



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

November 09, 2022

EA-22-099

Joseph Sullivan
Site Vice President
Entergy Operations, Inc.
N-TSB-58
1448 S.R. 333
Russellville, AR 72802-0967

SUBJECT: ARKANSAS NUCLEAR ONE - NOTICE OF VIOLATION; NRC INSPECTION
REPORT 05000313/2022011 AND 05000368/2022011

Dear Joseph Sullivan:

On October 25, 2022, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Arkansas Nuclear One and discussed the results of this inspection with you and other members of your staff. The results of this inspection are documented in the enclosed report, Enclosure 2.

The enclosed report discusses a violation associated with a finding of very low safety significance (Green). The NRC evaluated this violation in accordance with Section 2.3.2 of the NRC Enforcement Policy, which can be found on the NRC website at <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. The violation met the criteria for treatment as a non-cited violation; however, because the violation is associated with Entergy's failure to manage longstanding age-related degrading conditions in your buried service water supply piping and given that subsequent follow-up inspection to ensure compliance with your renewed operating license will be needed, the NRC determined the issuance of a Notice of Violation (Enclosure 1) is appropriate in this case.

You are required to respond to this letter and should follow the instructions specified in the Notice of Violation when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response. The NRC's review of your response will also determine whether further enforcement action is necessary to ensure your compliance with regulatory requirements.

In addition, a violation of minor significance is documented in the enclosed report.

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region IV; and the NRC Resident Inspector at Arkansas Nuclear One.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice and Procedure," a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or in the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, any response should not include any personal privacy or proprietary information so that it can be made available to the public without redaction.

Sincerely,



Signed by Taylor, Nicholas
on 11/09/22

Nicholas H. Taylor
Engineering Branch 2
Division of Operating Reactor Safety

Docket Nos. 05000313, 05000368
License Nos. DPR-51, NPF-6

Enclosures:

1. Notice of Violation
2. Inspection Report 05000313/2022011
and 05000368/2022011 w/Attachment

cc w/ encl: Distribution via LISTSERV

ARKANSAS NUCLEAR ONE - NOTICE OF VIOLATION; NRC INSPECTION REPORT
05000313/2022011 AND 05000368/2022011 – DATED NOVEMBER 09, 2022

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DOCUMENT NAME: ARKANSAS NUCLEAR ONE NOTICE OF VIOLATION; NRC
INSPECTION REPORT 05000313/2022011 AND 05000368/2022011

Non-Public Designation Category: MD 3.4 Non-Public _____ (A.3 - A.7 or B.1)

ADAMS ACCESSION NUMBER: **ML22301A153**

SUNSI Review: ADAMS: Non-Publicly Available Non-Sensitive Keyword:
By: GAP Yes No Publicly Available Sensitive

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NOTICE OF VIOLATION

Entergy Operations, Inc.
Arkansas Nuclear One, Units 1 and 2

Docket Nos. 50-313, 50-368
License Nos. DPR-51, NPF-6
EA-22-099

During an NRC inspection conducted from June 13 through October 25, 2022, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

10 CFR Part 50, Appendix B, Criterion III, requires, in part, that measures shall be established for verifying or checking the adequacy of design, such as by the performance of design reviews, using alternate or simplified calculational methods, or by the performance of a suitable testing program.

Unit 1 UFSAR, section 16.2.19, "Service Water Integrity" states, in part, that thickness mapping and visual inspections manage the aging effects of loss of material from the service water components.

Unit 2 UFSAR, section 18.1.25, "Service Water Integrity Program [SWIP]" states, in part, that the program relies on implementation of the recommendations of NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," to ensure that the effects of aging on the service water system will be managed. The licensee's response to Generic Letter 89-13, dated January 26, 1990 (ML20006B723), Attachment 3 "Program Document for SWIP Long-term Program Plans," section titled "Non-Destructive Examination," Step 2 states, in part, that mapping of piping thickness at selected locations with computerized ultrasonic equipment is periodically performed and trended.

Contrary to the above, from April 12, 2001, for Unit 1 and from April 7, 2005, for Unit 2, to September 29, 2022, the licensee failed to establish measures for verifying or checking the adequacy of design by the performance of a suitable testing program for the service water system. Specifically, when managing the effects of aging, the licensee had not performed thickness measurements of its buried in-scope emergency cooling pond supply piping to provide reasonable assurance that the service water system remained capable of performing its design function.

This violation is associated with a Green Significance Determination Process finding.

Pursuant to the provisions of 10 CFR 2.201, Entergy Operations, Inc., is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, U.S. Nuclear Regulatory Commission, Region IV, 1600 E. Lamar Blvd., Arlington, TX 76011-4511, and a copy to the NRC resident inspector at Arkansas Nuclear One, and email it to R4Enforcement@nrc.gov, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation; EA-22-099" and should include for the violation: (1) the reason for the violation or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken, and (4) the date when full compliance will be achieved.

Enclosure

Your response may reference or include previous docketed correspondence if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy or proprietary information so that it can be made available to the public without redaction.

If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information).

Dated this 9th day of November 2022

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

Docket Numbers: 05000313 and 05000368

License Numbers: DPR-51 and NPF-6

Report Numbers: 05000313/2022011 and 05000368/2022011

Enterprise Identifier: I-2022-011-0039

Licensee: Entergy Operations, Inc.

Facility: Arkansas Nuclear One

Location: Russellville, AR

Inspection Dates: June 12 to June 17, 2022

Inspectors: J. Mejia, Reactor Inspector
J. Drake, Senior Reactor Inspector
G. Pick, Senior Reactor Inspector
C. Smith, Senior Reactor Inspector

Accompanying
Personnel: B. Allik, Materials Engineer, Corrosion and Steam Generator Branch,
Office of Nuclear Reactor Regulation
J. Gavula, Materials Engineer, Corrosion and Steam Generator Branch,
Office of Nuclear Reactor Regulation

Approved By: Nicholas H. Taylor, Chief
Engineering Branch 2
Division of Operating Reactor Safety

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee’s performance by conducting a NRC inspection at Arkansas Nuclear One, in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC’s program for overseeing the safe operation of commercial nuclear power reactors. Refer to <https://www.nrc.gov/reactors/operating/oversight.html> for more information.

