actions Require an engineering evaluation to determine whether the unacceptable conditions may be applicable to other accessible or inaccessible MEBs.		
22	Enhance the ASME Section XI, Subsection IWL program procedures to: • incorporate the 2004 Edition of ASME Section XI, Subsection IWL (no addenda), supplemented with the applicable requirements of 10 CFR 50.55a(b)(2).	B2.1.28	Completed CR 10-23597
23	• Enhance the ASME Section XI, Subsection IWF program procedures to: • incorporate the 2004 Edition of ASME Section XI, Subsection IWF (with no addenda). • specify the preventive actions for storage, protection and lubricants recommended in Section 2 of Research Council for Structural Connections publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for ASTM A325, ASTM F-1852 and /or ASTM 490 bolts, and • specify that visual examinations are augmented with volumetric examinations, in accordance with ASME Code Section XI, Table IWB-2500-1, Examination	B2.1.29	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage

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	Category B-G-1, to detect stress corrosion cracking for 20 percent (25 bolts maximum per unit) of high strength bolts greater than 1-inch nominal diameter and with an actual yield strength greater than or equal to 150 ksi.		prior to the PEO, whichever occurs later. CR 10-23598-1
24	• Enhance the 10 CFR Part 50 Appendix J program procedures to: • specify a surveillance frequency of 15 years following a successful Type A test.	B2.1.30	Complete no later than six months prior to the period of extended operation. CR 15-848-5

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25	• Enhance the Structures Monitoring Program procedures to: • include the switchyard control building into the scope of the Structures Monitoring Program, • specify inspections of seismic gaps, caulking and sealants, duct banks and manholes, valve pits and access vaults, doors, electrical conduits, raceways, cable trays, electrical cabinets/enclosures and associated anchorage, • monitor at least two groundwater samples every five years for pH, sulfates, and chloride concentrations, • specify that the inspection frequency for structures within the scope of license renewal will be in accordance with ACI 349.3R, Table 6.1, which specifies: • For below-grade structures and structures in controlled interior environment (except inside primary containment), all accessible areas of both units will be inspected every 10 years. • For all other structures (including inside primary containment), all accessible areas of both units will be inspected every 5 years., • specify inspector qualifications in accordance with ACI 349.3R-96, • require the performance of a periodic visual inspection of the accessible sections of the spent fuel pool and transfer canal tell-tale drain lines for blockage every five years. The first inspection will be performed within the 5 years before entering the period of extended operation, • specify ACI 349.3R-96 and ACI 201.1R-68 as the basis for defining quantitative acceptance criteria, and • specify the preventive actions for storage, protection and lubricants recommended in Section 2 of Research Council for Structural Connections publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for ASTM A325, ASTM F1852 and/or ASTM 490 bolts. • Procedures will be enhanced to perform opportunistic inspections of exposed	B2.1.32	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later CR 10-23600-1

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	portions of the below-grade concrete when excavated for any reason, • Procedures will be enhanced to require an evaluation should ground water be determined to be aggressive or inspections of accessible concrete structural elements identify degradation. The evaluation will be performed to determine the appropriate actions necessary to assure that the affected structures will continue to perform their intended function. These actions may include increased visual inspections or other examination techniques. • specify that visual examinations will be augmented with volumetric examinations, in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, to detect SCC for 20 percent (25 bolts maximum) of high strength bolts greater than 1-inch nominal diameter and with an actual yield strength greater than or equal to 150 ksi.		

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26	Enhance the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program procedures to: • Specify inspections of the essential cooling pond and ECW Intake and Discharge structures at intervals not to exceed five years or to immediately follow significant natural phenomena. • Specify essential cooling pond sediment monitoring be performed every ten years using soundings. • Specify the preventive actions for storage, protection and lubricants recommended in Section 2 of Research Council for Structural Connections publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for ASTM A325, ASTM F-1852 and /or ASTM 490 bolts. • Specify ACI 349.3R-96 and ACI 201.1R-68 as the basis for defining quantitative acceptance criteria. • Specify the essential cooling pond seepage rate evaluation be performed not less than once every 5 years. • Specify visual inspection of the essential cooling pond embankment lining for signs of erosion, loss of form as in degradation of slope protection features.	B2.1.33	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23601-1
27	Implement the PWR Reactor Internals program as described in LRA Section B2.1.35.	B2.1.35	Completed CR 10-23602
28	Implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as described in LRA Section B2.1.36.	B2.1.36	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the

