



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV  
1600 EAST LAMAR BOULEVARD  
ARLINGTON, TEXAS 76011-4511

August 9, 2018

Mr. Richard L. Anderson, Site Vice President  
Arkansas Nuclear One  
Entergy Operations, Inc.  
N-TSB-58  
1448 S.R. 333  
Russellville, AR 72802-0967

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 2 – POST-APPROVAL SITE INSPECTION  
FOR LICENSE RENEWAL INSPECTION REPORT 05000368/2018010

Dear Mr. Anderson:

On July 27, 2018, a U.S. Nuclear Regulatory Commission (NRC) inspection team completed a post-approval site inspection for license renewal at Arkansas Nuclear One, Unit 2. The enclosed report documents the inspection results, which were discussed on July 27, 2018, with Mr. B. Daiber, Design Engineering Manager, and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations, and with the conditions of your license. The team reviewed selected procedures and records, observed activities, and interviewed personnel.

The NRC inspectors did not identify any finding or violation of more than minor significance.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <http://www.nrc.gov/reading-rm/adams.html> and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Gregory E. Werner, Chief  
Engineering Branch 2  
Division of Reactor Safety

Docket: 50-368  
License: NPF-6

Enclosure:  
Inspection Report 05000368/2018010

**U.S. NUCLEAR REGULATORY COMMISSION**  
**Inspection Report**

Docket Number: 05000368

License Number: NPF-6

Report Number: 05000368/2018010

Enterprise Identifier: I-2018-010-0039

Licensee: Entergy Operations, Inc.

Facility: Arkansas Nuclear One, Unit 2

Location: Russellville, Arkansas

Inspection Dates: May 21, 2018, to July 27, 2018

Inspectors: G. Pick, Senior Reactor Inspector  
S. Alferink, Reactor Inspector  
I. Anchondo, Reactor Inspector  
S. Makor, Reactor Inspector

Approved By: Gregory E. Werner, Chief  
Engineering Branch 2  
Division of Reactor Safety

Enclosure

## SUMMARY

IR 05000368/2018010; 05/21/2018 – 07/27/2018; Arkansas Nuclear One, Unit 2, Post-Approval Site Inspection for License Renewal

The significance of inspection findings is indicated by their color (i.e., Green, greater than Green, White, Yellow, or Red), determined using Inspection Manual Chapter 0609, "Significance Determination Process," dated April 29, 2015. Their cross-cutting aspects are determined using Inspection Manual Chapter 0310, "Aspects within the Cross-Cutting Areas," dated December 4, 2014. Violations of NRC requirements are dispositioned in accordance with the NRC Enforcement Policy. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," dated July 2016.

**A. NRC-Identified Findings and Self-Revealing Findings**

None

**B. Licensee-Identified Violations**

None

## REPORT DETAILS

### 4. OTHER ACTIVITIES (OA)

#### 4OA5 Other - Post-Approval Site Inspection for License Renewal (Phase 2) – IP 71003

##### Phase 2 Inspection Activities

Inspection Procedure 71003, "Post-Approval Site Inspection for License Renewal," recommended that the inspection be conducted shortly before the period of extended operation. The period of extended operation is the additional 20 years beyond the original 40-year licensed term. The period of extended operation for Arkansas Nuclear One, Unit 2 began after midnight on July 17, 2018.

The team evaluated whether the licensee: (1) completed actions required to comply with the license renewal license condition and commitments; (2) implemented the aging management programs that agreed with those approved in the safety evaluation report and described in the safety analysis report; (3) followed the guidance in Nuclear Energy Institute (NEI) 99-04, "Guidelines for Managing NRC Commitment Changes," for changing license renewal commitments and followed the guidance in 10 CFR 50.59 when making changes to the license renewal supplement; (4) identified, evaluated, and incorporated "newly identified" structures, systems, and components into their aging management programs; and (5) implemented operating experience review and corrective action programs that account for aging effects.

NUREG-1828, "Safety Evaluation Report (SER) Related to the License Renewal of Arkansas Nuclear One, Unit 2," Appendix A listed 40 commitments. The team reviewed 37 of the 40 commitments and closed 37 commitments. The NRC had previously closed two commitments and evaluated implementation of four aging management programs during the Phase 1 inspection documented in NRC Inspection Report 05000368/2017009 [ML17153A123]. The team did not close Commitment 17940. The team reviewed 32 aging management programs.

The team closed 37 commitments and 1 commitment remains open.

##### Review of Aging Management Programs

#### a. Inspection Scope

The team evaluated whether the licensee implemented the aging management programs and commitments described in NUREG-1828. For each aging management program reviewed, the team reviewed program documents, license renewal documents, the safety analysis report, and the safety evaluation report. Supporting documents reviewed included implementing procedures, work orders, inspection reports, engineering evaluations, calculations, database entries, and condition reports. The team interviewed program owners and license renewal program personnel.

The team determined that the licensee had translated their license renewal application into Chapter 18 of their safety analysis report. The team listed specific documents reviewed in the attachment.

b. Findings and Observations

.1 B.1.1 Alloy 600 Program (17905)

This program managed aging effects related to primary water stress corrosion cracking on Alloy 600/690 items, and Alloy 52/152 and 82/182 welds in the reactor coolant system. The licensee implemented the examination and inspection requirements of American Society of Mechanical Engineers (ASME) Section XI, as augmented by the commitments made to the NRC.

The licensee had three commitments related to this program. Specifically, the licensee committed to: (1) submit a description of the Alloy 600 aging management program, which includes the inspection plan, to the NRC staff for review and approval; (2) revise the supplement to identify the specific purpose of the program; and (3) provide the Alloy 600 inspection plan and program at least 24-months prior to entering the period of extended operation.

The team verified that the licensee had submitted their Alloy 600 aging management program as specified and determined that NRC had no concerns with the submittal. The team determined that the licensee had scheduled these inspections as part of their inservice inspection program.

The team identified no concerns with this program.

.2 B.1.4 Buried Piping Inspection Program (17910)

This program managed aging effects related to loss of material caused by corrosion. The licensee developed preventive measures to mitigate corrosion and conducted periodic inspection to manage the effects of corrosion on buried carbon steel piping, valve bodies, and bolting. The licensee established preventive measures that met the standard industry practice for maintaining external coatings and wrappings. The licensee provided guidance to inspect buried pipe coatings and wrappings when they were excavated during maintenance. The licensee included the fire water system, service water system, and fuel oil system piping.

The licensee identified one commitment related to this program, which specified implementing the program described in their safety analysis report.

The team reviewed the buried pipe program established to meet the guidance in NEI 09-14, "Guideline for The Management of Buried Piping Integrity," dated January 2010. The team verified that the licensee revised the program procedures to identify the need to conduct opportunistic inspections of buried piping and components. The team determined that the program being implemented exceeded the license renewal commitments. The team confirmed that the licensee had performed scheduled inspections based on risk ranking. The team determined that the licensee maintained their cathodic protection system using scheduled preventive maintenance tasks to monitor the rectifiers. From 2014-2017 the licensee replaced anodes identified during testing that produced marginal current levels.

The team identified no concerns with this program.

.3 B.1.5 Cast Austenitic Stainless Steel Evaluation Program (17911)

This program managed the aging effects related to loss of fracture toughness in reactor coolant system cast austenitic stainless steel components susceptible to thermal aging embrittlement using additional inspections and a component-specific flaw tolerance evaluation. The team determined that the licensee used their flaw tolerance evaluations to demonstrate that no inspections would be needed.

The licensee identified one commitment related to this program, which specified implementing the program described in their supplement and listed in Appendix A of the safety evaluation report. The team challenged the licensee's methodology used to perform the program's flaw tolerance evaluation given the fact that they had decided that no inspections of cast austenitic stainless steel components would be necessary. The methodology was probabilistic in nature demonstrating that no inspections would be needed.