List of Findings and Violations

Failure to Perform Required Thickness Measurements as Required by Design to Manage the Effects of Aging			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green VIO 05000313,05000368/2022011-01 Open EA-22-099	[H.5] – Work Management	71003
The team identified a green finding and associated Notice of Violation because the licensee failed to manage the effects of aging on their buried unit 1 and unit 2 service water supply piping as required by regulatory requirements. Specifically, the licensee failed to measure pipe wall thickness to assess the condition of the supply piping that provides cooling during a design basis accident.			

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
URI	05000313/2021013-02	Condition of Emergency Cooling Pond Buried Piping	71003	Closed

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html>. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program – Operations Phase." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

71003 – Post-Approval Site Inspection for License Renewal

Background

NRC inspectors completed a Phase IV inspection the week of April 11, 2022, as documented in Inspection Report 05000313/2021013. This inspection occurred 8 years after unit 1 and 4 years after unit 2 entered their periods of extended operation. The period of extended operation included the additional 20 years beyond the original 40-year licensed term. The period of extended operation for Arkansas Nuclear One, Unit 1 will end on May 20, 2034, and Unit 2 will end on July 17, 2038. The inspection identified areas that required further review related to managing aging effects for the buried service water piping return lines to the emergency cooling pond and supply lines from the emergency cooling pond to the plant intake structure. Unresolved Item (URI) 05000313/2021013-02, "Condition of Emergency Cooling Pond Buried Piping" described the concerns that affected both units. The emergency cooling pond provides the backup ultimate heat sink supply in the event of a loss of Lake Dardanelle.

With the assistance of program experts in buried piping and service water programs from the Office of Nuclear Reactor Regulation, the team evaluated the following items:

1. The licensing requirements related to the buried piping, service water, and microbiologically influenced corrosion programs
2. Whether the licensee has properly implemented the interface requirements among the buried piping, service water, and microbiologically influenced corrosion programs
3. Whether the licensee has implemented their required external and internal inspections and program requirements
4. Action plans for inspecting the buried emergency cooling pond supply and return lines
5. Plans for using carbon fiber reinforced polymer wrap, including interim actions to ensure health of the lines until installation of the repair

Post-Approval Site Inspection for License Renewal (1 Sample)

Licensing Requirements (Item 1)

The team confirmed that the licensee described their buried piping aging management programs in the unit 1 updated final safety analysis report (UFSAR), section 16.1.1 and unit 2, UFSAR, section 18.1.4. The buried piping programs focused on ensuring the integrity of the exterior coating on the buried piping and

maintaining the cathodic protection system. The licensee described their service water integrity aging management programs in the unit 1 UFSAR, section 16.2.19 and unit 2 UFSAR, section 18.1.25. The service water integrity programs focused on implementing commitments to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989. The activities implemented by the service water integrity programs included flow balancing and testing, heat exchanger inspections and testing, chemistry treatment, and pipe condition monitoring.

The licensee established microbiologically influenced corrosion programs to monitor the pipe interior conditions using periodic measurements of piping thickness. The team noted that the licensee explicitly called out monitoring the coating on the interior of the unit 1 return line to the emergency cooling pond. The team determined that the licensee established procedure requirements to perform thickness monitoring using their microbiologically influenced corrosion program to meet the Generic Letter 89-13, Section III requirements, as prescribed by the unit 1 UFSAR, section 16.2.19 and unit 2 UFSAR, section 18.1.25.

The implementing procedures for buried piping included the guidance in NEI 09-14, "Guideline for The Management of Underground Piping and Tank Integrity," Revision 4. For unit 1 the team determined that the licensee had a requirement to inspect the exterior coating of one in-scope buried pipe during the 20-year period of extended operation, and for unit 2 the licensee had a requirement to plan and inspect one in-scope buried pipe during the last 10 years of the period of extended operation if no opportunistic inspection occurred during the first 10 years.

Program Implementation (Item 2 and Item 3)

Buried Piping and Underground Tanks

The buried piping program evaluated the effect of aging on the exterior of buried piping by ensuring that the cathodic protection system remained available, and that the licensee maintained external coatings in good condition. This program included the fire water, diesel generator fuel oil, and service water systems. The buried service water piping included for each unit: (1) the return piping from the plant to the emergency cooling pond; (2) the supply piping from the emergency cooling pond to the intake structure; (3) the supply loops from the intake structure to both units; and (4) the return piping from each unit to the intake structure.

Procedure EN-DC-343, "Underground Piping and Tanks Inspection and Monitoring Program," described the requirements for managing the effects of aging of buried piping including fitness-for-service examinations. Procedure CEP-UPT-0100, "Underground Piping and Tanks Inspection and Monitoring," provided details related to the buried piping program at Entergy sites that included implementing NEI 09-14, Revision 4. Procedure SEP-UIP-ANO-001, "Underground Components Inspection Plan Non-Rad and Rad Piping," described the site-specific ranking, inspection plans, and historical evaluation activities for all buried piping within scope.

The asset management plan developed for procedure SEP-UIP-ANO-001 described the history of inspections for in-scope buried piping. The licensee inspected the unit 1 return to the emergency cooling pond piping (HBD-13-18") prior to entering the period

of extended operation in August 2010. As part of this activity the licensee: (1) cleaned and coated the interior of the piping, (2) evaluated the exterior condition of the pipe including the coating, and (3) performed thickness measurements of the piping. Since entering the period of extended operation, the licensee never inspected the exterior of any of the return or supply lines to determine the condition of the external coating.

During review of procedure SEP-UIP-ANO-001, the team identified that the classification tables misclassified some pipe segments. The team documented this performance deficiency in the Results section.

The team identified that the licensee had mixed results with maintaining their cathodic protection system. The licensee placed the site cathodic protection system on their top ten equipment concerns list but removed it from the list once plans were established to rehabilitate the system. The team documented the details in an observation in the Results section.

Service Water Integrity Program

The service water integrity program ensured that the service water systems met the requirements of Generic Letter 89-13 and managed the effects of aging on the interior of the piping. Procedure EN-DC-184, "NRC Generic Letter 89-13 Service Water Program," included requirements to implement (1) chemical treatment and monitoring, (2) system flushing and flow testing, (3) internal inspections and maintenance of service water piping and piping components, (4) condition monitoring and assessment, which included thickness measurements, and (5) heat exchanger capability verification. Procedure SEP-SW-ANO-001, "NRC Generic Letter 89-13 Service Water Program," prescribed the site-specific actions and credited the microbiologically influenced corrosion program for wall thickness monitoring as part of the piping component inspection and maintenance.