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			end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23603
29	As additional industry and plant-specific applicable operating experience becomes available, it will be evaluated and incorporated into each aging management program or in the development of a new aging management program(s), as necessary, to provide assurance that the effects of aging will be managed during the period of extended operation.	B2.1.16 B2.1.17 B2.1.19 B2.1.20 B2.1.22 B2.1.24 B2.1.35 B2.1.36 B1.4	Start implementation within ten years prior to entering the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23604
30	Enhance the Metal Fatigue of Reactor Coolant Pressure Boundary program procedures to: • include additional locations necessary to ensure accurate calculations of fatigue, • include additional transients that contribute significantly to fatigue usage, include counting of the transients used in the fatigue crack growth analyses, which support the leak-before-break analyses and ASME Section XI evaluations to ensure the analyses remain valid,	B3.1	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the

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	• include additional transients necessary to ensure accurate calculations of fatigue, fatigue usage monitoring at specified locations, and specify the frequency and process of periodic reviews of the results of the monitored cycle count and CUF data at least once per fuel cycle, • include additional cycle count and fatigue usage action limits, which will invoke appropriate corrective actions if a component approaches a cycle count action limit or a fatigue usage action limit. The acceptance criteria associated with the NUREG/CR-6260 sample locations for a newer vintage Westinghouse plant will account for environmental effects on fatigue locations in the reactor coolant pressure boundary, and reactor vessel internals locations with fatigue usage calculations, and • include appropriate corrective actions to be invoked if a component approaches a cycle count action limit or a fatigue usage action limit. Acceptable corrective actions include fatigue reanalysis, repair, or replacement. Re-analysis of a fatigue crack growth analysis must be consistent with or reconciled to the originally submitted analysis and receive the same level of regulatory review as the original analysis.		end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23605
31	STPNOC will: A. For Reactor Coolant System Nickel-Alloy Pressure Boundary Components: (1) Implement applicable NRC Orders, Bulletins and Generic Letters associated with nickel-alloys; (2) implement staff-accepted industry guidelines, (3) participate in the industry initiatives, such as owners group programs and the EPRI Materials Reliability Program, for managing aging effects associated with nickel-alloys, and (4) upon completion of these programs, but not less than 24 months before entering the period of extended operation, STPNOC will submit an inspection plan for reactor coolant system nickel-alloy pressure boundary components to the NRC for review and approval, and B. For Reactor Vessel Internals: (1) Participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as	3.1	Concurrent with industry initiatives and upon completion submit an inspection plan and not less than 24 months before entering the period of extended operation. CR 10-23606

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	applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, STPNOC will submit an inspection plan for reactor internals to the NRC for review and approval.		
32	The seven diesel generator cooling water expansion joints that are projected to exceed the analyzed number of cycles during the period of extended operation will be replaced. The analyses for the replacement expansion joints will include the period of extended operation.	4.3.6	Complete no later than six months prior to the period of extended operation Replacement to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 10-23607
33	Periodic inspection of a sample of transmission conductor connections for loose connections using thermography is currently performed as part of the preventive maintenance activities. The periodic thermography will continue into the period of extended operation.	3.6.2.2.3	Continued into the period of extended operation CR 10-23608
34	Prior to the period of extended operation, STP will perform a review of design basis ASME Class 1 component fatigue evaluations to determine whether the NUREG/CR-6260-based components that have been evaluated for the effects of the reactor coolant environment on fatigue usage are the limiting components for the STP configuration. If more limiting components are identified, the most limiting component will be evaluated for the effects of the reactor coolant environment on fatigue usage. If the limiting location consists of nickel alloy, the methodology for nickel alloy in NUREG/CR-6909 will be used to perform the environmentally-assisted fatigue calculation. The additional evaluation will be performed through the Metal Fatigue of Reactor Coolant Pressure	B3.1	Complete no later than six months prior to the period of extended operation CR 11-17184

