A.1 INTRODUCTION

This appendix provides the information submitted in an Updated Final Safety Analysis Report Supplement as required by 10 CFR 54.21(d) for the Indian Point Energy Center (IPEC) License Renewal Application (LRA). The LRA contains the technical information required by 10 CFR 54.21(a) and (c). Appendix B of the IPEC LRA provides descriptions of the programs and activities that manage the effects of aging for the period of extended operation. Section 4 of the LRA documents the evaluations of time-limited aging analyses for the period of extended operation. Appendix B and Section 4 have been used to prepare the program and activity descriptions for IP2 Updated Final Safety Analysis Report (UFSAR) Supplement information in this appendix.

With inclusion of the UFSAR Supplement in the UFSAR, future changes to the descriptions of the programs and activities will be made in accordance with 10 CFR 50.59.

A.2 NEW UFSAR SECTION FOR UNIT 2

The following information is being integrated into the UFSAR to document aging management programs and activities credited in the license renewal review and time-limited aging analyses evaluated for the period of extended operation. References to other sections are to UFSAR sections, not to sections in the LRA.

A.2.0 Supplement for Renewed Operating License

The Indian Point Energy Center license renewal application (Reference A.2-1) and information in subsequent related correspondence provided sufficient basis for the NRC to make the findings required by 10 CFR 54.29 (Final Safety Evaluation Report) (Reference A.2-2). As required by 10 CFR 54.21(d), this UFSAR supplement contains a summary description of the programs and activities for managing the effects of aging (Section A.2.1) and a description of the evaluation of time-limited aging analyses for the period of extended operation (Section A.2.2). The period of extended operation is the 20 years after the expiration date of the original operating license.

A.2.1 Aging Management Programs and Activities

The integrated plant assessment for license renewal identified 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) through the period of extended operation. This section describes the aging management programs and activities required during the period of extended operation. All aging management programs will be implemented prior to entering the period of extended operation.

IPEC quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The Entergy Quality Assurance Program applies to safety-related structures and components. Corrective actions and administrative (document) control for both safety-related and nonsafety-related structures and components are accomplished per the existing IPEC corrective action program and document control program and are applicable to all aging management programs and activities that will be required during the period of extended operation. The confirmation process is part of the corrective action program and includes reviews to assure that proposed actions are adequate, tracking and reporting of open corrective actions, and review of corrective action effectiveness. Any follow-up inspection required by the confirmation process is documented in accordance with the corrective action program. The corrective action, confirmation process, and administrative controls of the Entergy (10 CFR Part 50, Appendix B) Quality Assurance Program are applicable to all aging management programs and activities required during the period of extended operation.

The Operating Experience Program (OEP) and the Corrective Action Program (CAP) help to assure continued effectiveness of aging management programs through evaluations of

operating experience. The OEP implements the requirements of NRC NUREG-0737, "Clarification of TMI Action Plan Requirements," Section I.C.5 and evaluates site, Entergy fleet, and industry operating experience for impact on IPEC. The CAP implements the requirements of 10 CFR 50, Appendix B, Criterion XVI and is used to evaluate and effect appropriate actions in response to operating experience relevant to IPEC that indicates a condition adverse to quality or a non-conformance.

A.2.1.1 Aboveground Steel Tanks Program

The Aboveground Steel Tanks Program is an existing program that manages loss of material from external surfaces of aboveground carbon steel tanks by periodic visual inspection of external surfaces and thickness measurement of locations that are inaccessible for external visual inspection.

The Aboveground Steel Tanks Program will be enhanced to include the following.

- Revise applicable procedures to perform thickness measurements of the bottom surfaces of the condensate storage tank, city water tank, and fire water tank, once during the first 10 years of the period of extended operation.

- Revise applicable procedures to require trending of thickness measurements when material loss is detected.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.2 Bolting Integrity Program

The Bolting Integrity Program is an existing program that relies on recommendations for a comprehensive bolting integrity program, as delineated in NUREG-1339, industry recommendations, and Electric Power Research Institute (EPRI) NP-5769, with the exceptions noted in NUREG-1339 for safety-related bolting. The program relies on industry recommendations for comprehensive bolting maintenance, as delineated in EPRI TR-104213 for pressure retaining bolting and structural bolting.

The program applies to bolting and torquing practices of safety- and nonsafety-related bolting for pressure retaining components, NSSS component supports, and structural joints. The program addresses all bolting regardless of size except reactor head closure studs, which are addressed by the Reactor Head Closure Studs Program. The program includes periodic inspection of closure bolting for signs of leakage that may be due to crack initiation, loss of preload, or loss of material due to corrosion. The program also includes preventive measures to preclude or minimize loss of preload and cracking.

The Bolting Integrity Program will be enhanced to include the following.

- Revise applicable procedures to clarify that actual yield strength is used in selecting materials for low susceptibility to SCC and to clarify the prohibition on use of lubricants containing MoS_2 for bolting.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.3 Boraflex Monitoring Program

The Boraflex Monitoring Program is an existing program that assures degradation of the Boraflex panels in the spent fuel racks does not compromise the criticality analysis in support of the design of the spent fuel storage racks. The program relies on (1) areal density testing, (2) use of a predictive computer code, and (3) determination of boron loss through correlation of silica levels in spent fuel water samples to assure that the required 5% subcriticality margin is maintained. Corrective actions are initiated if the test results find that the 5% subcriticality margin cannot be maintained because of current or projected Boraflex degradation.

A.2.1.4 Boric Acid Corrosion Prevention Program

The Boric Acid Corrosion Prevention Program is an existing program that relies on implementation of recommendations of NRC Generic Letter 88-05 to monitor the condition of components on which borated reactor water may leak. The program detects boric acid leakage by periodic visual inspection of systems containing borated water for deposits of boric acid crystals and the presence of moisture; and by inspection of adjacent structures, components, and supports for evidence of leakage. This program manages loss of material and loss of circuit continuity, as applicable.

The program includes provisions for evaluation when leakage is discovered by other activities. Program improvements have been made as suggested in NRC Regulatory Issue Summary 2003-013.

A.2.1.5 Buried Piping and Tanks Inspection Program

The Buried Piping and Tanks Inspection Program is a new program that includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried and underground carbon steel, copper alloy, gray cast iron, and stainless steel components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance. If trending within the corrective action program identifies susceptible locations, the areas with a history of corrosion problems are evaluated for the need for additional inspection, alternate coating, or replacement.

IP2 will perform 20 direct visual inspections of buried piping during the 10 year period prior to the PEO. IP2 will perform 14 direct visual inspections during each 10-year period of the PEO. Soil samples will be taken prior to the PEO and at least once every 10 years in the PEO. Soil will be tested at a minimum of two locations at least three feet below the surface near in-scope

piping to determine representative soil conditions for each system. If test results indicate the soil is corrosive then the number of piping inspections will be increased to 20 during each 10-year period of the PEO.

The Buried Piping and Tanks Inspection Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.M34, Buried Piping and Tanks Inspection with the following modification.