Procedure EN-DC-340, "Microbiologically Influenced Corrosion (MIC) Program," provided the requirements for assessing and evaluating piping integrity caused by microbiologically influenced and other types of corrosion. The licensee had two additional documents that described the site-specific requirements for managing the effects of aging caused by internal pipe corrosion (1) Procedure SEP-MIC-ANO-001, "Microbiologically Influenced Corrosion (MIC) Program," and (2) Engineering Report A-EP-2005-001, "Microbiologically Influenced Corrosion (MIC) Program." The team reviewed licensee activities since 2003 related to evaluating the interior condition of the buried service water piping that returns water from the plant to the emergency cooling pond and that supplies water from the emergency cooling pond to the intake structure. The team documented key events in the timeline in an attachment to this report. The licensee initiated Condition Report CR-ANO-C-2003-00923 to track resolution of outstanding service water integrity program notebook actions using their corrective action program.

The licensee initiated several condition reports that documented a failure of the buried pipe program, the microbiologically influenced corrosion program, or both programs. These condition reports had outstanding corrective actions, as described below:

- Condition Report ANO-C-2019-01633 documented that the emergency cooling pond supply piping had not been monitored for degradation by either the buried pipe or the microbiologically influenced corrosion programs. A corrective action remained open to track the inspection of a buried section of the unit 1 supply pipe.
- Condition Report ANO-C-2021-00987 documented fitness-for-service evaluations had not been performed on buried safety-related service water emergency cooling pond supply pipes (HBD-12-36" and 2HBC-88-42") as required by procedure EN-DC-343. A corrective action remained open to take thickness measurements and complete a fitness-for-service evaluation of the supply pipes.
- Condition Reports ANO-1-2021-02429 and 2-2021-01204 documented that the licensee had not established an examination frequency to evaluate the wear and wear rate to support determining the service life of the piping as required by Procedure EN-DC-340, Section 5.5. A corrective action in each condition report tracked the need to take thickness measurements to determine a wear rate and evaluate the condition of the piping.

Because the licensee never performed thickness measurements for the supply lines nor performed fitness-for-service examinations of their buried piping, the team determined that the licensee failed to manage the effects of aging and ensure that the supply piping could meet all its design requirements. The team documented this performance deficiency in the Results section.

The team noted that the licensee performed ultrasonic testing of the entire unit 1 return line in August 2010 prior to coating the line. The team also noted that the licensee completed a partial visual inspection of the interior of the Unit 1 supply pipe from the emergency cooling pond in April 2021 to assess the pipe condition and measure the piping ovality in preparation for the carbon fiber reinforced polymer wrap. Similarly, in October 2021 the licensee attempted to visually inspect the interior of the unit 2 supply pipe to determine the pipe condition in preparation for the carbon fiber reinforced polymer wrap. The licensee only inspected the first 621-feet of the approximately 2300-foot supply pipe. Both inspections provided limited insights into the condition of the interior of the piping.

The team determined that the licensee inspected the interior coating of the unit 1 return line to the emergency cooling pond in 2016 as part of their aging management activities. Condition Report ANO-1-2016-04449 documented some instances of lost coating but concluded that the piping remained protected. The licensee coated this piping to increase the design basis flow characteristics. Condition Report ANO-C-2019-01633, CA10 described that work order 534148 existed to "Re-inspect to ensure coating has stopped ID [internal diameter] corrosion and pipe is structurally sound (inspection method – internal PIG) on the SW ECP [service water emergency cooling pond] Return Line (HBD-13-18)". This work included 100 percent UT [ultrasonic testing] scan from the internal (both ID and OD [outer diameter] measurements) of the return line piping." The team determined that the licensee cancelled this work in spring 2021 (1R29) and scheduled a visual inspection to review the condition of the internal coating in fall 2022 (1R30). Work Order 563639 tracks the

automatic crawler visual examination to assess the condition of the coating in the fall of 2022.

Corrective Actions

The team reviewed the operability evaluations that the licensee documented in Condition Reports CR-ANO-1-2021-0249, CR-ANO-2-2021-1204, and CR-ANO-C-2021-03142. The team determined that the conclusions that the piping remained structurally intact provided reasonable assurance of operability and documented specific observations related to the operability determinations in the Results section.

Short Term Actions (Item 4)

The team determined that the licensee scheduled work activities during the upcoming unit 1 fall outage (1R30) and the unit 2 spring outage (2R29) on the service water supply lines from the emergency cooling pond to the intake. The planned work activities included:

- Excavating and removing a section of piping during the unit 1 outage in accordance work order 581554. The planned manual ultrasonic testing of 18-inch-wide sections on each end of the removed piping and an 18-inch-wide section in the middle to perform a fitness-for-service evaluation as prescribed by procedure EN-DC-343. The licensee plans to conduct an automatic ultrasonic examination on the piping in support of the planned long-term corrective actions. The licensee will evaluate these examination results to evaluate actions required to use carbon fiber reinforced polymer wrap to rehabilitate the piping.
- Excavating and removing a section of piping during the unit 2 outage in accordance with work order 572224. The licensee had not finalized details of their plans at the time of this inspection. Like unit 1, the licensee planned to conduct ultrasonic examination of the piping to support thickness monitoring, a fitness-for-service examination, and assess the piping condition to support the long-term corrective actions.

Long Term Actions (Item 5)

The NRC staff reviewed the licensee's May 2021 scoping study IG-PM-SCO-03-TEM-SCO-V7.0, "Scope Document – ANO-1 & ANO-2 Buried ECP Supply Pipe Projects Revision 1." The licensee's staff described that in May 2022, the site approved a partial reroute solution that will involve (1) laying replacement piping in new trenches that has termination points near both the emergency cooling pond and the intake structure; (2) abandoning the existing piping in place, and (3) coating the existing piping at the emergency cooling pond and at the intake structure with carbon fiber polymer wrap up to the tie-in points to the replacement piping. The replacement piping will be installed in accordance with Code Case N-752, "Risk-Informed Categorization and Treatment for Repair/Replacement Activities in Class 2 and 3 Systems Section XI, Division 1." The use of this code case was approved for ANO in Letter Arkansas Nuclear One, Units 1 and 2 – "Approval of Request for Alternative from Certain Requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (EPID L-2020-LLR-0076)" [ML21118B039].

The licensee further described that planned supply line repair and replacement would begin in 2025 be completed in 2026 for Unit 2 and 2027 for Unit 1. The licensee also described plans to epoxy coat the unit 2 return piping in 2031.