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	Boundary Program in accordance with 10 CFR 54.21 (c)(1)(iii).		
35	Enhance the ASME Section XI, Subsection IWE program procedures to: • specify the preventive actions for storage, protection and lubricants recommended in Section 2 of Research Council for Structural Connections publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for ASTM A325, ASTM F-1852 and /or ASTM 490 bolts,	B2.1.27	Complete no later than six months prior to the period of extended operation CR 11-19936-1
36	Enhance the Masonry Wall Program procedures to: • Procedures will be enhanced to specify that the inspection frequency for structures within the scope of license renewal will be in accordance with ACI 349.3R, Table 6.1, which specifies: • For below-grade structures and structures in controlled interior environment (except inside primary containment), all accessible areas of both units will be inspected every 10 years. • For all other structures (including inside primary containment), all accessible areas of both units will be inspected every 5 years.	B2.1.31	Complete no later than six months prior to the period of extended operation Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. CR 11-19937-1
37	Groundwater samples will be taken at multiple locations around the site every three months for at least 24 consecutive months. The samples will analyze for pH, sulfates, and chlorides. This sampling plan will begin no later than September 2012.	B2.1.32	Completed CR 11-20856-1
38	Enhance the Reactor Head Closure Studs program procedures to: • preclude the future use of replacement closure stud assemblies fabricated from material with an actual measure yield strength greater than or equal to 150 ksi. The use of currently installed components and any spare components which are currently on site is allowed.	B2.1.3	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later

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			than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later CR 11-22923-1
39	Enhance the Selective Leaching of Aluminum Bronze procedures to: • Visually examine aluminum bronze materials exposed during inspection of the buried essential cooling water piping for evidence of coating degradation and • If degradation is identified near a weld a volumetric examination will be performed to determine if cracking of the weld is occurring. • If a leak from buried aluminum bronze welds is discovered by surface water monitoring or during a buried ECW piping inspection, a section of each leaking weld will be removed for destructive metallurgical examination.	B2.1.37	No later than the date the renewed operating licenses are issued. CR 11-28986
40	Enhance the Protective Coating Monitoring and Maintenance Program procedures to specify: • Parameters monitored or inspected include any visible defects, such as blistering, cracking, flaking, peeling, rusting, and physical damage, as specified in ASTM D 5163-08. • Inspection frequencies, personnel qualifications, inspection plans, inspection methods, and inspection equipment that meet the requirements of ASTM D 5163-08. • A pre-inspection review is performed of the previous two monitoring reports and, based on inspection report results, prioritize repair areas as either needing repair during the same outage, needing repair during the next available outage,	B2.1.39	Complete no later than six months prior to the period of extended operation. Inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs

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	or re-evaluated in next available outage. • A standardized coating condition assessment report form that will include the identification of coatings found intact with no defects identified, and the identification of coatings that were not inspected and the reason why the inspection cannot be conducted. • A standardized coating condition assessment report that will include written and/or photographic documentation of coating inspection areas, failures, and defects. • Destructive/non-destructive tests are performed by individuals trained in the applicable referenced standards of Guide D5498 on an as-needed basis as determined by the Nuclear Coatings Specialist.		later. CR 12-8955
41	Enhance the STP Operating Experience Program and Corrective Action Program for managing the effects of aging to: • Add License Renewal Interim Staff Guidance and revisions to NUREG-1801, “Generic Aging Lessons Learned (GALL) Report”, to the Operating Experience Program (OEP) procedure as sources of information within the scope of this program, • Revise the OEP procedure to include “aging effects” to the list of characteristics for determining applicability of an OE document that may require further evaluation. A screened-in evaluation should consider (a) systems, structures, or components, (b) materials, (c) environments, (d) aging effects, (e) aging mechanisms, and (f) aging management programs, • Review the Corrective Action Program Event Codes to determine if additional codes are needed to ensure age-related degradation effects are identified, • Perform a training “needs analysis” for those plant personnel, including aging management program owners, who screen, assign, evaluate, implement, and submit plant-specific and industry operating experience information for age-	A1	No later than the date the renewed operating licenses are issued CR 12-8990