The Buried Piping and Tanks Inspection Program will be modified based on operating experience to include a risk assessment of in-scope buried piping and tanks that includes consideration of the impacts of buried piping or tank leakage and of conditions affecting the risk for corrosion. The program will classify pipe segments and tanks as having a high, medium or low impact of leakage based on the safety class, the hazard posed by fluid contained in the piping and the impact of leakage on reliable plant operation. Corrosion risk will be determined through consideration of piping or tank material, soil resistivity, drainage, the presence of cathodic protection and the type of coating. Inspection priority and frequency for periodic inspections of the in-scope piping and tanks will be based on the results of the risk assessment. Inspections will be performed using qualified inspection techniques with demonstrated effectiveness, Inspections will begin prior to the period of extended operation. Underground piping within the scope of license renewal and subject to aging management review will be visually inspected prior to the period of extended operation and then on a frequency of at least once every two years during the period of extended operation. This inspection frequency will be maintained unless the piping is subsequently coated in accordance with the preventive actions specified in NUREG-1801 Section XI.M41 as modified by LR-ISG-2011-03. Visual inspections will be supplemented with surface or volumetric non-destructive testing if indications of significant loss of material are observed. Consistent with revised NUREG-1801 Section XI.M41, such adverse indications will be entered into the plant corrective action program for evaluation of extent of condition and for determination of appropriate corrective actions (e.g., increased inspection frequency, repair, replacement).

A.2.1.6 Containment Leak Rate Program

The Containment Leak Rate Program is an existing program. As described in 10 CFR Part 50, Appendix J, containment leak rate tests are required to assure that (a) leakage through reactor containment and systems and components penetrating containment shall not exceed allowable values specified in technical specifications or associated bases and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of containment, and systems and components penetrating containment.

A.2.1.7 Containment Inservice Inspection (CII) Program

The Containment Inservice Inspection Program is an existing program encompassing ASME Section XI Subsection IWE and IWL requirements as modified by 10 CFR 50.55a.

Visual inspections for IWE monitor loss of material of the steel containment liner and integral attachments; containment hatches and airlocks; moisture barriers; and pressure- retaining bolting by inspecting surfaces for evidence of flaking, blistering, peeling, discoloration, and other signs of distress.

Visual inspections for IWL monitor structural concrete surfaces for evidence of leaching, erosion, voids, scaling, spalls, corrosion, cracking, exposed reinforcing steel, and detached embedment.

The Containment Inservice Inspection (CII-IWL) Program will be enhanced to include the following.

- Revise applicable procedures to include inspections of containment using enhanced characterization of degradation (i.e., quantifying the dimensions of noted indications through the use of optical aids) during the period of extended operation. The enhancement includes obtaining critical dimensional data of degradation where possible through direct measurement or the use of scaling technologies for photographs, and the use of consistent vantage points for visual inspections.

A.2.1.8 Diesel Fuel Monitoring Program

The Diesel Fuel Monitoring Program is an existing program that entails sampling to ensure that adequate diesel fuel quality is maintained to prevent loss of material and fouling in fuel systems. Exposure to fuel oil contaminants such as water and microbiological organisms is minimized by periodically draining and cleaning tanks and by verifying the quality of new oil before its introduction into the storage tanks. Sampling and analysis activities are in accordance with technical specifications on fuel oil purity and the guidelines of ASTM Standards D4057-95 and D975-95 (or later revisions of these standards).

Thickness measurements of storage tank bottom surface verify that significant degradation is not occurring.

The One-Time Inspection Program describes inspections planned to verify the effectiveness of the Diesel Fuel Monitoring Program.

The Diesel Fuel Monitoring Program will be enhanced to include the following.

- Revise applicable procedures to include cleaning and inspection of the GT1 gas turbine fuel oil storage tanks, EDG fuel oil day tanks, and SBO/Appendix R diesel generator fuel oil day tank once every ten years.

- Revise applicable procedures to include quarterly sampling and analysis of the SBO/Appendix R diesel generator fuel oil day tank, security diesel fuel oil storage tank, and security diesel fuel oil day tank. Particulates (filterable solids), water and sediment checks will be performed on the samples. Filterable solids acceptance criterion will be

≤ 10mg/l. Water and sediment acceptance criterion will be ≤ 0.05%.

- Revise applicable procedures to include thickness measurement of the bottom surface of the EDG fuel oil storage tanks, EDG fuel oil day tanks, SBO/Appendix R diesel generator fuel oil day tank, GT1 gas turbine fuel oil storage tanks, GT2/3 fuel oil storage tank and diesel fire pump fuel oil storage tank once every ten years.

- Revise appropriate procedures to change the GT1 gas turbine fuel oil storage tanks and diesel fire pump fuel oil storage tank analysis for water and particulates to a quarterly frequency.

- Revise applicable procedures to specify acceptance criteria for thickness measurements of the fuel oil storage tanks within the scope of the program.

- Revise applicable procedures to direct samples be taken near the tank bottom and include direction to remove water when detected.

- Revise applicable procedures to direct sampling of the onsite portable fuel oil tanker contents prior to transferring the contents to the storage tanks.

- Revise applicable procedures to direct the addition of chemicals including biocide when the presence of biological activity is confirmed.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.9 Environmental Qualification (EQ) of Electric Components Program

The EQ of Electric Components Program is an existing program that manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluations. Some aging evaluations for EQ components are considered time-limited aging analyses (TLAAs) for license renewal.

A.2.1.10 External Surfaces Monitoring Program

The External Surfaces Monitoring Program is an existing program that inspects external surfaces of components subject to aging management review. The program is also credited with managing loss of material from internal surfaces, for situations in which internal and external material and environment combinations are the same such that external surface condition is representative of internal surface condition.

Surfaces that are inaccessible during plant operations are inspected during refueling outages. Surfaces that are insulated are inspected when the external surface is exposed (i.e., during

maintenance). Surfaces are inspected at frequencies to assure the effects of aging are managed such that applicable components will perform their intended function during the period of extended operation.

The External Surfaces Monitoring Program will be enhanced to include the following.

- Guidance documents will be revised to require periodic inspections of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(2).

Enhancements will be implemented prior to the period of extended operation.

A.2.1.11 Fatigue Monitoring Program

The Fatigue Monitoring Program is an existing program that tracks the number of critical thermal and pressure transients for selected reactor coolant system components. The program ensures the validity of analyses that explicitly analyzed a specified number of fatigue transients by assuring that the actual effective number of transients does not exceed the analyzed number of transients. The program provides for update of the fatigue usage calculations to maintain a cumulative usage factor (CUF) of < 1.0 for the period of extended operation. For the locations identified in Section A.2.2.2.4, updated calculations will account for the effects of the reactor water environment. These calculation updates are governed by Entergy's 10 CFR 50 Appendix B Quality Assurance (QA) program and include design input verification and independent reviews ensuring that valid assumptions, transients, cycles, external loadings, analysis methods, and environmental fatigue life correction factors will be used in the fatigue analyses. The program requires corrective actions including repair or replacement of affected components before fatigue usage calculations determine the CUF exceeds 1.0. Specific corrective actions are implemented in accordance with the IPEC corrective action program. Repair or replacement of the affected component(s), if necessary, will be in accordance with established plant procedures governing repair and replacement activities. These established procedures are governed by Entergy's 10 CFR 50 Appendix B QA program and meet the applicable repair or replacement requirements of the ASME Code Section XI.