INSPECTION RESULTS

Failure to Perform Required Thickness Measurements as Required by Design to Manage the Effects of Aging			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green VIO 05000313,05000368/2022011-01 Open EA-22-099	[H.5] - Work Management	71003
<p>The team identified a green finding and associated Notice of Violation because the licensee failed to manage the effects of aging on the buried unit 1 and unit 2 service water supply piping as required by regulatory requirements. Specifically, the licensee failed to measure pipe wall thickness to assess the condition of the supply piping that provides cooling during a design basis accident.</p>			
<p><u>Description:</u> The team reviewed licensee activities that managed the effects of aging related to the buried service water piping that returned water from the plant to the emergency cooling pond and the piping that supplied water from the emergency cooling pond to the service water intake structure. Procedure EN-DC-340 detailed the requirements of the microbiologically influenced corrosion program activities for in-scope piping and components which included performing pipe wall thickness measurements for buried service water piping. During review of the program implementation, the team identified that the licensee failed to measure the supply piping wall thickness for either unit as required by their license basis, and as such, the licensee failed to manage the effects of aging on the buried service water supply lines from the emergency cooling pond.</p> <p>The team reviewed the history related to corrosion of the service water return and supply piping for the emergency cooling pond. From this review the team discerned that the licensee maintained their design basis flows to the facility and to the emergency cooling pond. Further, the licensee knew of the potential for piping leakage and the need to conduct repairs to retard or stop the corrosion, as demonstrated by:</p> <ul style="list-style-type: none"> • In 2003, the licensee placed the outstanding actions in the service water integrity program notebook into their corrective action program. The actions included coating the unit 1 and unit 2 return piping and ensuring that they met their design flow requirements. The licensee ultimately chose to use pigging to clean the unit 2 piping rather than coat the piping. • In 2013, the licensee had plans listed in their asset management plan to excavate and inspect the unit 1 buried supply lines; however, the licensee cancelled these inspections. • In 2016, the NRC identified that the licensee had not maintained specific representative monitoring points in the microbiologically influenced corrosion program 			

and did not monitor pipe wall thickness frequently enough to prevent through-wall leaks.

- In 2020, the ANO-1 Emergency Cooling Pond (ECP) Supply Pipe Replacement Project was deferred for 3 years (two outage cycles to 2023 and 2024) due to cost variances.
- In 2020, the licensee initiated actions to clean and ultrasonically inspect the unit 1 return line during the 1R29 outage; however, the licensee removed this activity from the outage because of inadequate planning. The licensee changed the ultrasonic inspection to a video crawler visual inspection in the fall 2022 (1R30) outage.
- In 2021, the licensee again delayed their plans to repair/rehabilitate the unit 2 and unit 1 supply pipes from 2023 to 2026 and 2024 to 2027, respectively. The licensee delayed implementation until they received approval to implement carbon fiber reinforced polymer wrap and use of Code Case 752.

The team determined that, on April 12, 2001, after receipt of the license extension safety evaluation report, the licensee described in section 16.2.19 of the unit 1 UFSAR that thickness measurements of the service water piping would be performed as part of the service water integrity program. On April 7, 2005, after receipt of the license extension safety evaluation report, the licensee described in section 18.1.25 of the unit 2 UFSAR that they would implement the requirements of Generic Letter 89-13. Generic Letter 89-13, recommendation III, specified “Ensure by establishing a routine inspection and maintenance program for open-cycle service water system piping and components that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water.” Letter 0CAN019012, “Response to Generic Letter 89-13, ‘Service Water System Problems Affecting Safety-Related Equipment,’” Attachment 2, “Ongoing Programs,” Recommendation III.A, specified periodic thickness mapping of service water piping using automated means of nondestructive examination.

Procedure SEP-MIC-ANO-001, Revision 3, Step 2.4, required, in part, that the microbiologically influenced corrosion program owner shall take responsibility and ensure all underground piping and tanks susceptible to microbiologically influenced corrosion are included each outage. The team determined that the licensee changed Engineering Report A-EP-2005-001 inspection instructions in a manner that eliminated any programmatic guidance for taking thickness measurements for buried service water piping. Up through Revision 4 of this report, the licensee included the number of monitoring points for numerous in-scope line segments including the emergency cooling pond supply piping to the intake structure. The team determined that Revision 5 inappropriately credited long-term planned actions as the basis for no longer taking thickness measurements of the emergency cooling pond supply piping. Specifically, the licensee revised Section 2.2.1.1 “Buried Pipe,” to specify, “These pipes are currently being addressed by long-range plan items that are in the planning phase to replace and/or rehabilitate these pipes. Thus, no MIC Program activity is planned for these pipes.”

The team identified a performance deficiency because the licensee never performed thickness measurements of the supply piping from their emergency cooling pond to the intake structure to demonstrate that the piping would continue meet its design.

Corrective Actions: The licensee had several corrective action documents that tracked their short term actions to determine the condition of the piping. The licensee completed a scoping study that outlined replacing or rehabilitating segments of the buried piping.

Corrective Action References: C-2019-01633, C-2021-00987, 1-2021-02429, and 2-2021-01204

Performance Assessment:

Performance Deficiency: The failure to perform thickness measurements as required by plant procedures and as described in the license basis was a performance deficiency. Specifically, the licensee failed to measure the thickness of the buried emergency cooling pond supply piping for either unit.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee has never taken required thickness measurements of buried emergency cooling pond supply piping in either unit to support the conclusion that the supply piping remained capable of performing its design function.

Significance: The inspectors assessed the significance of the finding using IMC 0609 Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The team determined that the finding screened to green because the deficiency potentially affected the ability of the ultimate heat sink supply piping to deliver the required water during an accident; however, no failure or event had occurred.

Cross-Cutting Aspect: H.5 - Work Management: The organization implements a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities. Specifically, the team determined that the licensee did not take advantage of opportunities to inspect the piping when presented.

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion III, requires, in part, that measures shall be established for verifying or checking the adequacy of design, such as by the performance of design reviews, using alternate or simplified calculational methods, or by the performance of a suitable testing program.

Unit 1 UFSAR, section 16.2.19, "Service Water Integrity" states, in part, that thickness mapping and visual inspections manage the aging effects of loss of material from the service water components.