Upon further discussions, the team determined that the licensee had met the requirements specified in the underlying analysis requirements as described in the acceptance criteria section of Generic Aging Lessons Learned Report Section XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," Revision 0. The licensee had performed both deterministic and probabilistic fracture mechanics calculations for cast components that contained up to 25 percent delta ferrite. The methodology outlined in Section XI.M12 is deterministic in nature for components containing up to 25 percent delta ferrite while those with greater percentage required a case-by-case analysis. The team determined that the licensee met the commitment for components that exceeded 25 percent delta ferrite by completing a flaw tolerance evaluation using only the probabilistic fracture mechanics methodology that had been approved by the ASME for use in August 2015.

Specifically, the team determined that the licensee used the guidance in Materials Reliability Project MRP-362, "Technical Basis for ASME Section XI Code Case N-838 - Flaw Tolerance Evaluation of Cast Austenitic Stainless Steel (CASS) Piping Components," Revision 1, to determine whether the material had sufficient toughness to withstand fractures from critical flaw sizes. Calculation CALC-ANO2 -EP-17-00100-02, "CASS Aging Management Program Final Report at ANO-2," Revision 0, documented that reactor coolant system components with ferrite that exceeded 25 percent ferrite would not fail and did not require inspecting. The team requested assistance from agency technical experts who confirmed that the probabilistic fracture mechanics methodology demonstrated that a tolerable flaw, if it existed, would not propagate and cause component failure through the end of the period of extended operation.

The team identified no concerns with this program.

.4 B.1.6 Containment Leak Rate Testing (17912)

This program managed aging effects related to loss of material and cracking for equipment constituting the containment pressure boundary. The licensee implemented their existing 10 CFR Part 50, Appendix J program. The licensee performed their containment integrated leak rate test every 15 years and had adopted the performance-based option for leak rate testing. This program assured that (1) leakage through the primary reactor containment and systems and components penetrating primary

containment do not exceed allowable values, and (2) periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of the containment.

The team identified no concerns with this program.

.5 B.1.7 Diesel Fuel Monitoring Program (17913)

This program managed aging effects related to loss of material and cracking on the internal surfaces of fuel oil system components. The licensee performed maintenance tasks to monitor fuel oil quality and the levels of water and microbiological organisms to prevent plugging of filters, fouling of injectors, and corrosion of fuel systems. The program included the bulk fuel oil tank, emergency diesel tanks, emergency diesel day tanks, diesel fire pump day tank, and the alternate ac diesel day tank.

The team identified no concerns with this program.

.6 B.1.9 Fatigue Monitoring Program (17915)

This program managed aging effects related to fatigue cracking. The licensee tracked the number of critical thermal and pressure transients for selected reactor coolant system components in order not to exceed the design limit on fatigue usage. The program ensured the validity of analyses containing explicit cycle count assumptions. The components managed by this program were those shown to be acceptable by analyses that explicitly addressed thermal and pressure fatigue transient limits.

The team identified no concerns with this program.

.7 B.1.10.1 Fire Protection Program (17916)

This program managed aging effects related to loss of material, cracking, and change in material properties. The licensee performed 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. The licensee periodically tested the fuel supply line to ensure that diesel-driven fire pump inspection continued to perform its design function.

The team identified no concerns with this program.

.8 B.1.10.2 Fire Water System Program (17917)

This program managed aging effects related to loss of material, cracking, and corrosion in fire protection system components exposed to water. The licensee tested water-based fire protection systems that included sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, water storage tanks, and aboveground and underground piping and components according to the applicable National Fire Protection Association codes and standards. The licensee monitored the diesel fire pump jacket cooling water chemistry. These systems were normally maintained at required operating pressure and monitored such that the licensee would immediately detect leakage resulting in loss of system pressure and corrective actions initiated.

The licensee made a single commitment that specified that the licensee will enhance the program to inspect a sample of sprinkler heads in accordance with National Fire Protection Association 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems." The team determined that the licensee planned to implement the option of replacing the sprinkler heads at 50 years from original installation rather than establishing a sampling program as allowed by the code.

The team identified no concerns with this program.

.9 B.1.11 Flow-Accelerated Corrosion Program (17918)

This program managed aging effects related to loss of material caused by flow-accelerated corrosion. The licensee performed the following activities: (a) an analysis to determine critical locations, (b) limited baseline inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm the predictions, or component repair or replacement as necessary.

The team determined that the licensee also monitored for erosion aging mechanisms caused by cavitation, flashing, droplet impingement, and solid particles using their flow-accelerated corrosion management program.

The team identified no concerns with this program.

.10 B.1.12 Heat Exchanger Monitoring Program (17919)

This program managed aging effects related to loss of material, fouling and cracking for the specified heat exchangers. The licensee conducted visual and nondestructive examination techniques, such as eddy-current testing to monitor for degradation. If degradation was found, the licensee would evaluate the effects of the degradation on the design function of the heat exchanger. The licensee included the following heat exchangers in this program: (a) shutdown cooling heat exchangers 2E-35A/B, (b) emergency diesel generator jacket water heat exchangers 2E-20A/B, (c) emergency diesel generator lubricating oil heat exchangers 2E-63A/B, (d) emergency diesel generator air cooling water heat exchangers 2E-64A/B, and (e) the containment spray pump seal coolers 2E-47A/B.

The licensee identified two commitments related to this program. Specifically, the licensee committed to: (1) establish the program as described above with an acceptance criterion of less than 60 percent wall loss for eddy-current inspections and ensuring that the ferritic stainless steel tubes of the shutdown cooling heat exchangers will be monitored using appropriate nondestructive examination techniques, and (2) complete a fatigue evaluation showing the acceptability of the regenerative heat exchanger for the period of extended operation. The team confirmed that the licensee established requirements in their program to perform eddy-current inspections and established appropriate criteria. In addition, the team confirmed that the licensee demonstrated the acceptability of the regenerative heat exchanger to meet the fatigue life requirements.

The team identified no concerns with this program.



.11 B.1.13 Inservice Inspection - Containment Inservice Inspection Program (17920)

This program managed aging effects related to loss of material from the containment steel liner and integral attachments. The licensee implemented the applicable requirements of their ASME Section XI, Subsections IWE and IWL as modified by 10 CFR 50.55a.

The team identified no concerns with this program.

.12 B.1.14 Inservice Inspection Program (17921)

This program managed aging effects related to cracking, wear, loss of mechanical closure integrity, and loss of material from reactor coolant system piping and components. The licensee implemented the requirements of ASME Section XI, Subsections IWB, IWC, IWD, and IWF and other requirements specified in 10 CFR 50.55a with approved NRC alternatives and relief requests.

The team identified no concerns with this program.

.13 B.1.15 Non-Environmentally Qualified Inaccessible Medium-Voltage Cable Program (17922)

This program managed aging effects related to insulation breakdown in non-environmentally qualified inaccessible (buried or in conduit) medium voltage cables exposed to significant moisture. The licensee selected tan-delta testing to provide an indication of the condition of the conductor insulation. The team verified that the licensee performed tan-delta testing every 6 years and installed sump pumps. The in-scope components include the service water pumps, startup transformer 3 voltage regulator, and the voltage regulator for a switchyard breaker related to station blackout.

The licensee identified one commitment that specified that they would implement testing of the cables. The team verified that the licensee performed tan-delta testing for the in-scope cables.

The team identified no concerns with this program.

.14 B.1.16 Non-Environmentally Qualified Insulated Cables and Connections Program (17923)

This program managed aging effects related to discoloration, swelling, blistering, melting, cracking, splitting, and crazing. The adverse localized environments resulted from severe environments caused by heat, radiation, and moisture for non-environmentally qualified cables and connections. The licensee visually inspected a representative sample of accessible insulated cables and connections for cable and connection jacket surface anomalies.

The licensee had committed to implement this program. The team verified that the licensee had implemented this program as described in the licensing documents.

The team identified no concerns with this program.

.15 B.1.17 Oil Analysis Program (17924)

This program managed aging effects related to cracking, fouling, and loss of material. The licensee ensured the oil environment in the mechanical systems was maintained to the required quality. Periodically, the licensee sampled lubricating oil from plant components subject to aging management review.

The team identified no concerns with this program.

.16 B.1.18 Periodic Surveillance and Preventive Maintenance Program (17925)

This program managed aging effects related to change in material properties, cracking, heat exchanger fouling, loss of material, and loss of form. The license identified specific components included in this program because the other aging management programs did not monitor for the identified effects.