The Fatigue Monitoring Program will be enhanced to include the following.

- Perform an evaluation to confirm that monitoring steady state cycles and feedwater cycles is not required or revise appropriate procedures to monitor steady state cycles. Review the number of allowed events and resolve discrepancies between reference documents and monitoring procedures.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.12 Fire Protection Program

The Fire Protection Program is an existing program that includes a fire barrier inspection, an RCP oil collection system inspection, and a diesel-driven fire pump inspection. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire rated doors to ensure that their operability is maintained. The diesel-driven fire pump inspection requires that the pump and its driver be periodically tested and inspected to ensure that diesel engine sub-systems including the fuel supply line can perform their intended functions.

The program also includes periodic inspection and testing of the Halon fire protection system.

The Fire Protection Program will be enhanced to include the following.

- Revise appropriate procedures to explicitly state that the diesel fire pump engine sub-systems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be revised to verify that the diesel engine does not exhibit signs of degradation while it is running; such as fuel oil, lube oil, coolant, or exhaust gas leakage.

- Revise appropriate procedures to specify that diesel fire pump engine carbon steel exhaust components are inspected for evidence of corrosion or cracking at least once each operating cycle.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.13 Fire Water System Program

The Fire Water System Program is an existing program that manages water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, piping, and components that are tested in accordance with applicable National Fire Protection Association (NFPA) codes and standards. Such testing assures functionality of systems. To determine if significant corrosion has occurred in water-based fire protection systems, periodic flushing, system performance testing and inspections are conducted. Also, many of these systems are normally maintained at required operating pressure and monitored such that leakage resulting in loss of system pressure is immediately detected and corrective actions initiated.

In addition, wall thickness evaluations of fire protection piping are periodically performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify loss of material due to corrosion.

A sample of sprinkler heads required for 10 CFR 50.48 will be inspected using the guidance of NFPA 25 (2002 Edition) Section 5.3.1.1.1, which states, "Where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing." This sampling will be repeated every 10 years after initial field service testing.

The Fire Water System Program will be enhanced to include the following.

- Revise applicable procedures to include inspection of hose reels for corrosion. Acceptance criteria will be revised to verify no unacceptable signs of degradation.

- Sprinkler heads required for 10 CFR 50.48 will be replaced or a sample tested using guidance of NFPA 25 (2002 edition), Section 5.3.1.1.1 before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

- Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.

- Revise applicable procedures to inspect the internal surface of the foam-based fire suppression tanks. Acceptance criteria will be enhanced to verify no significant corrosion.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.14 Flow-Accelerated Corrosion Program

The Flow-Accelerated Corrosion Program is an existing program that applies to safety-related and nonsafety-related carbon and low alloy steel components in systems containing high-energy fluids carrying two-phase or single-phase high-energy fluid $\geq$ 2% of plant operating time.

The program, based on EPRI guidelines in the Nuclear Safety Analysis Center (NSAC)-202L-R3 for an effective flow-accelerated corrosion program, predicts, detects, and monitors FAC in plant piping and other pressure retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm predictions. The program specifies repair or replacement of components as necessary. The aging effect of loss of material managed by the Flow Accelerated Corrosion Program is equivalent to the aging effect of wall thinning as defined in NUREG-1801 Volume 2 Table IX.E.

A.2.1.15 Flux Thimble Tube Inspection Program

The Flux Thimble Tube Inspection Program is an existing program that monitors for thinning of the flux thimble tube wall, which provides a path for the incore neutron flux monitoring system detectors and forms part of the RCS pressure boundary. Flux thimble tubes are subject to loss of material at certain locations in the reactor vessel where flow-induced fretting causes wear at discontinuities in the path from the reactor vessel instrument nozzle to the fuel assembly instrument guide tube. An NDE methodology, such as eddy current testing (ECT), is used to monitor for wear of the flux thimble tubes. This program implements the recommendations of NRC Bulletin 88-09, “Thimble Tube Thinning in Westinghouse Reactors”.

The Flux Thimble Tube Inspection Program will be enhanced to include the following.

- Revise appropriate procedures to implement comparisons to wear rates identified in WCAP-12866. Include provisions to compare data to the previous performances and perform evaluations regarding change to test frequency and scope.

- Revise appropriate procedures to specify the acceptance criteria as outlined in WCAP-12866 or other plant-specific values based on evaluation of previous test results.

- Revise appropriate procedures to direct evaluation and performance of corrective actions based on tubes that exceed or are projected to exceed the acceptance criteria.

- Stipulate in procedures that flux thimble tubes that cannot be inspected over the tube length and can not be shown by analysis to be satisfactory for continued service, must be removed from service to ensure the integrity of the reactor coolant system pressure boundary.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.16 Heat Exchanger Monitoring Program

The Heat Exchanger Monitoring Program is an existing plant-specific program that inspects heat exchangers for loss of material through visual or other non-destructive examination.

Heat exchanger tubes are inspected at frequencies based on plant-specific and application-specific knowledge, as well as past history, heat exchanger operating conditions, and heat exchanger availability. Inspection frequencies may be changed based on engineering evaluation of inspection results.

The Heat Exchanger Monitoring Program will be enhanced to include the following.

- Revise applicable procedures to include the following heat exchangers in the scope of the program.

- safety injection pump lube oil heat exchangers
- RHR heat exchangers
- RHR pump seal coolers
- non-regenerative heat exchangers
- charging pump seal water heat exchangers
- charging pump crankcase oil coolers
- charging pump fluid drive coolers
- spent fuel pit heat exchangers
- secondary system steam generator sample coolers
- waste gas compressor heat exchangers
- SBO/Appendix R diesel cooling water heat exchangers

- Revise appropriate procedures to perform visual inspection on heat exchangers where non-destructive examination, such as eddy current inspection, is not possible due to heat exchanger design limitations.

- Revise appropriate procedures to include consideration of material-environment combination when determining sample population of heat exchangers.

- Revise appropriate procedures establishing the minimum tube wall thickness for the new heat exchangers identified in the scope of the program. Revise appropriate procedures establishing acceptance criteria for heat exchangers visually inspected to include no unacceptable signs of degradation.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.17 Inservice Inspection – Inservice Inspection (ISI) Program

The ISI Program is an existing program based on ASME Section XI Inspection Program B (Section XI, IWA-2432), which has 10-year inspection intervals. Every 10 years the program is updated to the latest ASME Section XI code edition and addendum approved in 10 CFR 50.55a.

The program consists of periodic volumetric, surface, and visual examination of components and their supports for assessment of signs of degradation, flaw evaluation, and corrective actions.

On March 1, 2007, IP2 entered the fourth ISI interval. The ASME code edition and addenda used for the fourth interval is the 2001 Edition with 2003 addenda.

IPEC will perform twenty-five volumetric weld metal inspections of small-bore Class 1 socket welds during each 10-year ISI interval scheduled as specified by IWB-2412 of the ASME Section XI Code. In lieu of volumetric examinations, destructive examinations may be performed, where one destructive examination may be substituted for two volumetric examinations.