Unit 2 UFSAR, section 18.1.25, "Service Water Integrity Program [SWIP]" states, in part, that the program relies on implementation of the recommendations of NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," to ensure that the effects of aging on the service water system will be managed. The licensee's response to Generic Letter 89-13, dated January 26, 1990 (ML20006B723), Attachment 3 "Program Document for SWIP Long-term Program Plans," section titled "Non-Destructive Examination" Step 2 states, in part, that mapping of piping thickness at selected locations with

computerized ultrasonic equipment is periodically performed and trended.

Contrary to the above, from April 12, 2001, for Unit 1 and from April 7, 2005, for Unit 2, to September 29, 2022, the licensee failed to establish measures for verifying or checking the adequacy of design by the performance of a suitable testing program for the service water system. Specifically, when managing the effects of aging, the licensee never performed thickness measurements of its buried in-scope emergency cooling pond supply piping to provide reasonable assurance that the service water system remained capable of performing its design function.

Enforcement Action: The violation met the criteria for treatment as a non-cited violation; however, because the violation is associated with Entergy's failure to manage longstanding age-related degrading conditions in buried service water supply piping and given that subsequent follow-up inspection is needed to ensure compliance with ANO's renewed operating license, the NRC determined the issuance of a Notice of Violation is appropriate in this case (Enforcement Manual Section 2.3.2).

The disposition of this finding and associated violation closes URI: 05000313/2021013-02.

Minor Violation

71003

Minor Violation: Procedure SEP-UIP-ANO, "Underground Components Inspection Plan Non-Rad and Rad Piping," Revision 7, Appendix C, "Asset Management Plan," described historical and current plans for managing buried piping such as coating the interior of the emergency cooling pond return piping from the plant. During review of piping classifications related to risk ranking the underground piping, the team identified that the licensee placed the buried service water piping into a lower risk pipe grouping that affected the risk ranking of the piping.

The team determined that the licensee failed to classify the safety-related service water piping as described in procedure SEP-UIP-ANO, "Underground Components Inspection Plan Non-Rad and Rad Piping," Revision 6. The licensee identified the piping in their system as nonradioactive nonsafety-related rather than nonradioactive safety-related, which affected the ranking related to the relative risk of a piping failure.

Screening: The inspectors determined the performance deficiency was minor. The failure to classify service water piping as nonradioactive safety-related was a performance deficiency for failure properly implement the requirements in procedure SEP-UIP-ANO. Specifically, the licensee misclassified the service water piping as nonradioactive nonsafety-related that resulted in a lower risk ranking for selecting buried pipe segments to review. The team determined that this performance deficiency was not more than minor because the licensee treated the piping as safety-related despite the ranking and completed inspections of similar material carbon steel pipes in the diesel fuel oil system.

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion V, requires, in part, that activities affecting quality shall be prescribed by documented procedures of a type appropriate to the circumstances and shall be accomplished in accordance with these procedures.

Procedure SEP-UIP-ANO provides the guidance and requirements to manage the buried piping based on risk ranking according, in part, to safety classification and the presence of radioactive fluids. Contrary to the above, on January 31, 2022, the licensee failed to properly classify the service water piping. Specifically, the licensee classified service water piping as

nonradioactive nonsafety-related, rather than nonradioactive safety-related. The licensee documented this failure to properly classify the service water piping in condition report ANO-1-2022-00171. This failure to comply with procedure SEP-UIP-ANO constitutes a minor violation that is subject to enforcement action in accordance with the NRC's Enforcement Policy.

Observation: Operability Evaluation Observations

71003

The team noted that procedure EN-OP-104, "Operability Determination Process," described that to determine if an ASME Class 2 or 3 system, structure, or component with a flaw is OPERABLE then the degradation mechanism must be readily apparent. To be readily apparent, the degradation mechanism is discernible from visual examination (as external corrosion or wear) or there is substantial operating experience with the identified degradation mechanism in the affected system, structure, or component. The team reviewed operability evaluations related to condition reports ANO-1-2021-0249, ANO-2-2021-1204, and ANO-C-2021-03142. All three operability evaluations assume that any degradation in the buried portions of the supply and returns lines to the emergency cooling pond resulted from microbiologically influenced corrosion, and based on extensive operating experience, had not affected the structural integrity of the piping.

The licensee compared the minimum thickness values derived in CALC-19-E-0013-02, "Minimum Thickness Calculation for HBD-12-36", HBD-14-18", HBD-20-18", 2HBC-33-20", 2HBC-34-20", 2HBC-83 30", and 2HBC-88-42" Buried Pipe," Revision 0 with the pipe wall thickness values derived in CALC-20-E-0001-30, " Unit 2 Failure Effects Analysis for 2HBC-83," Revision 0, and determined that the lowest measured thickness for the above ground portion of 2HBC-83-30" did not challenge the largest calculated minimum wall thickness for the buried portions of the system.

The team did not identify any specific issues with the conclusion related to structural integrity but identified the following insights not addressed by the operability determinations:

1. The licensee replaced significant amount of their treated, small-bore service water piping (8" and under) because extensive internal corrosion caused low flow conditions and pinhole leaks over the life of the plant. The team concluded that the buried, untreated piping had a high likelihood of experiencing similar leakage. The team noted that pinhole leaks in above ground piping would not alter the external surface environment for the pipe; however, leakage through the buried coated pipe could trap water against the pipe under the coating and create additional external corrosion. Based on these differences, it was not clear to the team that the site has "substantial operating experience with the degradation mechanism" in the associated buried piping environment, such that the degradation mechanism can be considered "readily apparent" as described in EN-OP-104.
2. For the 30-inch unit 2 return line, the team did not identify where the licensee addressed that the minimum wall thickness should be 0.200 inches for the specified 22-inch soil coverage depth to account for buckling shown in CALC-19-E-0013-02, which provided the thinning limits. The calculation cautioned that the shallow-cover regions were likely not subjected to surface loads but noted that the user of the calculation must ultimately determine that the burial depth at the point of interest is greater than 36 inches and that no surface loads are applicable. The operability evaluations did not address this aspect of the calculation to determine the actual soil

coverage depth and to verify that the shallow portions of the pipe are not subject to surface loads.

3. CALC-19-E-0013-02 states that the ASME Code Case N-806, "Analytical Evaluation of Metal Loss in Class 2 and 3 Metallic Piping Buried in a Back-Filled Trench," provided guidelines for the design of buried steel piping and served as the technical basis and methodology for assessing the design of buried piping according to a calculable required uniform minimum wall thickness. The team noted that the NRC had not approved this code case for use as described in Regulatory Guide 1.193, "ASME Code Cases Not Approved for Use." Although the licensee determined that they could have minimum wall thickness values of less than 0.1 inches in several of their buried pipes, the team noted that these values did not meet the minimum allowed thickness as specified in ASME Code Case N-806. Based on the questions, the licensee reperformed their calculation and determined that the minimum wall thickness in CALC-19-E-0013-02 will need to increase by 25 percent. The licensee documented the change in the calculation in Condition Report ANO C-2022-02699.