The team verified that the licensee created preventive maintenance tasks or identified routine monitoring actions and surveillance testing activities to monitor aging effects for specific components in selected systems. The systems included:

- Emergency feedwater
- Station battery racks
- Emergency core cooling system
- Containment spray, chemical volume control
- Containment cooling, auxiliary building ventilation, control room ventilation
- Emergency diesel generator, alternate ac diesel generator, fuel oil
- Halon and reactor coolant pump, and
- Service water, emergency cooling pond

The licensee identified two commitments related to this program. Specifically, the licensee committed to: (1) manage aging effects related to cracking, loss of flexibility, and embrittlement of flexible hoses in the emergency diesel generator, fuel oil, alternate ac diesel generator, and nitrogen systems through visual inspection and physical manipulation of internal and external surfaces or replacement every 10 years; and (2) enhance this program, as well as the service water integrity program, to look for selective leaching.

The team determined that the licensee had revised the second commitment through development of a specific aging management program created to monitor for selective leaching (refer to Section 32 for more details). In addition, the team determined that Letter 2CAN04180, "Notification of Revised License Renewal Commitments," dated April 30, 2018, eliminated or modified several inspection requirements. Specifically, the licensee:

- Eliminated the requirement to inspect high pressure safety injection pumps in accordance with this program since both the service water integrity program and the oil analysis programs managed the aging for both the internal and external environments for the heat exchangers associated with these pumps.

- Revised the requirement to ultrasonically test the metal expansion boots for the emergency and alternate ac diesel generators to visually inspect and to dye penetrant test as needed because the boot configuration prevented ultrasonic testing.
- Revised monitoring of dew points for the alternate ac diesel generator air system to routine maintenance to look for moisture since the replacement air compressor units did not have that ability.

The team identified no concerns with this program.

.17 B.1.19 Pressurizer Examination Program (17926)

This program managed aging effects related to cracking of the stainless steel and nickel-based alloy cladding, and attachment welds that may propagate into the underlying ferritic steel. The licensee performed volumetric examinations, required by ASME Section XI, of the circumferential shell-to-head weld and the weld metal between the surge nozzle and the vessel lower head each inspection interval.

The licensee made two commitments related to this program. Specifically, the licensee committed to: (1) manage aging effects using the volumetric examinations described above and carry forward the existing risk-informed inservice inspection of the pressurizer surge line piping welds; and (2) revise the safety analysis report supplement to indicate this program was an existing program. The team verified the licensee managed the aging effects with volumetric examinations and had revised the safety analysis report to indicate this program was an existing program. In addition, the team noted that the licensee replaced the pressurizer in 2006.

The team identified no concerns with this program.

.18 B.1.20 Reactor Vessel Head Penetration Program (17927)

This program managed aging effects related to cracking of nickel-based alloy reactor vessel head penetrations exposed to borated water to assure that the pressure boundary function was maintained. The licensee performed visual and volumetric inspections as required by 10 CFR 50.55a to manage the effects of aging.

Letter 2CAN041801 deleted the program since the referenced NRC order no longer applied and 10 CFR 50.55a specified inspection requirements for the reactor vessel head penetrations. The team determined that the licensee should have revised the program to meet the inspection requirements described in 10 CFR 50.55a similar to their other inservice inspection aging management programs rather than deleting the program. The licensee documented this deficiency in Condition Report 2-2018-01275. Letter 2CAN061801, "Notification of Revised License Renewal Commitment," dated June 28, 2018, reinstated the aging management program.

The team reviewed the procedure and work order instructions used to perform the reactor vessel head penetration examinations and identified a violation of minor significance. The team identified that the procedural steps to address a relevant condition indicative of possible nozzle leakage did not implement the requirements of Code Case N-729-4, "Alternative Examination Requirements for PWR Vessel Upper

Heads with Nozzles Having Pressure-Retaining Partial-Penetrations Welds.” Specifically, the team identified a weakness in the way the licensee dispositions boric acid indications in the annulus of the head penetrations. This lack of guidance could result in the licensee failing to identify leakage from the annulus. The licensee documented this performance deficiency in Condition Report C-2018-02215.

The team did not identified any further concerns with this program.

.19 B.1.21 Reactor Vessel Integrity Program (17928)

This program managed aging effects related to reduction in fracture toughness of reactor vessel beltline materials. The licensee assured that they maintained the pressure boundary function by evaluating the radiation damage through comparison of pre-irradiation and post-irradiation testing of Charpy V-notch and tensile specimens. The licensee implemented ASTM E-185-82, “Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels,” to meet the requirements of 10 CFR Part 50, Appendices G and H.

The licensee identified one commitment that required revising safety analysis report, Table 5.2-12, “Capsule Removal Schedule,” to require withdrawing and testing one standby capsule to cover the peak fluence expected through the end of the period of extended operation. The team verified that the licensee implemented this commitment.

The licensee submitted a license amendment request per Letter 2CAN111702, dated November 20, 2017, to revise the reactor coolant system pressure-temperature limits applicable to the period of extended operation. The team determined that the licensee was responding to a request for additional information associated with this submittal.

The team identified no concerns with this program.

.20 B.1.22 Reactor Vessel Internals Cast Austenitic Stainless Steel Program (17929)

This program managed aging effects related to cracking, reduction of fracture toughness, and dimensional change using inspections of applicable components, which will be determined based on the neutron fluence and thermal embrittlement susceptibility of the component. This program supplemented the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program.

The licensee identified three commitments related to this program. Specifically, the licensee will: (1) develop this aging management program and submit to the NRC for review and approval; (2) begin the inspections during the fifth inspection interval after entering the period of extended operation; and (3) require that enhanced VT-1 examinations be performed one time during the period of extended operation. The team confirmed that the licensee submitted their reactor vessel internals aging management program plan to the NRC. This program plan implements the guidance of MRP-227-A, “Reactor Internals Inspection and Evaluation Guidelines,” to address aging effects of cast austenitic stainless steel components.

Letter 2CAN041801 moved the requirement to inspect the cast austenitic stainless steel control element assembly shroud tubes from this program into the existing reactor vessel

internals inspection program. The team determined that the control element assembly shroud tubes would not be required to be inspected per the classification guidance of MRP-227-A. The team identified no concerns with deleting this aging management program after including the component that required aging management to a different aging management program

The team identified no concerns with this program.

.21 B.1.23 Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program (17930)

This program managed aging effects related to crack initiation and growth, loss of fracture toughness, and distortion. The aging mechanisms included stress corrosion cracking or irradiation assisted stress corrosion cracking, neutron irradiation embrittlement, and void swelling. This program supplements the reactor vessel internals inspections required by the ASME Section XI Inservice Inspection Program.

The licensee identified two commitments related to this program. Specifically, the licensee: (1) committed to implement the program described in the supplement and the safety evaluation report, and submit to the NRC for review and approval; and (2) evaluate relevant indications in accordance with ASME Section XI.

The team reviewed the reactor vessel internals aging management program plan that the licensee submitted by Letter 2CAN071603, "Reactor Vessel Internals Aging Management Program Plan Arkansas Nuclear One – Unit 2," dated July 18, 2016. The team verified that the program provided reasonable assurance for addressing the applicable aging mechanisms. The team also verified that the licensee included the applicable Section XI evaluation criteria in this program.

The team identified no concerns with this program.

.22 B.1.24 Service Water Integrity Program (17931)

This program managed aging effects related to loss of material, fouling and cracking resulting from biofouling, corrosion, erosion, protective coating failures, and silting. The licensee performed surveillance testing and chemistry control techniques to manage aging effects in the service water system and components cooled by service water. The licensee implemented this program to meet the requirements of Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Systems."

This program had a single commitment specifying that licensee will enhance the program to inspect for evidence of selective leaching. The team determined that the licensee revised this commitment by Letter 2CAN041801 to develop an independent selective leaching aging management program (refer to Section 32).

The team identified no concerns with this program.