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	related effects. Include in the analysis: - A requirement that individuals complete training before performing tasks, and A- determination of the periodicity of the training. • Revise the OEP procedure to provide criteria for reporting plant-specific operating experience of age-related degradation.		
42	Enhance the Reactor Head Closure Studs program procedures to: • perform a remote VT-1 of stud insert #30 (Unit 2 only) concurrent with the volumetric examination once every 10 years to verify no additional loss of bearing surface area.	B2.1.3	Starting with the current (Third Interval) 10-year ASME Section XI inspection interval CR 12-15170
43	The seal cap enclosures from Unit 2 Safety Injection System Check Valve SI0010A and from Unit 1 and Unit 2 Chemical Volume Control System Check Valves CV0001, CV0002, CV0004, and CV0005 will be permanently removed. After removal of the seal cap enclosures, the component bolting will be replaced or inspected for intergranular stress corrosion cracking.	B2.1.7	Unit 1 completed Unit 2 completed CR 12-21155
44	The Selective Leaching of Aluminum Bronze program will: • Replace all aluminum bronze castings susceptible to selective leaching, including attachment welds related to the castings with material that is not susceptible to selective leaching. • Replace aluminum bronze root valve adapter socket welds with material that is not susceptible to selective leaching. • Replace extruded piping tees with aluminum bronze weld repairs where the repair size is such that failure of the repair would affect the structural integrity of the component. Enhance the Selective Leaching of Aluminum Bronze procedure to: • Specify loss of material due to selective leaching is monitored through system walkdowns and destructive examinations.	B2.1.37	Replacements and inspections to be complete no later than six months prior to the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later. Procedure changes no later than the date the renewed

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	• Specify cracking associated with selective leaching is monitored through volumetric examination and destructive examination. • Specify phase distribution to verify the potential for continuous selective leaching is monitored through destructive examination. • Verify the management of cracking of the above ground weld population with no backing rings by performing a one-time volumetric examination on 20 percent with a maximum of 25 welds prior to the period of extended operation. • Specify, if a weld indication that does not meet the acceptance criteria is found during the one-time inspection of welds with no backing rings, periodic volumetric examinations of 20 percent with a maximum of 25 welds will be performed every 10 years thereafter. • Verify, the management of cracking of the above ground weld population with backing rings by performing periodic volumetric examinations on 20 percent with a maximum of 25 welds prior to the period of extended operation and every 10 years thereafter. • Specify, the samples for volumetric examination be selected from the total population of above ground welds, considering construction and size distributions. • Verify, the management of loss of material due to selective leaching and microstructure phase distribution of the above ground weld population with and without backing rings by performing a one-time destructive examination on 20 percent with a maximum of 25 welds with backing rings and 20 percent with a maximum of 25 welds without backing rings prior to the period of extended operation. • Require the sample population for destructive examinations be selected from the total population of welds with and without backing rings, construction and size distribution. • Require a weld which does not meet the acceptance criteria, or has through wall leakage, be removed and destructively examined to determine extent of cracking, extent of selective leaching and the microstructure phase distribution. • Require a weld which does not meet the acceptance criteria or has through wall		operating licenses are issued. CR 12-22150