Observation: Condition of Cathodic Protection System

71003

The team evaluated the condition of the cathodic protection system because a functioning cathodic protection system effectively protects piping from external corrosion. Although not required as part of the license extension, the NRC evaluated the protection afforded by cathodic protection systems and the licensee credited the protection provided by their cathodic protection system. Letter 1CNA090004, "License Renewal Application RAls," dated September 12, 2000, response to Request for Additional Information 3.3.4.3.2-7.c(1), described that the buried piping inspection program will be effective because coating, wrapping, and cathodic protection have been demonstrated in this and many other industries to be effective at mitigating corrosion by inhibiting environmental effects.

Procedure CEP-UPT-0100, "Underground Piping and Tanks Inspection and Monitoring," Revision 6, Section 5.6, specified preventive maintenance requirements for installed cathodic protection systems. Based on the team's review of the 2020 and 2021 annual surveys, the licensee had the system functioning at 50 percent of capability based on the -850 mV relative to a copper/copper sulfate reference electrode, instant-off, acceptance criterion for their buried piping. In addition, based on its review of the 2022 annual survey, the team noted the following: (a) the effectiveness of the cathodic protection system had dropped to 42 percent; and (b) many anodes at the site will reach the end of their service life within 5 years. The team determined that the licensee recently removed the cathodic protection system from their Top Ten Equipment Reliability concerns list after engineering established plans to restore the system to optimal design conditions to protect the buried piping. The licensee started phase 2 of a three-phase plan to identify the upgrades and replacements needed to restore the system. The licensee expects to complete phase 2 in 2022-2023. Phase 3 will implement any system upgrades and replacements needed to ensure the system functioned as designed by 2024-2025. The licensee will replace depleted anodes and install new rectifiers as part of the system upgrades. The licensee tracked these corrective actions in condition report ANO-C-2019-01013.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On October 25, 2022, the inspectors presented the NRC inspection results to Joseph Sullivan, Site Vice President, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71003	Calculations	CALC-01-E-0012-6	Evaluation of underground utilities from new wheel loads during transport of Holtec DFS cask	0
		CALC-13-D-2001-12	Structural Evaluation of Haul Path at ANO	0
		CALC-19-E-0013-2	Minimum thickness calculation for buried pipes	0
		CALC-20-E-0001-30	Unit 2 FEA for 2HBC-83	0
	Corrective Action Documents	CR-ANO-1-	2011-00476, 2016-01133, 2016-01603, 2016-01793, 2016-02087, 2016-04449, 2017-02152, 2019-00958, 2019-01507, 2019-01759, 2019-03104, 2019-03862, 2020-00427, 2020-01675, 2020-01822, 2020-01855, 2021-00030, 2021-00492, 2021-01188, 2021-01263, 2021-01326, 2021-01841, 2021-02129, 2021-02183, 2021-02429, 2021-02751, 2021-02815, 2021-02824, 2021-03018	
		CR-ANO-2-	2003-01339, 2003-01584, 2016-02365, 2016-02835, 2016-02843, 2017-00968, 2017-03766, 2017-04493, 2019-00524, 2019-00741, 2019-00780, 2019-00964, 2019-00986, 2019-01727, 2019-01812, 2019-02092, 2019-02313, 2019-02373, 2019-03029, 2020-00419, 2020-00509, 2020-01797, 2020-02986, 2020-03628, 2020-03650, 2021-00739, 2021-01204, 2021-02199, 2021-02633, 2021-03502, 2021-03502, 2021-03595	
		CR-ANO-C-	2003-00923, 2004-00066, 2011-00476, 2011-00935, 2013-02041, 2016-04023, 2019-00756, 2019-00756, 2019-01012, 2019-01015, 2019-01633, 2019-02458, 2019-03982, 2019-04099, 2020-00373, 2020-01378, 2020-02404, 2020-03265, 2021-00987, 2021-02203, 2021-02633, 2021-02703, 2021-02887, 2021-02893, 2021-03013, 2021-03110, 2021-03142, 2021-03176, 2021-03247, 2022-00137, 2022-00464, 2022-00502, 2022-00804, 2022-00955	
	Corrective Action	CR-ANO-1	2022-00171	

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
	Documents Resulting from Inspection	CR-ANO-C-	2022-01673, 2022-01897	
	Drawings	C-2064	Emergency Cooling Water Suction and Discharge Lines	9
		C-64	Emergency Cooling Water Suction and Discharge Lines 10" Gas Line Relocation	7
	Engineering Changes	54483	Service Water Buried Piping Project Scoping Study	0
		93-R-1011-01	Review of the Programs Credited in the License Renewal Evaluations, Section 3.1 Buried Pipe Inspection	3
		93-R-1011-01	Review of the Programs Credited in the License Renewal Evaluations, Section 4.19 Service Water Integrity	3
		A-EP-2005-001	ANO Microbiologically Influenced Corrosion (MIC) Program	0
		A-EP-2005-001	ANO Microbiologically Influenced Corrosion (MIC) Program	4
		A-EP-2005-001	ANO Microbiologically Influenced Corrosion (MIC) Program	5
		CALC-ANO1-ME-11-00002	Buried Pipe Inspection Program Review	0
		CALC-ANO1-ME-11-00004	Review of the Service Water Integrity Aging Management Program for License Renewal Implementation	0
		CALC-ANO2-ME-15-00006	Review of the Buried Piping Inspection Program for License Renewal Implementation	0
		CALC-ANO2-ME-15-00023	Review of the Service Water Integrity Program for License Renewal Implementation	0
		ER-ANO-2004-0573-000	ANO Buried Piping Life Cycle Management Study for SW, ACW, FW, CW and Fuel Oil Piping	7/2/2004
		LA190752-R-001	Condition Assessment of Degraded Essential Service Water Pipe Segment, Line HBD-20-18"	0
		LA200162-R-001	Fire Protection System Piping Condition Assessment and MIC Sampling	0
		LA211525-LR-001	Independent Third Party Review (ITPR) of Engineering Evaluation supporting Operability for Emergency Cooling Pond (ECP) Service Water Piping - Arkansas Nuclear One	7/30/2021
		R06045-0029-006	Arkansas Nuclear One Buried Piping Soil Sampling Report	5/30/2014
	Miscellaneous		Visual Inspection Service for 36" Pipe at Arkansas Nuclear	5/18/2021