.23 B.1.25 Steam Generator Integrity Program (17932)

This program managed aging effects related to cracking and loss of material from steam generator internal components. The licensee performed nondestructive examination

techniques to identify defective tubes that needed removal from service or repaired in accordance with the guidelines of the technical specifications. In addition, the licensee used nondestructive examination techniques to manage the aging effects on secondary side internals needed to maintain steam generator integrity.

The licensee made one commitment related to performing visual inspections of the steam generator upper and lower internals at least once every 5 years. This visual inspection checked for loose parts as well as corrosion. The licensee also committed to perform an integrity assessment after each steam generator inspection which addresses all known degradation mechanisms. Letter 2CAN041801 clarified that the licensee did not perform specialized inspections of several components during inspection of the lower internals since these components were not visible and were not required by the industry standard.

The team verified the licensee managed the aging effects with nondestructive examination techniques and visual inspections. In addition, the team noted that the licensee replaced the steam generators in 2000.

The team identified no concerns with this program.

.24 B.1.26 Structures Monitoring - Masonry Wall Program (17933)

This program managed aging effects related to cracking of the Category 1 masonry block walls. The licensee performed visual inspections to monitor for cracking in joints and blocks that could potentially affect wall qualification.

The licensee had committed to manage cracking of masonry walls within the scope of license renewal as part of their maintenance rule program. The team verified the licensee managed the aging effects with visual inspections as part of the maintenance rule program.

The team identified no concerns with this program.

.25 B.1.27 Structures Monitoring - Structures Monitoring Program (17934)

This program managed aging effects related to loss of material for component supports and aging effects related to concrete. The program included loss of material for cranes, rails, and supports. Although no aging effects requiring management were identified, this program also included the intake canal and concrete subject to aging management review.

The licensee had committed to periodically inspect concrete exposed to groundwater to confirm the absence of aging effects. The licensee also committed to inspect inaccessible concrete exposed to groundwater when excavated for maintenance activities. The licensee made these commitments because wells were not available for sampling groundwater at the time of the license renewal application. Subsequently, wells became available for sampling groundwater, and the licensee revised this program to periodically perform groundwater sampling. The licensee determined that they had developed a process to take the ground water readings every 5 years, but had failed to take the samples as expected. The licensee documented their failure to take the samples in Condition Report C-2018-02365. Subsequently, the licensee took samples

and determined that the groundwater remained nonaggressive and within the specified limits.

The team identified no concerns with this program.

.26 B.1.28 System Walkdown Program (17935)

This program managed aging effects related to loss of material, loss of mechanical closure integrity, and cracking, as applicable, for systems and components within the scope of license renewal. The licensee performed visual inspections of readily accessible system and component surfaces during system walkdowns.

The licensee had committed to include visual inspections in the program to manage the aging effects listed above. The team verified the licensee included visual inspections in this program to manage loss of material, loss of mechanical closure integrity, and cracking, as applicable, for systems and components within the scope of license renewal.

The team identified no concerns with this program.

.27 B.1.29 Wall Thinning Monitoring Program (17936)

This program managed aging effects related to loss of material caused by erosion mechanisms. The licensee established visual inspections and nondestructive examinations to monitor wall thickness. The licensee included the emergency diesel generator exhaust piping and silencers, the diesel starting air receivers, and the alternate ac diesel generator exhaust piping and silencer.

The licensee identified two commitments related to this program. Specifically, the licensee committed to: (1) conduct ultrasonic examination of the alternate ac diesel generator stainless steel expansion joints in lieu of disassembling the component and (2) utilize industry accepted methods to conduct the wall thinning examinations.

Letter 2CAN041801 revised the commitment to monitor the thickness of the alternate ac diesel generator expansion joints from ultrasonic examination to conducting dye penetrant testing and visual examinations of the expansion joints every 18 months as part of the Periodic Surveillance and Periodic Maintenance Program.

The team determined that the licensee had developed specific monitoring locations identified on plant isometric drawings. The licensee recently replaced and repaired portions of the train A diesel generator exhaust piping and silencer, and had plans to replace the same components on train B during their upcoming refueling outage.

The team identified no concerns with this program.

.28 B.1.30.1 Water Chemistry Control – Auxiliary Systems (17937)

This program managed aging effects related to loss of material, cracking, and fouling of components exposed to treated water environments. The licensee monitored and maintained chemistry parameters that included pH, conductivity, solids, hardness, nitrite freeze point, and biological count. The licensee added sodium nitrite or sodium

molybdate as corrosion inhibitors. The licensee performed visual inspections to detect visible corrosion, deposits, and biological growth. This program included the emergency diesel generator jacket water, alternate ac diesel generator cooling water, plant boilers, closed cooling water systems, cooling towers, and chilled water systems.

The team identified no concerns with this program.

.29 B.1.30.2 Water Chemistry Control – Closed Cooling (17938)

This program managed aging effects related to loss of material, cracking, and fouling for closed cooling water system components. The licensee monitored and controlled closed cooling water chemistry within acceptable limits using procedures and processes based on Electric Power Research Institute TR-107396, "Closed Cooling Water Chemistry Guidelines." The implementation activities included visual inspections of systems/components. The licensee added corrosion inhibitors to manage general, crevice, and pitting corrosion. This program included the emergency diesel generator jacket water, alternate ac diesel generator cooling water, plant boilers, closed cooling water systems, cooling towers, and chilled water systems.

The team identified no concerns with this program.

.30 B.1.31 One Time Inspection Program (18175, 18207)

This program managed aging effects related to loss of material for the following systems: (1) auxiliary building heating and ventilation, (2) auxiliary building sump, (3) drain collection header, (4) liquid radwaste management, (5) resin transfer, (6) regenerative waste, and (7) spent resin. The licensee performed nondestructive examination methods to determine whether degradation, as a result of loss of material, was occurring at a rate slow enough to ensure that the intended functions of the components will be maintained during the extended period of operation.

The licensee made two commitments related to this program. Specifically, the licensee committed to: (1) implement a one-time inspection program for the identified systems that was consistent with the generic aging lessons learned report and (2) revise the safety analysis report supplement to describe this program.

The original commitments included the post-accident sampling system in the list of systems managed by this program. Letter 2CAN041801 revised the commitment to remove the post-accident sampling system from this program since the licensee removed this system from serve.

The team verified the licensee implemented a one-time inspection program for the remaining seven systems consistent with the generic aging lessons learned report and revised the safety analysis report to describe this program.

During the performance of the inspections, the licensee identified four samples where the measured wall thickness was less than the acceptance criteria. The team identified that the licensee failed to consider scope expansion for the copper piping for the auxiliary building heating and ventilation system, as required by the one-time inspection program. The licensee documented this concern in Condition Report 2-2018-01107. Subsequently, the licensee expanded the scope and performed four additional



inspections on the population of copper piping. Since these inspections were performed prior to the period of extended operation, there was no performance deficiency. The licensee determined that the other copper piping samples had no aging effects present.

The team identified no additional concerns with this program.

.31 Selective Leaching Program (B.1.10.2, B.1.18, B.1.24) (20017)

This program managed aging effects related to loss of material resulting from selective leaching in components made of susceptible materials in aggressive environments. The susceptible materials included gray cast iron and copper alloys containing greater than 15 percent zinc or 8 percent aluminum, respectively. The aggressive environments included raw water, ground water, and waste water.

This program credited the water chemistry and closed treated water systems programs to control pH and concentration of corrosive contaminants to minimize selective leaching.

In the license renewal application process, the licensee credited the fire water system, periodic surveillance and preventive maintenance, and service water integrity programs with managing loss of material caused by selective leaching. Subsequently, the licensee committed to implement a standalone program to monitor for selective leaching.

The licensee established this as an independent aging management program. This program planned to use visual inspections and mechanical examination techniques (e.g., chipping or scraping) when opportunities arise as well as periodic destructive examinations to monitor for selective leaching. At a minimum, a sample of 3 percent of each material/environment population up to a maximum of 10 components per population will be inspected in each 10-year period during the period of extended operation.