The current program ensures that the structural integrity of Class 1, 2, and 3 systems and associated supports is maintained at the level required by 10 CFR 50.55a.

A.2.1.18 Masonry Wall Program

The Masonry Wall Program is an existing program that manages aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.

The program includes visual inspection of all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are the 10 CFR 50.48-required masonry walls, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components.

Structural steel components of masonry walls are managed by the Structures Monitoring Program.

Masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

The Masonry Wall Program will be enhanced to include the following.

- Revise applicable procedures to specify that the IP1 intake structure is included in the program.

The enhancement will be implemented prior to the period of extended operation.

A.2.1.19 Metal-Enclosed Bus Inspection Program

The Metal-Enclosed Bus Inspection Program is an existing program that performs inspections on the following non-segregated phase buses.

- 6.9kV bus between station aux transformers and switchgear buses 1/2/3/4/5/6

- 480V bus between emergency diesel generators and switchgear buses 2A/3A/5A/6A

Inspections of the metal enclosed bus (MEB) include the bus and bus connections, the bus enclosure assemblies, and the bus insulation and insulators. A sample of the accessible bolted connections will be inspected for loose connections. The bus enclosure assemblies will be inspected for loss of material and elastomer degradation. This program will be used instead of the Structures Monitoring Program for external surfaces of the bus enclosure assemblies. The internal portions of the MEB will be inspected for foreign debris, excessive dust buildup, and evidence of moisture intrusion. The bus insulation or insulators are inspected for degradation leading to reduced insulation resistance (IR). The bus insulation will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or

aging degradation. The internal bus supports or insulators will be inspected for structural integrity and signs of cracks and corrosion. These inspections include visual inspections, as well as quantitative measurements, such as thermography or connection resistance measurements, as required.

The Metal-Enclosed Bus Inspection Program will be enhanced to include the following.

- Revise appropriate procedures to visually inspect the external surface of MEB enclosure assemblies for no unacceptable loss of material at least once every ten years. The inspection will occur prior to the period of extended operation and the acceptance criterion will be no significant loss of material.

- Revise appropriate procedures to inspect bolted connections at least once every five years if only performed visually or at least once every ten years using quantitative measurements such as thermography or contact resistance measurements. The first inspection will occur prior to the period of extended operation.

- Revise acceptance criteria of appropriate procedures for MEB internal visual inspections that will include the absence of indications of dust accumulation on the bus bar, on the insulators, and in the duct, in addition to the absence of indications of moisture intrusion into the duct.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.20 Nickel Alloy Inspection Program

The Nickel Alloy Inspection Program is an existing program that manages aging effects of Alloy 600 items and 82/182 welds in the reactor coolant system that are not addressed by the Reactor Vessel Head Penetration Inspection Program, Section A.2.1.30 or the Steam Generator Integrity Program, Section A.2.1.34. The aging effect requiring management for nickel alloys exposed to borated water at an elevated temperature is primary water stress corrosion cracking (PWSCC). The Nickel Alloy Inspection Program includes elements of the Inservice Inspection (ISI) Program, Section A.2.1.17, which specifies the nondestructive examination (NDE) techniques and acceptance criteria applied to evaluation of identified cracks, and the Boric Acid Corrosion Control Program, Section A.2.1.4. Also, the Water Chemistry Control - Primary and Secondary Program, Section A.2.1.40 maintains primary water in accordance with the Electric Power Research Institute (EPRI) guidelines to minimize the potential for crack initiation and growth.

The site commits to comply with future applicable (1) NRC Orders. In addition, IPEC commits to implement applicable (1) Bulletins and Generic Letters associated with nickel alloys and (2) staff accepted industry guidelines associated with nickel alloys.

A.2.1.21 Non-EQ Bolted Cable Connections Program

The Non-EQ Bolted Cable Connections Program is a new program which monitors for loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. It provides for one-time inspections on a sample of connections that will be completed prior to the period of extended operation. The following factors are considered for sampling: application (medium and low voltage, defined as < 35 kV), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selections will be documented. If an unacceptable condition or situation is identified in the selected sample, the corrective action program will be used to evaluate additional requirements.

A.2.1.22 Non-EQ Inaccessible Medium-Voltage Cable Program

The Non-EQ Inaccessible Medium-Voltage Cable Program is a new program that entails periodic and event-driven inspections for water collection in cable manholes and periodic testing of cables. In scope medium-voltage cables (cables with operating voltage from 2kV to 35kV) and low-voltage power cables (400 V to 2kV) exposed to significant moisture will be tested at least once every six years to provide an indication of the condition of the conductor insulation. Test frequencies are adjusted based on test results and operating experience.

The program includes periodic inspections for water accumulation in manholes at least once every year (annually). In addition to the periodic manhole inspections, manhole inspection for water after events, such as heavy rain or flooding will be performed. Inspection frequency will be increased as necessary based on evaluation of inspection results.

The Non-EQ Inaccessible Medium-Voltage Cable Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E3, Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements.

A.2.1.23 Non-EQ Instrumentation Circuits Test Review Program

The Non-EQ Instrumentation Circuits Test Review Program is a new program that assures the intended functions of sensitive, high-voltage, low-signal cables exposed to adverse localized equipment environments caused by heat, radiation and moisture (i.e., neutron flux monitoring instrumentation and high range radiation monitors) can be maintained consistent with the current licensing basis through the period of extended operation. Most sensitive instrumentation circuit cables and connections are included in the instrumentation loop calibration at the normal calibration frequency, which provides sufficient indication of the need for corrective actions based on acceptance criteria related to instrumentation loop performance. The review of calibration results will be performed once every ten years, with the first review occurring before the period of extended operation.

For sensitive instrumentation circuit cables that are disconnected during instrument calibrations, testing using a proven method for detecting deterioration for the insulation system (such as insulation resistance tests or time domain reflectometry) will occur at least every ten years, with the first test occurring before the period of extended operation. In accordance with the corrective action program, an engineering evaluation will be performed when test acceptance criteria are not met and corrective actions, including modified inspection frequency, will be implemented to ensure that the intended functions of the cables can be maintained consistent with the current licensing basis through the period of extended operation. This program will consider the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR109619.

The Non-EQ Instrumentation Circuits Test Review Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E2, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.

A.2.1.24 Non-EQ Insulated Cables and Connections Program

The Non-EQ Insulated Cables and Connections Program is a new program that assures the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation and moisture can be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is significantly more severe than the specified service condition for the insulated cable or connection.

A representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. The program sample consists of all accessible cables and connections in localized adverse environments.

The Non-EQ Insulated Cables and Connections Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801 Section XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

A.2.1.25 Oil Analysis Program

The Oil Analysis Program is an existing program that maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling. Activities include sampling and analysis of lubricating oil in accordance with industry standards such as ISO 4406, ASTM D445, ASTM D4951 and ASTM D96. Water, particle concentration and viscosity acceptance criteria are based on industry standards supplemented by manufacturer’s recommendations.

Oil analysis frequencies for IP2 and IP3 equipment are based on Entergy templates with technical basis justifications. Procedure EN-DC-335, “PM Bases Template”, is based on EPRI PM bases documents TR-106857 volumes 1 thru 39 and TR-103147. Each template contains sections describing failure location and cause, progression of degradation to failure, fault discovery and intervention, task content, and task objective. From information in these sections, frequencies are selected for the components managed by the Oil Analysis Program to mitigate failure.