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
			One Plant Unit 1	
			Visual Inspection Service for 42" Pipe at Arkansas Nuclear One Plant Unit 2	11/8/2021
		Case N-752	Risk-Informed Categorization and Treatment for Repair/Replacement Activities in Class 2 and 3 Systems Section XI, Division 1	7/23/2019
		Case-N-806-1	Analytical Evaluation of Metal Loss in Class 2 and 3 Metallic Piping Buried in a Back-Filled Trench Section XI, Division 1	12/15/2015
		EN-20-RR-001	Arkansas Nuclear One, Units 1 and 2 - Approval of Request for Alternate from Certain Requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code	1
		IG-PM-SCO-03-TEM-SCO-V7.0	Scope Document – ANO-1 & ANO-2 Buried ECP Supply Pipe Projects	5/2/2022
		Letter CAN019012	Response to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"	1/26/1990
		LR-LAR-2008-00048	Implement the Buried Piping and Tanks Inspection Program as described in LRA Section B.1.1	2/27/2008
		NEI 09-14	Guideline for the Management of Underground Piping and Tank Integrity	4
		R06045-0029-006	Buried Piping Soil Sampling Report	5/30/2014
		Report 15422-FOR-01-1	2022 Annual Survey Cathodic Protection Systems Entergy Arkansas Nuclear One	5/2022
		Report 1901127.01	2020 Annual Survey Report (Cathodic Protection)	9/3/2020
		Report 2100141.021	2021 Annual Survey Report (Cathodic Protection)	9/4/2021
		Report No. 1000089	Area Potential Electric Current Survey	2/16/2012
		Risk Assessments	ANO-1-2017-0661, Revision 0 ANO-1-2017-0661, Revision 1 ANO-1-2018-0253, Revision 0 ANO-1-2018-0253, Revision 1 ANO-1-2018-0253, Revision 2	

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
			ANO-2-2017-0664, Revision 0 ANO-2-2017-0664, Revision 1 ANO-2-2017-0664, Revision 2 ANO-2-2020-0057, Revision 0	
		SPEC-6600-M-400	Specification for External Surface Treatment of Underground Metallic Pipe for the Arkansas Nuclear One Arkansas Power and Light Company	4/1/1971
		Specification ANO-C-2301	Structural Backfill	4
		Specification SPEC-C-301	Technical Specification for Structural Backfill Pipe Trench Excavation, and Pipe Trench Backfill	1
	NDE Reports Reports NDE Reports NDE Reports NDE Reports NDE Reports	1-BOP-UT-21-031	Oily Water Buried Pipe 6' Baseline Inspection	9/8/2021
		1-BOP-UT-21-032	Oily Water Buried Pipe: Buried 6" Pipe Outside of Oily Water Separator	9/9/2021
		2-BOP-UT-15-050	Service Water Return Spool #8 (MC 2.C.3.1)	9/2/2015
		2-BOP-UT-17-006	#1 Header supply to ECP (MIC 2.A.1.1)	2/1/2017
		2-BOP-UT-17-010	ECP 30 in. Return Piping (MIC 2.C.3.2)	2/9/2017
		2R27 ECP SW Return AUT 001	2R27 ECP SW Return (2HBC-83-30")	12/12/2019
		BOP-UT-09-046	ECP 30 in. Return Piping (MIC 2.C.3.2)	8/11/2009
		ISI-UT-08-024	Spool #1 (At tee to 2HBC-51-81")	2/27/2008
	Operability Evaluations	CR-ANO-1-2021-02429	Per the requirements of EN-DC-340, Microbiologically Influenced Corrosion (MIC) Monitoring Program, the examination frequency has not been determined for the Unit 1 Emergency Cooling Pond Supply and Return Lines.	
		ECH-EP-12-00001	Guidelines for Management of Reasonable Assurance of Integrity for Above and Underground SSCs Containing Radioactive Material	0
		EN-DC-147	Engineering Reports	8

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		EN-DC-184	NRC Generic Letter 89-13 Service Water Program	6
		EN-DC-340	Microbiologically Influenced Corrosion (MIC) Monitoring Program	5
		EN-DC-343	Underground Piping and Tanks Inspection and Monitoring Program	13
		EN-EP-S-002-MULTI	Underground Piping and Tanks General Visual Inspection	5
		EN-OM-132	Nuclear Risk Management Process	3
		EN-OP-104	Operability Determination Process	17
		SEP-MIC-ANO-001	Microbiologically Influenced Corrosion (MIC) Program	3
		SEP-SW-ANO-001	NRC Generic Letter 89-13 Service Water Program	1
	Self-Assessments	HQNLO-2019-77	Self-Assessment on the Buried Pipe and Tank Program	9/30/2020
		LO-ALO-2015-0080	NRC Generic Letter 89-13 Service Water Program Assessment	12/17/2015
		LO-ALO-2015-0095	Microbiologically Induced Corrosion (MIC) Monitoring Program Assessment	9/18/2015
		LO-ALO-2015-0097	Underground Piping and Tank Inspection Program	12/18/2015
		LO-ALO-2016-0016	Underground Piping & Tanks Inspection and Monitoring Program Snapshot Assessment	0
		LO-ALO-2016-0078	Confirmatory Action Letter Key Improvement Action 6: Service Water System Operational Performance Inspection	12/2016
		LO-ALO-2017-0071	Pre-NRC Focused Self Assessment: Triennial Heat Sink Assessment	0
	Work Orders	WO-	478947, 507271, 507346, 549458, 556989, 559400, 559401, 563877, 567020, 567026, 572240,	

Timeline of Important Buried Piping Corrective Action Documentation After Approval of Renewed License