The team verified that the licensee implemented the selective leaching program. The team concluded that this program provided reasonable assurance that the licensee will detect loss of material caused by selective leaching. The team based this conclusion, in part, on (1) the use of laser-induced breakdown spectroscopy to accurately identify the population of components susceptible to selective leaching, (2) the use of destructive examinations to identify selective leaching, and (3) spreading out the inspections over each 10-year period allowed a longer period for this aging mechanism to manifest itself and be positively identified.

The team identified no concerns with this program.

.32 Implement the Environmentally Assisted Fatigue Option Program (Section 4.3.3.1) (17940)

This program managed aging effects related to environmentally assisted fatigue. Prior to entering the period of extended operation, the safety evaluation report required the licensee to address the effects of environmentally assisted fatigue for several fatigue-sensitive locations, which included:

- Reactor vessel shell and lower head

- Reactor vessel inlet and outlet nozzles
- Surge line
- Charging nozzle
- Safety injection nozzle
- Shutdown cooling system Class 1 piping

The licensee elected to perform the inspection option as allowed by their safety analysis report Section 4.3.3.1. The licensee identified two locations that would be inspected in accordance with ASME Section XI, Appendix L, "Operating Plant Fatigue Assessment," and submitted that to the NRC for review. The licensee had preliminarily calculated that the cumulative usage factor for the other monitored locations remained less than one (1.0) and did not require inspection. Since the calculations were not available for review at the time of this inspection, this commitment will remain open.

This commitment and item remain open pending review during a future inspection.

c. Conclusions

Based on review of the actions implemented, inspection results reviewed, and interviews with program owners, the team determined that the licensee provided reasonable assurance and demonstrated that they would implement actions to effectively manage the effects of aging for each respective program. The team determined that the licensee met the commitments described prior to the period of extended operation. The team will need to review two additional commitments and associated aging management programs during a future inspection.

**40A6 Meetings, Including Exit**

The team presented the inspection results to Mr. B. Daiber, Design Engineering Manager, and other members of the licensee staff during an exit meeting conducted on July 27, 2018. The licensee acknowledged the NRC inspection observations. The team retained no proprietary information and verified that no proprietary information was documented in this report.

## **SUPPLEMENTAL INFORMATION**

### **PERSONNEL CONTACTED**

#### **Licensee Personnel**

R. Anderson, Site Vice President  
D. Bauman, License Renewal Project Manager  
J. Beldin, Programs Engineer  
D. Bice, Regulatory Assurance Specialist  
M. Bradley, Programs Engineer  
A. Bratton, Programs Engineer  
K. Campbell, Design Engineer  
B. Clark, Regulatory Assurance Specialist  
C. Coffman, Systems Engineer  
S. Creel, Programs Engineer  
K. Ellis, Programs Engineer  
K. Fresneda, Systems Engineer  
D. Fromaberger, Licensing Engineer  
R. Fougrousse, Contractor, Engineering Support  
T. Hatfield, Engineering Programs Supervisor  
C. Heinzen, Fire Protection Specialist  
M. Hossain, Senior Engineer  
A. Lamb, Electrical Engineer  
J. Loving, Systems Engineer  
T. Lunger, Containment Inservice Inspection Program Engineer  
A. Osborne, Programs Engineer  
N. Mosher, Licensing Specialist  
M. Prock, Chemistry Supervisor  
S. Pyle, Regulatory Assurance Manager  
J. Rodan, Chemistry  
S. Shelton, Fix-it-Now Engineer  
B. Smith, Programs Engineer  
R. Smith, Programs Engineer  
D. Stringer, Inservice Inspection Contractor  
S. Taylor, Inservice Inspection Program Engineer  
B. Wayne, Senior Engineer  
J. Wesselhoft, Civil Engineer  
B. Whipple, Senior Engineer  
J. Young, Electrical Engineer

#### **NRC Personnel**

C. Henderson, Senior Resident Inspector

## **COMMITMENTS REVIEWED**

NRC closed Commitments 17908, 17909, 17914, and 17939 in Inspection Report 05000368/2017009, which included NUREG-1828, "Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 2," Appendix A items 6 and 28.

The team closed the following tracking commitments in this inspection report during review of the aging management program implementation:

17905, 17910, 17911, 17912, 17913, 17915, 17916, 17917, 17918, 17919, 17920, 17921, 17922, 17923, 17924, 17925, 17926, 17927, 17928, 17929, 17930, 17931, 17932, 17933, 17934, 17935, 17936, 17937, 17938, 18175, 18207, and 20017.

During review of these commitments the team confirmed that the licensee had met the conditions for safety evaluation report, Appendix A, Items 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, and 40.

As described in the report, the team did not complete review of the aging management program and associated tracking commitments related to environmentally assisted fatigue (17940, safety evaluation report, Appendix A, Item 39).

## DOCUMENTS REVIEWED

### **General**

Condition Report (CR-ANO-)  
2-2018-01152\*

\*Condition Report generated during the inspection.

### **License Renewal**

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
NUREG-1801, Volume 2	Generic Aging Lessons Learned (GALL) Report	September 2005
NUREG-1828	Safety Evaluation Report Related to the License Renewal of Arkansas Nuclear One, Unit 2	April 2001
USAR Chapter 16	Aging Management Programs and Activities	24
2CAN100302	License Renewal Application	October 14, 2003
2CAN010401	License Renewal Application Clarifications	January 22, 2004
2CAN041801	Notification of Revised License Renewal Commitments	April 30, 2018

### **Procedures**

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-LI-110	Commitment Management Program	11
EN-LI-113	Licensing Basis Document Change Process	16

### **Aging Management Programs**

#### **Alloy 600 Program**

### **License Renewal**

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CAN070405	Request for Additional Information Responses for License Renewal Application	July 22, 2004
2CAN071602	Nickel-Based Alloy Aging Management Program Plan	July 18, 2016
2CAN090402	License Renewal Application Clarifications	September 10, 2004
2CAN090403	License Renewal Application Clarifications	September 23, 2004

License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CNA061702	Review of Commitment Submittal for License Renewal Regarding Nickel-Based Alloy Aging Management Program Plan	June 28, 2017
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
CALC-ANO2-NE-15-00006	Review of the Alloy 600 Aging Management Program for License Renewal Implementation	0

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
SEP-A600-001	Alloy 600 Management Program	0
SEP-ISI-ANO2-105	ASME Section XI, Division 1, ANO-2 Inservice Inspection Program	3
SI-UT-175	Procedure for Encoded, Phased Array Ultrasonic Examination of Dissimilar Metal Piping Welds	1

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
OP-2311-009	ANO Unit 1 and Unit 2 Alloy 600 Inspection	14

**Buried Piping Inspection Program**License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00006	Review of the Buried Piping Inspection Program for License Renewal Implementation	0

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
	Annual Survey of The Cathodic Protection Systems Installed at the Arkansas Nuclear One Power Station	December 2014
	Data Related to Historical Piping Replacements and Future Planned Inspection Activities	
CEP-UPT-0100	Underground Piping and Tanks Inspection and Monitoring	3

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
SEP-U IP-ANO	Underground Components Inspection Plan Non-Rad and Rad Piping	3
SPEC-C-2301	Technical Specification for Structural Backfill and Pipe Trench Excavation and Backfill	1
SPEC-M-2400	Technical Specification for External Surface Treatment of Underground Metallic Pipe	2

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-343	Underground Piping and Tanks Inspection and Monitoring Program	9
EN-EP-S-002-MULTI	Underground Piping and Tanks General Visual Inspection	4
EN-WM-105	Planning	16

Work Orders

00275348      00277890      00358760      50257843

**Cast Austenitic Stainless Steel Evaluation Program**License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
CALC-ANO2-ME-15-00007	Review of the Cast Austenitic Stainless Steel (CASS) Evaluation Program for License Renewal Implementation	0

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2 -EP-17- 00100-02	Cast Austenitic Stainless Steel (CASS) Aging Management Program Final Report at ANO-2	0
SEP-ISI-ANO2-105	ASME Section XI, Division 1, ANO-2 Inservice Inspection Program	3

## **Containment Leak Rate Testing**

### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC ANO2-CS-15-00005	Review of the Containment Leak Rate Program for License Renewal Implementation	0

### Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
5120.403	Unit 2 Primary Containment Leak Rate Running Total	2R24
5120.403	Unit 2 Primary Containment Leak Rate Running Total	2R25

### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2305.017	Local Leak Rate Testing	32
5120.401	Unit 2 Integrated Leak Rate Test	6
5120.403	Unit 2 Primary Containment Leak Rate Running Total	10
CEP-APJ-001	Primary Containment Leakage Rate Testing (10 CFR 50 Appendix J) Program Plan	3
EN-DC-334	Primary Containment Leakage Rate Testing (Appendix J)	3
SEP-APJ-002	Primary Containment Leakage Rate Testing (Appendix J) Program Section	4

## **Diesel Fuel Monitoring Program**

### Condition Reports (CR-ANO-)

2-2017-03535      2-2017-04279      C-2017-04159

### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00008	Review of the Diesel Fuel Monitoring Aging Management Program for License Renewal Implementation	0



Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1000.113	Diesel Fuel Monitoring Program	15
1052.023	Conduct of Chemistry	20
1605.099	Determination of Particulate Contamination in Diesel Fuel Oils	3
1618.035	Sampling and Analyzing Diesel Fuel Oil from Diesel Fuel Oil Transports	21
2402.028	Unit 2 Emergency Diesel Generator Fuel Oil Tanks 2T-30A&B and 2T-57A&B Cleaning and Inspection	12
2618.005	Sampling Unit 2 Diesel Fuel	20
2618.027	Sampling the Unit 2 Emergency Diesel Fuel Oil Day Tanks (2T-30A and B)	9

Work Orders

51013866	51013867	51053303	51053304	52216491	52220411
52430683	52457881	52573387	52573388		

**Fatigue Monitoring Program**License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00009	Review of the Fatigue Monitoring Program for License Renewal Implementation	0
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-SE-2015-0001	ANO Unit 2 Transient Cycle Report for 2014	0
CALC-ANO2-SE-16-0001	ANO Unit 2 Transient Cycle Report for 2015	0
CALC-ANO2-SE-17-0003	ANO Unit 2 Transient Cycle Report for 2016	0

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
OP-1010-002	Unit 2 Transient Cycle Logging and Reporting	10

**Fire Protection Program**Condition Reports (CR-ANO-)

2-2017-00753      2-2017-00754      2-2017-00746

License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00010	Review of the Fire Protection Aging Management Program for License Renewal Implementation	0

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1104.032	Fire Protection Systems	87
1306.027	Unit 1 K-5 Diesel Fire Pump Engine Surveillance Inspection	27
2306.025	Unit 2 Fire Door Inspection Procedure	18

Work Orders

52600436      52669474      52687160      52707730

**Fire Water System Program**License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00011	Review of the Fire Water System Aging Management Program for License Renewal Implementation	1

Model Work Orders

00094725      00289560      50235187      50235711      50235907      50235923  
50236026      50239643      50241731      50242169

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1003.012	Fire Hose Station Inspection	13
1104.032	Fire Protection Systems	86

### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1203.009	Fire Protection System Annunciator Corrective Action	34
1605.035	Determination of Diesel Coolant Additive	8
1618.030	Sampling Emergency Fire Diesel (K-5) Cooling Water	8
2104.032	Unit 2 Fire Protection System Operations	41
2306.027	Unit 2 Fire Hose Station Testing and Hydrostatic Test	15
EN-DC-340	Microbiologically Influenced Corrosion (MIC) Monitoring Program	5

### Work Orders

00335737	52367211	52572001	52635209	52678826	52692225
52700338	52708114	52713219			

## **Flow-Accelerated Corrosion Program**

### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00012	Review of the Flow-Accelerated Corrosion Aging Management Program for License Renewal Implementation	0

### Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Date</u>
	2R24 Flow Accelerated Corrosion Program Final Inspection Report	
	2R27 Flow Accelerated Corrosion Inspection Plan	
BP-2017-0013-TR-02	Erosion Susceptibility Evaluation	March 28, 2018
EC 69055	1R26 Flow Accelerated Corrosion Program Final Inspection Report	
EC 72408	2R25 Flow Accelerated Corrosion Program Final Inspection Report	

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-315	Flow Accelerated Corrosion Program	13
EN-DC-360	Erosion Program	1

**Heat Exchanger Monitoring Program**License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00013	Review of the Heat Exchanger Monitoring Aging Management Program for License Renewal Implementation	0

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
	Eddy-Current Test Results for the Emergency Diesel Generator Heat Exchangers	November 2014
CALC-86-E-0036-250	Regenerative and Letdown Heat Exchangers, Revised Transient Cycle Limits	0
SEP-HX-ANO-001	Heat Exchanger Program	5

Model Work Orders

00075114	00075115	00075102	00075104	00300398	00301181
00301133	00301186	50236224	50236226		

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2311.001	Shutdown Cooling Heat Exchanger Performance Test	3
2311.008	Emergency Diesel Generator Heat Exchanger Performance Test	8
EN-DC-316	Heat Exchanger Performance and Condition Monitoring	9

Work Orders

00455753	00455754	52318640	52318641	52388103	52469137
52469138	52469139	52498955	52508554	52538024	52594008

## **Inservice Inspection – Containment Inservice Inspection Program**

### License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CAN050404	Request for Additional Information Responses for License Renewal Application	May 19, 2004
2CAN070409	License Renewal Application Clarifications	July 22, 2004
2CAN080401	License Renewal Application Clarifications	August 18, 2004
2CAN090402	License Renewal Application Clarifications	September 10, 2004
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
CALC-ANO2-CS-15-00007	Review of the Inservice Inspection – Containment Inservice Inspection Program for License Renewal Implementation	0

### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CEP-CII-003	Visual Examination of Class MC Components	306
CEP-CII-004	General and Detailed Visual Examinations of Concrete Containments	308
SEP-CISI-ANO-001	Containment Tendon Inspections	2
SEP-CISI-ANO-105	Program Section For ASME Section XI, Division 1, ANO-2 Containment Inservice Inspection Program	1

### Work Order

00363510

## **Inservice Inspection Program**

### License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CAN010401	License Renewal Application Clarifications	January 22, 2004
2CAN060403	Request for Additional Information Responses for License Renewal Application	June 16, 2004
2CAN070404	Request for Additional Information Responses for License Renewal Application	July 1, 2004

### License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CAN070409	License Renewal Application Clarifications	July 22, 2004
CALC-ANO2-CS-15-00006	Review of the Inservice Inspection – Inservice Inspection Program for License Renewal Implementation	0

### Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
SEP-ISI-ANO2-105	ASME Section XI, Division 1, ANO-2 Inservice Inspection Program	3
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2

### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CEP-ISI-100	ASME Section XI, Division 1, Fleet Administrative Controls for Inservice Inspection Program	2
CEP-RR-001	ASME Section XI, Repair/Replacement Program	313

## **Non-EQ Inaccessible Medium-Voltage Cable Program**

### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-EE-15-00002	Review of Non-EQ Inaccessible Medium-Voltage Cable Program for License Renewal Implementation	0

### Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-346	Cable Reliability Program	6

## **Non-EQ Insulated Cables and Connections Program**

### Condition Reports (CR-ANO-)

1-2011-01520      2-2011-03319      2-2013-00154      2-2017-02891

License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-EE-15-00005	Review of the Non-EQ Insulated Cables and Connections Program for License Renewal Implementation	0

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-EE-11-0001 (EC-56948)	ANO-2 Cable and Connection Inspection Summary Report	0
ECS-17-0010	Non-EQ Insulated Cables and Connections Program CALC-ANO2-EE-11-0001 Corrective Action Evaluation	0

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-346	Cable Reliability Program	6
EN-DC-348	Non-EQ Insulated Cables and Connections Inspection	5

Work Orders

52641098      52695076      52698636

**Oil Analysis Program**License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00004	Review of the Oil Analysis Aging Management Program for License Renewal Implementation	0

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
OP-1052.007	Secondary Chemistry Monitoring	42
OP-1052.023	Conduct of Chemistry	20
SEP-LUB-ANO-002	ANO Oil Analysis Program	4