The One-Time Inspection Program includes inspections planned to verify the effectiveness of the Oil Analysis Program.

The Oil Analysis Program will be enhanced to include the following.

- Revise appropriate procedures to sample and analyze lubricating oil used in the SBO/Appendix R diesel generator consistent with oil analysis for other site diesel generators.

- Revise appropriate procedures to sample and analyze generator seal oil and turbine hydraulic control oil (electrohydraulic fluid).

- Formalize preliminary oil screening for water and particulates and laboratory analyses including defined acceptance criteria for all components included in the scope of the program. The program will specify corrective actions in the event acceptance criteria are not met.

- Formalize trending of preliminary oil screening results as well as data provided from independent laboratories.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.26 One-Time Inspection Program

The One-Time Inspection Program is a new program that includes measures to verify effectiveness of an aging management program (AMP) and confirm the absence of an aging effect. For structures and components that rely on an AMP, this program will verify effectiveness of the AMP by confirming that unacceptable degradation is not occurring and the intended function of a component will be maintained during the period of extended operation. One-time inspections may be needed to address concerns for potentially long incubation periods for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly. For these cases, there will be confirmation that either the aging effect is indeed not occurring, or the aging effect is occurring very slowly so as not to affect the component or structure intended function. A one-time inspection of the subject component or structure is appropriate for this verification. The inspections will be nondestructive examinations (including visual, ultrasonic, and surface techniques).

The elements of the program include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any aging degradation.

A one-time inspection activity is used to verify the effectiveness of the water chemistry control programs by confirming that unacceptable cracking, loss of material, and fouling is not occurring on components within systems covered by water chemistry control programs [Sections A.2.1.38, A.2.1.39, and A.2.1.40].

A one-time inspection activity is used to verify the effectiveness of the Oil Analysis Program by confirming that unacceptable cracking, loss of material and fouling are not occurring on components within systems covered by the Oil Analysis Program [Section A.2.1.25].

A one-time inspection activity is used to verify the effectiveness of the Diesel Fuel Monitoring Program by confirming that unacceptable loss of material and fouling is not occurring on components within systems covered by the Diesel Fuel Monitoring Program [Section A.2.1.8].

One-time inspection activities on the following confirm that loss of material is not occurring or is so insignificant that an aging management program is not warranted.

- internal surfaces of stainless steel drain piping, piping elements and components containing raw water (drain water)
- internal surfaces of stainless steel piping, piping elements and components in the station air containment penetration exposed to condensation
- internal surfaces of stainless steel dryer housings, filter housings, piping, tubing, strainers and valve bodies in the IP1 station air system exposed to condensation
- internal surfaces of stainless steel EDG starting air tanks, piping, piping elements and components exposed to condensation
- internal surfaces of carbon steel and stainless steel tanks, piping, piping elements and components in the RCP oil collection system exposed to lube oil
- internal surfaces of auxiliary feedwater system stainless steel piping, piping elements and components exposed to treated water from the city water system
- internal surfaces of stainless steel piping, piping elements and components in the containment penetration for gas analyzers exposed to condensation
- internal surfaces of circulating water stainless steel and CASS piping, piping elements and components containing raw water
- internal surfaces of intake structure system stainless steel piping elements and components containing raw water
- internal surfaces of chemical feed system stainless steel tanks, pump casings, piping, piping elements and components containing treated water

- internal surfaces of city water system stainless steel and CASS flex hoses, strainers, strainer housings, tanks, tubing, pump casings, piping, piping elements, valve bodies and components containing treated water (city water)
- internal surfaces of EDG system stainless steel piping, piping elements and components containing condensation or treated water (city water)
- internal surfaces of fresh water cooling system stainless steel piping, piping elements and components containing treated water (city water)
- internal surfaces of integrated liquid waste handling system stainless steel tanks, pump casings, piping, piping elements and components containing raw water
- internal surfaces of lube oil system aluminum tanks piping, piping elements and components containing raw water
- internal surfaces of river water service system stainless steel piping, piping elements and components containing raw water
- internal surfaces of waste disposal system stainless steel and CASS tanks, pump casings, piping, piping elements and components containing raw water
- internal surfaces of water treatment plant system stainless steel piping, piping elements and components containing treated water (city water)
- containment liner affected by the 1973 event behind the insulation to assure liner degradation is not occurring
- sample of potentially affected refueling cavity concrete obtained by core boring the refueling cavity wall in an area susceptible to exposure to borated water leakage. Include an assessment of embedded reinforcing steel.
- internal surfaces of instrument air system stainless steel tubing, valve bodies and aluminum valve bodies

When evidence of an aging effect is revealed by a one-time inspection, routine evaluation of the inspection results will identify appropriate corrective actions.

The inspection will be performed prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M32, One-Time Inspection.

A.2.1.27 One-Time Inspection – Small Bore Piping Program

The One-Time Inspection – Small Bore Piping Program is a new program applicable to small bore ASME Code Class 1 piping less than 4 inches nominal pipe size (NPS 4), which includes pipe, fittings, and branch connections. The ASME Code does not require volumetric examination of Class 1 small bore piping. The One-Time Inspection of ASME Code Class 1 Small Bore Piping Program will manage cracking through the use of volumetric examinations.

The program will include a sample selected based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small bore piping butt welds. Small bore piping socket welds are periodically inspected and therefore are not included.

When evidence of an aging effect is revealed by a one-time inspection, evaluation of the inspection results will identify appropriate corrective actions.

The inspection will be performed prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M35, One-Time Inspection of ASME Code Class I Small-Bore Piping.

A.2.1.28 Periodic Surveillance and Preventive Maintenance Program

The Periodic Surveillance and Preventive Maintenance Program is an existing program that includes periodic inspections and tests that manage aging effects not managed by other aging management programs. In addition to specific activities in the plant's preventive maintenance program and surveillance program, the Periodic Surveillance and Preventive Maintenance Program includes enhancements to add new activities. The preventive maintenance and surveillance testing activities are generally implemented through repetitive tasks or routine monitoring of plant operations.

Surveillance testing and periodic inspections using visual or other non-destructive examination techniques verify that the following components are capable of performing their intended function.