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	leakage, be documented in the corrective action program, and a structural integrity analysis be performed to confirm that the load carrying capacity of the installed welds remain adequate to support the intended function of the ECW system through the period of extended operation. • Require an external surface examination capable of detecting selective leaching will be performed on the buried ECW piping welds in the vicinity of degraded coatings to detect loss of material due to selective leaching. • Require that the history of the volumetric and destructive examinations results be maintained and a review be performed to identify potential adverse trends or other indications requiring action. • Specify, the acceptance criterion for volumetric examination of aluminum bronze welds is no detected planar indication that is surface connected (exposed to the ECW environment) unless the depth of the indication is contained within the 80% of the weld root pass region. An indication not connected to the surface (not exposed to the ECW environment) is acceptable. • Specify, the acceptance criterion for visual inspection of the aluminum bronze welds and adjacent copper alloy piping during the walkdowns is no through wall leakage. • Specify, the acceptance criterion for destructive examinations is; • No loss of material due to selective leaching penetrating 80% of the root-pass region. • Found selective leaching is non-propagating (surrounded by a non-continuous resistant phase distribution). • The microstructure of the weld root region shall exhibit a non-continuous resistant phase distribution consistent with the metallurgical technical basis report. • Specify, the acceptance criterion for TOFD UT examination is no loss of material due to selective leaching resulting in not meeting ASME Section XI Code required margins imposed by ASME Section XI structural factors for		

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	normal/upset and emergency/faulted conditions. • Specify, discovery of a weld indication that does not meet the acceptance criteria requires expansion of the volumetric examination sample population. Each weld found with a weld indication not meeting the acceptance criteria requires five additional volumetric examinations to be performed until no additional weld indication not meeting the acceptance criteria is found. Specify, discovery of selective leaching or continuous microstructure phase distribution that do not meet the acceptance criteria but the welds meets structural integrity requires performing the following: • Five TOFD UT examinations within 60 days for each weld not meeting acceptance criteria until no additional weld not meeting the acceptance criteria is found to. Welds for examination will be selected from the total population of above ground welds associated with the weld type (with or without backing ring) consider variability of construction, size distributions, structural integrity margins, and consequence of failure. • Periodic TOFD UT monitoring every 5 years of any welds not removed and previously found to not meet acceptance criterion but met structural integrity capability. These welds shall be monitored until 3 consecutive examinations identify no additional propagation of the selective leaching. • Periodic TOFD examinations of an additional 10% sample of the remaining above ground weld types every 5 years. The sample will be selected from the total population of above ground welds associated with the weld type (with or without backing ring) not meeting acceptance criteria, considering construction, size distributions, structural integrity margins, and consequence of failure. • A structural integrity evaluation on a weld not meeting acceptance		

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	criteria to confirm that the load carrying capacity of the installed welds remain adequate to support the intended function of the ECW system through the period of extended operation. • An AMP effectiveness evaluation to determine program changes required to manage the aging. Specify, discovery of loss of material due to selective leaching resulting in a weld not meeting ASME Section XI Code required margins with the weld declared operable per station Operability, Functionality, and Reportability procedure requires:. • An extent of condition evaluation to identify other locations requiring examination. These additional examinations will focus on stress margin locations less than or equal to that of the structurally unacceptable weld. • Monthly walkdowns of above ground aluminum bronze welds. • Monthly yard walkdowns to verify no through-wall leakage is occurring. • Performing TOFD UT examination on the remaining above ground weld population using a sample with a 95/95 confidence until no additional weld indication not meeting the TOFD UT examination acceptance criteria and within structural integrity is found. The weld population used to determine the 95/95 confidence sample will be based on the above ground weld types (with or without backing rings) and locations that would not meet code allowable margins when evaluated against the failed components degraded load carrying capability. The TOFD UT examinations will be prioritized by examining the weld locations with		

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	the least structural integrity margin and with the highest consequence of failure first. Planning and preparations for performing TOFD UT extent of condition examinations will commence upon discovery of the condition. The examinations will commence at the next ECW train outage and will sequence through all the ECW trains during each ECW train outage with at least 20% of the examinations being completed within 30 days and all examinations completed within 180 days. This allows for timely planning and execution of sequenced train by train examinations during first available train work windows. If a second weld is found that does not meet TOFD UT examination acceptance criteria; • Develop examination plan, schedule and bases for the examination of the remaining above ground welds. • Perform TOFD UT examinations on 100 percent of the remaining above ground welds to determine extent of condition with at least 20% of the examinations being completed within 30 days and all examinations completed within 180 days of finding the second weld. • Perform an evaluation of the below ground weld margins to identify locations requiring inspection. The evaluation will focus on below ground locations where structural integrity could be challenged based on the relative stress margins and the inspection results obtained on the above ground structurally unacceptable weld(s). • Preforming periodic 95/95 confidence sample TOFD UT examinations every 5 years on the remaining welds which have not been TOFD UT examined. The population used to determine the 95/95 confidence sample will be based on the above ground weld types (with or without backing rings). The sample will be selected from the total population of above ground welds associated with the weld type (with or without backing ring), considering variability of construction, size distributions, structural integrity margins, and consequence of		