## One time inspection program

### Condition Reports (CR-ANO-)

2-2017-02791      2-2017-02793      2-2017-02922      2-2018-01051\*      2-2018-01107\*  
C-2017-02086

\*Condition Reports generated during the inspection

### Engineering Reports

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00015	Review of the One-Time Inspection Program for License Renewal Implementation	0
CALC-ANO2-ME-17-00004	License Renewal One-Time Inspection Summary Report	0
EN-CS-S-008-MULTI	Pipe Wall Thinning Structural Evaluation	1
EN-FAP-LR-024	One-Time Inspection	3

### Work Orders

248961      479351      479369      492782      492790

## Periodic Surveillance and Preventive Maintenance Program – General

### License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
CALC-ANO2-ME-15-00016	Review of the Periodic Surveillance and Preventive Maintenance Program for License Renewal Implementation	1

### Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-324	Preventive Maintenance Program	18

## Periodic Surveillance and Preventive Maintenance Program - Emergency Feedwater

### Model Work Orders

00074845      50233786      50234208      50234213      50234218      50241655  
50241656      50241827      50241828



Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2106.006	Emergency Feedwater System Operations	96
2411.091	Emergency Feedwater Pump Turbine Internal Inspection	9

**Periodic Surveillance and Preventive Maintenance Program – Station Battery Racks**

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2307.016	Unit 2– 2D-11, 2D-12 and 2D-13 Battery Surveillance	38

**Periodic Surveillance and Preventive Maintenance Program – Emergency Core Cooling Systems**

Work Orders

00119184	00155998	52534782	52549584	52550868
52558112	52564432	52565621	52572864	52574430
52581440	52584562	52588222	52590626	52591828
52597775	52599002	52602514	52604860	52613589
52614978	52618471	52620788	52621995	52628655
52633633	52636054	52637123	52643203	52644582
52648650	52651168	52652787	52659638	52660858
52664202	52666793	52668165	52673981	52675249
52679566	52683343	52687189	52689640	52694577
52698182	52701901	52704091	52705970	52710517
52714428	52714429	52720085	52721275	52725610
52729230	52729231	52735086	52736029	52739615
52743401	52743402	52749672	52750958	52754457

**Periodic Surveillance and Preventive Maintenance Program – Containment Spray, Chemical Volume Control**

Work Orders

52678689	52577054
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**Periodic Surveillance and Preventive Maintenance Program – Containment Cooling, Auxiliary Building Ventilation, Control Room Ventilation**

Model Work Orders

00485770	00485771	50233600	50235474	50235479	50235480	50235484
50238286	50238551	50238674	50240605	50240606	50240607	50240608

Model Work Orders

50240609	50240610	50240611	50240612	50240613	50240614	50240615
50240616	50240617	50240624	50240625	50240626	50240627	50240629
50240630	50240631	50240632	50240633	50240634	50240635	50240636
50240637	50240638	50241813	50241814			

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2104.007	Control Room Emergency Air Conditioning and Ventilation	75
5120.406	Flow Verification of the U1 and U2 Control Room Emergency Air Conditioning System	4
5120.415	In-place Testing of the U1 Control Room Filtration System	14
5120.425	In-place Testing of the U2 Control Room Filtration System	15

Work Orders

52527131	52626929	52722541	52725680
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**Periodic Surveillance and Preventive Maintenance Program – Emergency Diesel Generator, Alternate AC Diesel Generator, Fuel Oil**Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1000.113	Diesel Fuel Monitoring Program	15
1605.099	Determination of Particulate Contamination in Diesel Fuel Oils	3
1618.035	Sampling and Analyzing Diesel Fuel Oil from Diesel Fuel Oil Transports	21
2104.036	Emergency Diesel Generator Operations	94
2104.037	Alternate AC Diesel Generator Operations	33
2306.005	Maintenance Surveillance on Unit 2 Emergency Diesel Generator 2k-4 and 2K-4B	49

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2402.028	Unit 2 Emergency Diesel Generator Fuel Oil Tanks 2T-30A&B and 2T-57A&B Cleaning and Inspection	12
2402.028	Unit 2 Emergency Diesel Generator Fuel Oil Tanks 2T-30A&B and 2T-57A&B Cleaning and Inspection	12
2618.005	Sampling Unit 2 Diesel Fuel	20
2618.027	Sampling the Unit 2 Emergency Diesel Fuel Oil Day Tanks (2T-30A and B)	9

**Periodic Surveillance and Preventive Maintenance Program – Halon and Reactor Coolant Pump**Model Work Orders

50234892      50242036

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1504.001	Visual Inspection of the Unit 1 and 2 RCPs Oil Collection System	12
2307.036	CPC Room Number 2098C Fire Protection Test	17

**Periodic Surveillance and Preventive Maintenance Program – Service Water, Emergency Cooling Pond**Model Work Orders

00374845	00374847	00374849	00404828	00404829	00404830
50236263	50237898	50241829	50241830	50241831	

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1306.019	Annual Emergency Cooling Pond Sounding	16

Work Orders

52652762      52713201      52720086      52723739

## Pressurizer Examination Program

### Condition Report (CR-ANO-)

2-2018-01152\*

\*Condition Report generated during the inspection

### Engineering Request

<u>Number</u>	<u>Title</u>	<u>Revision</u>
ER-ANO-2002-0836-003	ANO-2 Pressurizer Replacement Project	0

### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00017	Review of the Pressurizer Examination Program for License Renewal Implementation	0

### Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
SEP-ISI-ANO2-105	Program Section for ASME Section XI, Division 1, ANO-2 Inservice Inspection Program	3

## Reactor Vessel Head Penetration Program

### Condition Reports (CR-ANO-)

2-2018-01035\*    2-2018-01053\*    C-2018-02215\*

\*Condition Reports generated during the inspection

### License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CAN070405	Request for Additional Information Responses for License Renewal Application	July 22, 2004
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
CALC-ANO2-ME-15-00019	Review of the Reactor Vessel Head Penetration Program for License Renewal Implementation	0

### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2102.001	Plant Pre-Heatup and Pre-Critical Checklist	85, 86, 87

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2311.009	ANO Unit 1 and 2 Alloy 600 Inspection	15
2311.009G	Unit 2 RPV Closure Head A-600 Visual Inspection	10
2311.009M	Unit 2 RPV Head Non-Visual Nondestructive Examination A-600 Inspections	9

Work Orders

52360058      52575671

**Reactor Vessel Integrity Program**License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CNA051801	Request for Additional Information Regarding License Amendment Request to Update the Reactor Coolant System Pressure-Temperature Limits	May 10, 2018
2CAN070405	Request for Additional Information Responses for License Renewal Application	July 22, 2004
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
CALC-ANO2-ME-15-00018	Review of the Reactor Vessel Integrity Program for License Renewal Implementation	0

Miscellaneous

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1600537.401	ANO-2 Reactor Vessel Integrity Program	0

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CEP-FTP-ANO2	Reactor Vessel Fracture Toughness and Surveillance Material Testing at ANO-2	1
1022.013	Preparation and Conduct of Refueling Activities	13
2402.004	Removal of the Unit 2 Reactor Vessel Surveillance Capsule Assemblies	12

Work Order

52574250

**Reactor Vessel Internals Cast Austenitic Stainless Steel Program**

License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CAN050401	Request for Additional Information Responses for License Renewal Application	May 19, 2004
2CAN070405	Request for Additional Information Responses for License Renewal Application	July 22, 2004
2CAN090402	License Renewal Application Clarification	September 10, 2004
2CAN100403	Annual Update to the License Renewal Application	October 13, 2004
2CNA101702	Staff Assessment Regarding Program Plan for Aging Management of Reactor Vessel Internals	October 26, 2017
CALC-ANO2-NE-15-00005	Review of the Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Aging Management Program for License Renewal Implementation	1
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
2CAN071603	Reactor Vessel Internals Aging Management Program Plan Arkansas Nuclear One – Unit 2	July 18, 2016

Miscellaneous

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1600537.402	ANO-2 PWR Reactor Vessel Internals Program	0
1660402.402	Development of a Cast Austenitic Stainless Steel (CASS) Aging Management Program for Arkansas Nuclear One Unit 2 Task 5 Report	0