- reactor building cranes (polar and manipulator), crane rails, and girders, and refueling platform
- recirculation pump motor cooling coils and housing
- city water system strainer housings and valve bodies
- charging pump casings
- plant drain components and backwater valves
- station air containment penetration piping
- HVAC duct flexible connections
- HVAC stored portable blowers and flexible trunks
- EDG exhaust components
- EDG duct flexible connections
- EDG air intake and aftercooler components
- EDG air start components
- EDG cooling water makeup supply valves
- security generator exhaust components
- security generator radiator tubes
- SBO/Appendix R diesel exhaust components
- SBO/Appendix R diesel turbochargers and aftercoolers
- SBO/Appendix R diesel cooling water heat exchangers
- SBO/Appendix R diesel fuel oil cooler
- diesel fuel oil trailer transfer tank and associated valves
- auxiliary feedwater components
- containment cooling duct flexible connections
- containment cooling fan units internals

- control room HVAC condensers and evaporators
- control room HVAC ducts and drip pans
- control room HVAC duct flexible connections
- circulating water, city water, intake structure system, emergency diesel generator, fresh water cooling, instrument air, integrated liquid waste handling, lube oil, miscellaneous, radiation monitoring, river water, station air, waste disposal, wash water, and water treatment plant system piping, piping components, and piping elements
- pressurizer relief tank
- main steam safety valve tailpipes
- atmospheric dump valve silencers
- feedwater system sight glass housings
- off-site power feeder, 138 kV underground transmission cable
- main condenser tube internal surfaces and condensate system expansion joints
- instrument air aftercooler tube internal surfaces and filters
- fresh water/river water heat exchanger internal and external surfaces
- circulating water system expansion joints and pump casings
- river water system pump casings
- wash water system pump casings
- station air, compressor casings, filter housings, heat exchanger tubes, strainer housings, tanks, and traps
- [Deleted]
- [Deleted]
- emergency fuel oil trailer transfer tank and related components

The Periodic Surveillance and Preventive Maintenance Program will be enhanced as follows.

- Program activity guidance documents will be developed or revised as necessary to assure that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.29 Reactor Head Closure Studs Program

The Reactor Head Closure Studs Program is an existing program that includes inservice inspection (ISI) in conformance with the requirements of the ASME Code, Section XI, Subsection IWB, and preventive measures (e.g. rust inhibitors, stable lubricants, appropriate materials) to mitigate cracking and loss of material of reactor head closure studs, nuts, washers, and bushings.

A.2.1.30 Reactor Vessel Head Penetration Inspection Program

The Reactor Vessel Head Penetration Inspection Program is an existing program that manages primary water stress corrosion cracking (PWSCC) of nickel-based alloy reactor vessel head penetrations exposed to borated water to ensure that the pressure boundary function is maintained. This program was developed in response to NRC Order EA-03-009. The ASME Section XI, Subsection IWB Inservice Inspection and Water Chemistry Control Programs are used in conjunction with this program to manage cracking of the reactor vessel head penetrations. Detection of cracking is accomplished through implementation of a combination of bare metal visual examination (external surface of head) and non-visual examination (underside of head) techniques. Procedures are developed to perform reactor vessel head bare metal inspections and calculations of the susceptibility ranking of the plant.

The plant will continue to implement commitments associated with (1) NRC Orders, Bulletins and Generic Letters associated with nickel alloys and (2) staff-accepted industry guidelines.

A.2.1.31 Reactor Vessel Surveillance Program

The Reactor Vessel Surveillance Program is an existing program that manages reduction in fracture toughness of reactor vessel beltline materials to assure that the pressure boundary function of the reactor pressure vessel is maintained through the period of extended operation.

The Reactor Vessel Surveillance Program will be enhanced to include the following.

- The specimen capsule withdrawal schedules will be revised to draw and test a standby capsule to cover the peak reactor vessel fluence expected through the end of the period of extended operation.

- Revise appropriate procedures to require that tested and untested specimens from all capsules pulled from the reactor vessel are maintained in storage.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.32 Selective Leaching Program

The Selective Leaching Program is a new program that ensures the integrity of components made of gray cast iron, bronze, brass, and other alloys exposed to raw water, treated water, or groundwater that may lead to selective leaching. The program includes a one-time visual inspection, hardness measurement (where feasible based on form and configuration), or other industry accepted mechanical inspection techniques of selected components that may be susceptible to selective leaching to determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function through the period of extended operation.

The Selective Leaching Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M33 Selective Leaching of Materials.

A.2.1.33 Service Water Integrity Program

The Service Water Integrity Program is an existing program that relies on implementation of the recommendations of GL 89-13 to ensure that the effects of aging on the service water system are managed through the period of extended operation. The program includes component inspections for erosion, corrosion, and biofouling to verify the heat transfer capability of safety-related heat exchangers cooled by service water. Chemical treatment using biocides and sodium hypochlorite and periodic cleaning and flushing of infrequently used loops are methods used to control fouling within the heat exchangers and to manage loss of material in service water components.

A.2.1.34 Steam Generator Integrity Program

The Steam Generator Integrity Program is an existing program that uses nondestructive examination (NDE) techniques to identify tubes that are defective and need to be removed from service or repaired in accordance with the guidelines of the plant technical specifications. The program also includes processes for monitoring and maintaining secondary side component integrity. The program defines when inspections and maintenance are performed, the scope of work, and the methods used.

The Steam Generator Integrity Program will be enhanced to include the following.

- Revise appropriate procedures to require that the results of the condition monitoring assessment are compared to the operational assessment performed for the prior operating cycle with differences evaluated.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.35 Structures Monitoring Program

The Structures Monitoring Program is an existing program that performs inspections in accordance with 10 CFR 50.65 (Maintenance Rule) as addressed in Regulatory Guide 1.160 and NUMARC 93-01. Periodic inspections are used to monitor the condition of structures and structural commodities to ensure there is no loss of intended function.

The Structures Monitoring Program will be enhanced to include the following.

- Appropriate procedures will be revised to explicitly specify that the following structures are included in the program.

    - city water storage tank foundation

- discharge canal
- emergency lighting poles and foundations
- fire pumphouse
- fire water storage tank foundation
- gas turbine 1 fuel storage tank foundation
- maintenance and outage building–elevated passageway
- new station security building
- nuclear service building (IP1)
- service water pipe chase
- superheater stack
- transformer/switchyard support structures
- waste holdup tank pit

- Appropriate procedures will be revised to clarify that in addition to structural steel and concrete, the following commodities (including their anchorages) are inspected for each structure as applicable.

  - cable trays and supports
  - concrete portion of reactor vessel supports
  - conduits and supports
  - cranes, rails, and girders
  - equipment pads and foundations
  - fire proofing (pyrocrete)
  - HVAC duct supports
  - jib cranes
  - manholes and duct banks
  - manways, hatches, and hatch covers
  - monorails
  - new fuel storage racks
  - sumps

- Guidance will be added to the Structures Monitoring Program to inspect inaccessible concrete areas that are exposed by excavation for any reason. The site will also inspect inaccessible concrete areas in environments where observed conditions in accessible areas exposed to the same environment indicate that significant concrete degradation is occurring.

- Revise applicable structures monitoring procedures for inspection of elastomers (seals, gaskets, seismic joint filler, and roof elastomers) to identify cracking and change in material properties and for inspection of aluminum vents and louvers to identify loss of material.

- Guidance to perform evaluation of groundwater samples will be added to the Structures Monitoring Program. To assess the aggressiveness of groundwater to concrete, IPEC

will obtain samples from at least five wells that are representative of the ground water surrounding below-grade site structures at least once every five years and perform an engineering evaluation of the results from those samples for sulfates, pH and chlorides. Additionally, to assess potential indications of spent fuel pool leakage, IPEC will sample for tritium in groundwater wells in close proximity to the IP2 spent fuel pool at least once every three months.

- Revise applicable structures monitoring procedures to inspect normally submerged concrete portions of the intake structures at least once every 5 years.