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	failure. • Repair or replacement program of the susceptible welds within the STP Technical Specification requirements based on the cause of the structural integrity evaluation failure, results of the additional volumetric examinations and the extent of condition. • Specify, discovery of a weld not meeting ASME Section XI Code required margins with the weld declared inoperable per station Operability, Functionality, and Reportability procedure requires: • If the weld has been removed from service for examination, then the examination results will be used to determine past operability and reportability. • An extent of condition evaluation to determine the cause of the structural integrity evaluation failure and identify weld population requiring examination. • Performing TOFD UT examinations on 100% of the remaining above ground weld population. • The TOFD UT examinations will be prioritized by examining the weld locations with the least structural integrity margin and with the highest consequence of failure first. Planning and preparations for performing TOFD UT extent of condition examinations will commence upon discovery of the condition. The examinations will commence at the next ECW train outage and will sequence through all the ECW trains during each ECW train outage with at least 20% of the examinations being completed within 30 days and all examinations completed within 180 days. This allows for timely planning and execution of sequenced train by train examinations during first available train work windows. • An evaluation of the below ground weld margins to identify locations requiring inspection. The evaluation will focus on below ground locations where structural integrity could be challenged based on the relative stress margins and		

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	the inspection results obtained on the above ground structurally unacceptable weld(s). All below ground welds where the evaluation shows that the structural integrity could challenge operability will be examined using TOFD UT during the next scheduled refueling outage. • Twice a month above ground walkdowns of the aluminum bronze welds. • Twice a month yard walkdowns to verify no through-wall leakage is occurring. • Repair or replacement of the susceptible weld(s) based on the cause of the structural integrity evaluation failure, results of the additional TOFD UT examinations and the extent of condition. • Specify, the acceptance criterion for extent of loss of material on the external surface of buried aluminum bronze piping with coating degradation is that upon removal of the selective leaching the minimum wall thickness is maintained. • Specify, corrective action for selective leaching found under depredated ECW buried piping coatings such as surface conditioning is performed until no selective leaching is detected. If unacceptable wall thickness following surface conditioning is found, the buried ECW piping is repaired or replaced.		
45			All items incorporated into Item # 44 by NOC-AE-14003135 CR 12-26987
46	Leak rates that could occur upstream of any individual component supplied by the ECW system will be determined to validate the maximum size flaw for which piping can still perform its intended function. • A summary of the results of these leak rates will be provided to the NRC for	N/A	Completed Results submitted in NOC-AE-43003135

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	review.		CR 12-27257
47	• Unit 1 RWST only: Perform a one time internal tank bottom and side weld inspection to confirm the effectiveness of the corrective actions to repair the leaking tank floor 5 years prior to entering the period of extended operation. The inspection will include VTW; PT; and Vacuum Box (VB) Leak Test of susceptible locations of the floor bottom and side welds to ensure no leaks.	B2.1.20	Five years prior to the Period of Extended Operation CR 14-1154
48	Enhance the Steam Generator Tube Integrity program procedures to: • Specify perform visual inspections of the steam generator head internal areas (head interior surfaces, divider plate assemblies, tubesheets (primary side) and tube-to-tubesheet welds) for signs of cracking or loss of material. • Specify the frequency of the visual inspections be at least every 72 effective full power months or every third refueling outage whichever results in more frequent inspections. • Procedures will be revised to evaluate the acceptability of any degraded conditions of the divider plate assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) on a case-by-case basis.	B2.1.8	Complete no later than six months prior to the period of extended operation CR 16-15866