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-130	Entergy Reactor Vessel Internals Management (RVIM) Program	6
SEP-ISI-ANO2-105	ASME Section XI, Division 1, ANO-2 Inservice Inspection Program	3

Work Order  
00428178

### **Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program**

#### License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
2CAN040405	Request for Additional Information Responses for License Renewal Application	July 22, 2004
2CAN050401	Request for Additional Information Responses for License Renewal Application	May 19, 2004
2CAN071603	Reactor Vessel Internals Aging Management Program Plan Arkansas Nuclear One – Unit 2	July 18, 2016
2CAN090402	License Renewal Application Clarification	September 10, 2004
2CAN100403	Annual Update to the License Renewal Application	October 13, 2004
A2-EP-2002-002	ANO-2 License Renewal Project Evaluation of Aging Management Programs	2
CALC-ANO2-ME-15-00020	Review of the Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program for License Renewal Implementation	0

#### Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
1000.106	Primary Chemistry Monitoring Program	13
1600537.402	ANO-2 PWR Vessel Internals Program	0

#### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-133	PWR Vessel Internals Program	1
SEP-ISI-ANO2-105	ASME Section XI, Division 1, ANO-2 Inservice Inspection Program	3

Work Order  
00428178

### **Service Water Integrity Program**

License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00023	Review of the Service Water Integrity Program for License Renewal implementation	0

Miscellaneous

<u>Numbers</u>	<u>Title</u>	<u>Revision/Date</u>
A-EP-2005-001	ANO Microbiological Influenced Corrosion (MIC) Program	4
EC 77690	Document Analysis of 1R27 As-Found and As-Left Service Water Flow Test Per Guidance in CALC-91-R-2013-01	May 11, 2018
SEP-MIC-ANO-001	Microbiological Influenced Corrosion (MIC) Program	2

Model Work Orders

00047862	00075102	00075104	00075114	00075115	00300398
00301133	00301181	00301186	50236224	50236226	50236227
50236228	50236229	50236230	50236231	50236232	50236233
50238640	50238650	50240608	50240609	50240610	50240611
50240612	50240613	50240614	50240615	50240616	50240617
50240624	50240625	50240626	50240627	50240629	50240630
50240631	50240632	50240633	50240634	50240635	50240636
50240637	50240638				

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1104.029	Service Water and Auxiliary Cooling System	117
EN-DC-184	NRC Generic Letter 89-13 Service Water Program	4
EN-DC-316	Heat Exchanger Performance and Condition Monitoring	9
EN-DC-340	Microbiologically Influenced Corrosion (MIC) Monitoring Program	5

Work Orders

00067450	00067451	00156283	00326923	00370501	00429948
00440778	00511516	50274120	50274121	50995106	51015566
52318640	52318641	52426635	52455623	52466266	52469137



Work Orders

52469139	52502821	52534324	52538024	52548685	52552715
52562136	52562274	52563303	52573117	52580296	52585095
52588774	52594008	52600963	52627547	52640852	52643544
52643653	52643813	52650297	52650710	52689581	52689582
52697485	52702568	52718927			

**Steam Generator Integrity Program**Condition Reports (CR-ANO-)

2-2014-01394	2-2014-01395	2-2014-01414	2-2014-01449	2-2014-01454
2-2014-01481	2-2014-01496	2-2014-01539		

Engineering Information Record

<u>Number</u>	<u>Title</u>	<u>Revision</u>
51-9223883-000	ANO Unit 2 Condition Monitoring for EOC23 and Operational Assessment for Cycles 24, 25, and 26	0

License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00022	Review of the Steam Generator Integrity Program for License Renewal Implementation	0

Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-317	Steam Generator Program	9
SEP-SG-ANO-2-001	ANO Steam Generator Program	2

**Structures Monitoring - Masonry Wall Program**License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-CS-15-00008	Review of the Structures Monitoring – Masonry Wall Program for License Renewal Implementation	0
CALC-ANOC-CS-15-00001	2015 Maintenance Rule Structural Monitoring, 5 Year Walkdown of High Risk Structures	0

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-150	Condition Monitoring of Maintenance Rule Structures	13

**Structures Monitoring - Structures Monitoring Program**

Condition Reports (CR-ANO-)

C-2012-03292      C-2015-00666      C-2015-00729      C-2015-01003      C-2017-04426  
C-2018-02365\*

\*Condition Reports generated during the inspection

License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
CALC-ANOC-CS-15-00001	2015 Maintenance Rule Structural Monitoring, 5 Year Walkdown of High Risk Structures	0
CALC-ANO2-CS-15-00009	Review of the Structures Monitoring – Structures Monitoring Program for License Renewal Implementation	0

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-150	Condition Monitoring of Maintenance Rule Structures	13

**System Walkdown Program**

Condition Report (CR-ANO-)

C-2018-02232\*

\*Condition Report generated during the inspection

License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00024	Review of the System Walkdown Program for License Renewal Implementation	0

Procedure

<u>Number</u>	<u>Title</u>	<u>Revision</u>
EN-DC-178	System Walkdowns	11

## Wall Thinning Monitoring Program

### Drawings

<u>Number</u>	<u>Title</u>	<u>Revision</u>
2JBD-201-1, Sheet 1	Large Pipe Isometric 2K-4A Emergency Diesel Generator Exhaust	15
2JBD-202-1, Sheet 1	Large Pipe Isometric 2K-4B Emergency Diesel Generator Exhaust	13

### License Renewal

<u>Numbers</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00025	Review of the Wall Thinning Monitoring Program for License Renewal Implementation	0
SEP-WTI-ANO-001	Wall Thinning Inspection (WTI) Program	4

### Model Work Orders

00439691      00437904

### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1104.029	Service Water and Auxiliary Cooling System	117
EN-DC-315	Flow Accelerated Corrosion Program	13

## Water Chemistry Control- Auxiliary Systems

### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00026	Review of the Auxiliary Systems Water Chemistry Control Aging Management Program for License Renewal Implementation	0

### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1052.003	Nuclear Chemistry Quality Control Program	32
1052.007	Secondary Chemistry Monitoring	41
1052.019	Chemistry Inspections of Plant Systems and Heat Exchangers	9
1052.023	Conduct of Chemistry	20

1052.027	Auxiliary Systems Water Chemistry Monitoring	22
EN-LI-113	Licensing Basis Document Change Process	11
EN-CY-102	Laboratory Analytical Quality Control	9

#### **Water Chemistry Control- Closed Cooling**

##### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00027	Review of the Closed Cooling Water Chemistry Control Aging Management Program for License Renewal Implementation	0

##### Procedures

<u>Number</u>	<u>Title</u>	<u>Revision</u>
1052.003	Nuclear Chemistry Quality Control Program	32
1052.007	Secondary Chemistry Monitoring	41
1052.019	Chemistry Inspections of Plant Systems and Heat Exchangers	9
1052.023	Conduct of Chemistry	20
1052.027	Auxiliary Systems Water Chemistry Monitoring	22
EN-LI-113	Licensing Basis Document Change Process	11
EN-CY-102	Laboratory Analytical Quality Control	9

#### **Implement the Environmentally Assisted Fatigue Option Program**

##### License Renewal

<u>Number</u>	<u>Title</u>	<u>Date</u>
2CAN051801	License Renewal Pressurizer Surge Line and Safety Injection Nozzle Inspection	May 24, 2018

#### **Selective Leaching Program**

##### License Renewal

<u>Number</u>	<u>Title</u>	<u>Revision</u>
CALC-ANO2-ME-15-00021	Review of the Selective Leaching Program for License Renewal Implementation	1

Procedure

Number

SEP-SLP-ANO

Title

Selective Leaching Program Section

Revision

0

Report

Number

ECS-17-0002

Title

ANO-2 License Renewal Implementation Project:  
Selective Leaching Material Composition and  
Sample Population

Revision

0

R. Anderson

ARKANSAS NUCLEAR ONE, UNIT 2 – NRC POST-APPROVAL LICENSE RENEWAL  
INSPECTION REPORT 05000368/2018010 – DATED AUGUST 9, 2018

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