- Enhance the Structures Monitoring Program to perform inspection of the degraded areas of the water control structure once every three years rather than the normal frequency of once every five years during the period of extended operation.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.36 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

The Thermal Aging Embrittlement of CASS Program is a new program that augments the inspection of the reactor coolant system components in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI. The inspection detects the effects of loss of fracture toughness due to thermal aging embrittlement of cast austenitic stainless steel (CASS) components. This aging management program determines the susceptibility of CASS components to thermal aging embrittlement based on casting method, molybdenum content, and percent ferrite. The program provides aging management through either enhanced volumetric examination or flaw tolerance evaluation. Additional inspection or evaluations to demonstrate that the material has adequate fracture toughness are not required for components that are not susceptible to thermal aging embrittlement.

The Thermal Aging Embrittlement of CASS Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M12, Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program.

A.2.1.37 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is a new program that augments the reactor vessel internals visual inspection in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, Subsection IWB. This inspection manages the effects of loss of fracture toughness due to thermal aging and neutron embrittlement of cast austenitic stainless steel (CASS) components. This aging management program determines the susceptibility of CASS components to thermal

aging or neutron irradiation (neutron fluence) embrittlement based on casting method, molybdenum content, operating temperature and percent ferrite. For each "potentially susceptible" component, aging management is accomplished through either a component-specific evaluation or a supplemental examination of the affected component as part of the inservice inspection (ISI) program during the license renewal term.

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program.

A.2.1.38 Water Chemistry Control – Auxiliary Systems Program

The Water Chemistry Control – Auxiliary Systems Program is an existing program that manages loss of material and cracking for components exposed to treated water.

Program activities include sampling and analysis to minimize component exposure to aggressive environments for stator cooling water systems.

The One-Time Inspection Program for Water Chemistry utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Auxiliary Systems Program has been effective at managing aging effects.

A.2.1.39 Water Chemistry Control – Closed Cooling Water Program

The Water Chemistry Control – Closed Cooling Water Program is an existing program that includes preventive measures that manage loss of material, cracking, or fouling for components in closed cooling water systems (component cooling water (CCW), instrument air cooling (IP2 only), fresh water cooling, [Deleted] conventional closed cooling (CCC), instrument air closed cooling (IACC), emergency diesel generator cooling, security generator cooling, station air (IP1) cooling and SBO/Appendix R diesel generator cooling. These chemistry activities provide for monitoring and controlling closed cooling water chemistry using procedures and processes based on EPRI guidance for closed cooling water chemistry.

The One-Time Inspection Program for Water Chemistry utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Closed Cooling Water Program has been effective at managing aging effects.

The Water Chemistry Control – Closed Cooling Water Program will be enhanced to include the following.

- Revise appropriate procedures to maintain water chemistry of the SBO/Appendix R diesel generator cooling system per EPRI guidelines.

- Revise appropriate procedures to maintain the security generator [Deleted] and fire protection diesel cooling water pH and glycol within limits specified by EPRI guidelines.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.40 Water Chemistry Control – Primary and Secondary

The Water Chemistry Control – Primary and Secondary Program is an existing program that manages aging effects caused by corrosion and cracking mechanisms. The program relies on monitoring and control of reactor water chemistry based on the EPRI guidelines in TR-105714 for primary water chemistry and TR-102134 for secondary water chemistry.

The One-Time Inspection Program for Water Chemistry utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Primary and Secondary Program has been effective at managing aging effects.

The Water Chemistry Control – Primary and Secondary Program will be enhanced to include the following.

- Revise appropriate procedures to test sulfates monthly in the RWST with a limit of < 150 ppb.

Enhancements will be implemented prior to the period of extended operation.

A.2.1.41 Reactor Vessel Internals Aging Management Activities

The Reactor Vessel Internals (RVI) Program is a new plant specific program to manage aging effects of reactor vessel internals using the guidance from the Electric Power Research Institute (EPRI) Materials Reliability Program (MRP). The MRP inspection and evaluation (I&E) guidelines for managing the effects of aging on pressurized water reactor vessel internals are presented in MRP-227-A, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines." The MRP also developed inspection requirements specific to the inspection methods delineated in MRP-227-A, as well as requirements for qualification of the nondestructive examination (NDE) systems used to perform those inspections. These inspection requirements are presented in MRP-228, "Materials Reliability Program: Inspection Standard for PWR Internals."

MRP-227-A and MRP-228 provide the basis of the IPEC Reactor Vessel Internals (RVI) Program. The RVI Program will monitor the effects of aging degradation mechanisms on the intended functions of the internals through periodic and conditional examinations. The RVI Program will detect and evaluate cracking, loss of material, reduction of fracture toughness, loss of preload and dimensional changes of vessel internals components in accordance with MRP-227-A inspection requirements and evaluation acceptance criteria.

The IPEC RVI Program will be implemented and maintained in accordance with the guidance in NEI 03-08 [Addenda], Addendum A, “RCS Materials Degradation Management Program Guidelines.” Any deviations from mandatory, needed, or good practice implementation requirements established in MRP-227-A or MRP-228 will be resolved in accordance with the NEI 03-08 implementation protocol. The RVI Program will be implemented prior to the period of extended operation.

The IP2 guide tube support pins (split pins) will be replaced during the 2016 refueling outage (2R22).

A.2.2 Evaluation of Time-Limited Aging Analyses – Unit 2

In accordance with 10 CFR 54.21(c), an application for a renewed license requires an evaluation of time-limited aging analyses (TLAA) for the period of extended operation. The following TLAA have been identified and evaluated to meet this requirement.

A.2.2.1 Reactor Vessel Neutron Embrittlement

The current licensing basis analyses evaluating reduction of fracture toughness of the reactor vessel for 40 years are TLAA. The reactor vessel neutron embrittlement TLAA is summarized below. Forty-eight effective full-power years (EFPY) are conservatively projected for the end of the period of extended operation (60 years) based on actual capacity factors from the start of commercial operation until 2005 and an average capacity factor of 99% from 2005 to the end of the period of extended operation.

A.2.2.1.1 Reactor Vessel Fluence

As part of the stretch power uprate analysis, the neutron exposure levels for the reactor pressure vessel were projected for an operating period extending to 48 EFPY. These fluence values included peak plate and weld ID fluences. The 1/4 T fluences were derived using RG 1.99 formula and conservative wall thicknesses.

A.2.2.1.2 Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires operation of the reactor pressure vessel be accomplished within established pressure-temperature (P-T) limits. These limits are established by calculations that utilize the materials and fluence data obtained through the unit specific reactor surveillance capsule program.

Technical Specifications contain pressure/temperature limits and LTOP (PORV) maximum open setpoints valid through 48 EFPY including the effects of power uprate.

A.2.2.1.3 ~~[Deleted]~~Charpy Upper-Shelf Energy

The predictions for percent drop in C_VUSE at 48 EFPY are based on chemistry data, unirradiated C_VUSE data, and 1/4 T fluence values. The projected 48 EFPY peak beltline fluence level was applied to all beltline materials with the exception of axial welds. Based on surveillance data, peak fluence levels at the beltline axial welds is based on the expected fluence at the 30 degree azimuth position.

One intermediate shell plate (B2002-3) and one lower shell plate (B2003-1) have projected upper shelf energy levels that fall below 50 ft-lb during the period of extended operation. All remaining plate and weld beltline materials meet or exceed the requirement of [Deleted] 50 ft-lb at 48 EFPY.

An equivalent margins analysis performed in WCAP-13587, Rev. 1, demonstrated that the minimum acceptable USE for reactor vessel plate material in four-loop plants is 43 ft-lb. In the safety assessment of WCAP-13587, the NRC concluded the report demonstrated margins of safety equivalent to those of the ASME code for beltline plate and forging materials. The USE values are therefore acceptable since the lowest projected USE level for the beltline plate material through the period of extended operation of 48.3 ft-lb for intermediate shell plate B2002-3 is above the 43 ft-lb minimum acceptable USE for four-loop plants determined in WCAP-13587 Rev. 1.

A.2.2.1.4 Pressurized Thermal Shock

10 CFR 50.61(b)(1) provides rules for protection against pressurized thermal shock events for pressurized water reactors. Licensees are required to perform an assessment of the projected values of reference temperature whenever a significant change occurs in projected values of the adjusted reference temperature for pressurized thermal shock (RT_{PTS}). The screening criteria for RT_{PTS} is 270°F for plates, forgings, and axial welds and 300°F for circumferential welds.

Adjusted reference temperatures are calculated for both Positions 1 and 2 by following the guidance in Regulatory Guide 1.99, Sections 1.1 and 2.1, respectively, using copper and nickel content of beltline materials and end-of-life (EOL) best estimate fluence projections.

All projected RT_{PTS} values are within the established screening criteria at 48 EFPY.

A.2.2.2 Metal Fatigue

A.2.2.2.1 Class 1 Metal Fatigue

Class 1 components evaluated for fatigue and flaw growth include the reactor pressure vessel (RPV), [Deleted] pressurizer, steam generators, reactor coolant pumps, control rod drive mechanisms, regenerative letdown heat exchanger, and Class 1 piping and in-line components.

The Fatigue Monitoring Program will assure that the analyzed number of transient cycles is not exceeded. The program requires corrective action if the analyzed number of transient cycles is approached. Consequently, the effects of aging related to these TLAA (fatigue analyses) based on those transients will be managed by the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

A.2.2.2.2 Non-Class 1 Metal Fatigue

For non-Class 1 piping and in-line components identified as subject to cracking due to fatigue, a review of system operating characteristics was conducted to determine the approximate frequency of any significant thermal cycling. If the number of equivalent full temperature cycles is below the limit used for the original design (usually 7000 cycles), the component is suitable for extended operation. If the number of equivalent full temperature cycles exceeds the limit, the individual stress calculations require evaluation. No systems were identified with projected cycles exceeding 7000. Therefore, the TLAA for non-Class 1 piping and in-line components remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(i).

A.2.2.2.3 Subsection NG Fatigue Analysis of Reactor Pressure Vessel Internals

The reactor vessel internals were designed to meet the intent of Subsection NG of the ASME Boiler and Pressure Vessel Code, Section III. Subsequent plant uprate evaluations determined CUFs for some reactor vessel internals components. These evaluations were performed to the intent of Subsection NG. The Fatigue Monitoring Program manages the effects of aging related to these TLAAs (fatigue analyses) in accordance with 10 CFR 54.21(c)(1)(iii).

Each of the limiting CUFs for the reactor vessel internals will be recalculated prior to September 28, 2013, to include the reactor coolant environment effects ($F_{en)}$ as provided in the Fatigue Monitoring Program using NUREG/CR-5704 or NUREG/CR-6909. Corrective actions specified in the Fatigue Monitoring Program include further CUF reanalysis and/or repair or replacement of the affected components prior to the CUF_{en} reaching 1.0.

A.2.2.2.4 Environmental Effects on Fatigue

The effects of reactor water environment on fatigue were evaluated for license renewal. Projected cumulative usage factors (CUFs) were calculated for the limiting locations based on NUREG/CR-6260. The identified IP2 locations are those listed in the license renewal application, Table 4.3-13. Several locations may exceed a CUF of 1.0 with consideration of environmental effects during the period of extended operation. The Fatigue Monitoring Program requires that at least two years prior to entering the period of extended operation the site will implement one or more of the following:

(1) Consistent with the Fatigue Monitoring Program, Detection of Aging Effects, update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment. This includes applying the appropriate F_{en} factors to valid CUFs determined in accordance with one of the following.

For locations with existing fatigue analysis valid for the period of extended operation, use the existing CUF.

Additional plant-specific locations with a valid CUF may be evaluated. In particular, the pressurizer lower shell will be reviewed to ensure the surge nozzle remains the limiting component.

Representative CUF values from other plants, adjusted to or enveloping the plant-specific external loads may be used if demonstrated applicable.

An analysis using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case) may be performed to determine a valid CUF.

(2) Consistent with the Fatigue Monitoring Program, Corrective Actions, repair or replace the affected locations before exceeding a CUF of 1.0.

A.2.2.3 Environmental Qualification of Electrical Components

The EQ Program implements the requirements of 10 CFR 50.49 (as further defined by the Division of Operating Reactors Guidelines, NUREG-0588, and Reg. Guide 1.89). The program requires action before individual components exceed their qualified life. In accordance with 10 CFR 54.21(c)(1)(iii), implementation of the EQ Program provides reasonable assurance that the effects of aging on components with EQ TLAAs will be adequately managed such that the intended functions can be maintained for the period of extended operation.

A.2.2.4 Containment Liner Plate and Penetrations Fatigue Analyses

In 1973, a feedwater line cracked circumferentially, resulting in damage to the liner plate causing containment liner plate buckling at the penetration for feedwater line #22. Studies were performed to evaluate the effects of fatigue on the deformed area of the liner due to predicted high strain-limited cycle loading during its projected life. The evaluation was based on the 40 year operating life of the plant and is thus considered a TLAA. The TLAA associated with the buckled liner adjacent to the feedwater line #22 penetration remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

There are no TLAA associated with the containment penetrations.

A.2.2.5 Leak before Break

Leak before break (LBB) analyses evaluate postulated flaw growth in piping to justify changes to the structural design basis involving protection against the effect of postulated reactor coolant loop pipe ruptures. The LBB evaluations use saturated (fully aged) fracture toughness properties, and these analyses do not have a material property time-limited assumption. The fatigue crack growth for 40 years was calculated using the design transients for the reactor vessel. As these transients will not be exceeded in 60 years, these analyses will remain valid during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.2.6 Steam Generator Flow-Induced Vibration and Tube Wear

The steam generators were evaluated with respect to flow-induced vibration (tube wear). The replacement steam generators went into service in January 2000 and will have less than 40 years of service at the end of the period of extended operation (September 2033). Therefore, these TLAA will remain valid through the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.2.3 References

A.2-1 Letter from F. Dacimo, Indian Point Energy Center, to Document Control Desk, NRC, *License Renewal Application,* dated April 23, 2007.

A.2-2 NRC Safety Evaluation Report (SER), *Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3*, dated October 2009 and Supplement 1, dated August 2011.