Date	Discussion	Reference
9/26/2003	Low service water flows in unit 2 to safety related loads resulted from corrosion on the interior of the piping. Recovered some design margins and improved the flow conditions by cleaning the emergency cooling pond return and supply piping through pigging. Long term corrective actions proposed coating the interior of the piping and/or replacement.	Condition Report ANO-2-2003-01339
10/27/2003	Conversion of outstanding service water integrity plan notebook actions to individual actions in the corrective action program. Specific corrective actions included: CA6 – tracked decision to clean the supply and return headers to the plant to meet flow requirements; replacement of large bore piping to service water components in the plant; determine the quantity and location to monitor piping thickness CA10 – evaluate coating the unit 1 and 2 service water return piping to the emergency cooling pond; identified that the coating on unit 1 had been successful and considered coating the unit 2 return line. The licensee used pigging to clean the return line to restore flows (refer to condition report 2-2003-01339).	Condition Report ANO-C-2003-00923
1/16/2004	Service water integrity plan notebook specified mapping pipe wall thickness with non-destructive examinations. The licensee identified the initial population from the intake structure into the power block. The licensee had established these activities to implement Generic Letter 89-13, recommendation III, and Unit 1 license renewal commitments. The program did not have a defined a scope or implementation frequency to manage the aging effects caused by corrosion/erosion occurring in the service water system. Developed a program documented in engineering report A-EP-2005-001 that discussed specific monitoring locations, piping systems and materials, ranking methodology, and acceptance criteria.	Condition Report ANO-C-2004-00066
3/12/2014	Procedure SEP-UIP-001, Underground Components Inspection Plan (Rad And Non-Rad Lines), Revision 1 identified that the licensee had plans to inspect the unit 1 supply line in accordance with work orders WO 292676 & 292678	Inspection Report 05000313/2014007
3/4/2015	A scoping study based on 2005 and 2012 Life Cycle Management Reports statistically analyzed risks due to leaks in the buried service water and fire protection piping. Identified a high likelihood of developing leaks caused by pitting and the lack of consistent cathodic protection. Service water piping replacements had occurred inside the power block for the past 30 years. Because of feasibility uncertainty related to a cured-in-place piping repair option that had been considered, the licensee discontinued this option, and evaluated other options. The unit 2 service water return to the emergency cooling pond piping was scheduled to be relined in spring 2017 (2R25).	Engineering Change 54483

Date	Discussion	Reference
	Recommended long term corrective actions for the unit 1 and unit 2 supply pipes included evaluating site chemical controls to assist with passivation, developing an inspection plan to validate structural integrity, evaluating industry experience with internal coating/lining repairs, developing detailed construction estimates for pipe replacement or refurbishment, and upgrading the cathodic protection system to ensure system reliability.	
2/26/2016	During review of the microbiologically influenced corrosion program implementation, NRC identified that the licensee had not maintained specific representative monitoring points in the microbiologically influenced corrosion program and did not monitor pipe wall thickness frequently enough to prevent through-wall leaks. Specifically, the licensee had not established a maximum time limit for monitoring points	Condition Reports ANO-C-2016-00435, ANO-C-2016-00524, ANO-C-2016-00546 Noncited Violation 05000313; 05000368/2016007
5/2/2019	Described that the emergency cooling pond supply piping that allows water to gravity flow to the intake structure had not been monitored for degradation either by the buried pipe or the microbiologically influenced corrosion programs. Identified gaps included: (1) coordinating between the program owners; (2) identifying planned inspections; and (3) selecting buried piping sections for evaluation based on risk ranking. CA 7 (2/27/2020) initiated to track ultrasonically scanning the Unit 1 return piping inside and outside diameters in 1R29. Inspection plans cancelled because of a lack of preparedness and contingency planning. CA 12 (5/5/2021) tracking completion of visual inspection of the unit 1 supply in 1R30 for HBD-13 CA 13 (11/12/2021) documented video crawler inspection of the unit 2 supply line in 2R28. Inspected the first 681 feet of approximately 2300 feet CA 14 (11/12/2021) documented ultrasonic inspection of accessible portions of the unit 2 return in 2R28 CA 16 (11/11/2021) incorporated Condition Report ANO-C-2021-02703 related to a noncited violation for failure to test of buried piping to ensure it could perform its safety function	Condition Report ANO-C-2019-01633
7/9/2019	Buried piping program health report changed to “red” related to cathodic protection deficiencies. Procedure EN-DC-143 required that the licensee identify causes for any deficiencies and implement corrective actions	Condition Report ANO-C-2019-02458
2/6/2020	Assessed the cathodic protection system as “red” and placed it on the top ten equipment reliability concerns list. The plant developed actions to improve the system reliability with an expected completion in 2025	Condition Report ANO-C-2019-03982

Date	Discussion	Reference
5/7/2020	The cathodic protection system area potential earth current survey recommended actions to optimize the level of protection provided across the system until permanent corrective actions implemented.	Condition Report ANO-C-2020-01378
4/8/2021	Fitness-for-service evaluations had not been performed on buried service water emergency cooling pond supply pipes (HBD-12-36" and 2HBC-88-42") as required by procedure EN-DC-343. The licensee program had until 2025 to complete this procedure requirement.	Condition Report ANO-C-2021-00987
4/19/2021	During setup of a robotic crawler at the unit 1 supply pipe entrance, licensee identified a significant amount of microbiologically influenced corrosion tubercles on the inside surfaces. The licensee advanced the crawler to the first 90-degree elbow (approximately 50 feet) to assess the conditions and inside diameter of the piping to support the planned carbon fiber reinforced polymer wrap in the spring 2027 (1R33)	Condition Report ANO-1-2021-01188
4/21/2021	Three sections of pipe between the emergency cooling pond supply piping entrance and 642 feet into the piping had ponding of water suggesting possible ground water in leakage. Inspection personnel stopped the inspection because they had concerns about the equipment getting stuck.	Condition Report ANO-1-2021-01326
5/5/2021	Significant corrosion observed on wedges and associated studs and nuts on the gate guide knuckles at the entrance to the unit 1 supply pipe (HBD-12-36") when initiating crawler inspections.	Condition Report ANO-1-2021-01841
7/15/2021	Documented no examination frequency established to evaluate the wear and wear rate to determine the remaining service life of the piping. The licensee concluded that internal environment for the piping in the auxiliary building immediately prior to going underground had similar water quality, flow, and temperatures; therefore, the wear and rate from the aboveground piping matches that of buried piping. Piping determined to be operable and structurally sound by comparison.	Condition Reports ANO-1-2021-02429 and ANO-2-2021-01204
9/23/2021	The licensee delayed work order 563877 from the spring 2021 (1R29) until the fall 2022 (1R30). This activity would have removed and replaced a 20-foot section of piping to provide insights into the condition of the supply piping and allowed performing a fitness-for-service evaluation.	Condition Report ANO-1-2021-02824
10/16/2021	Ultrasonic evaluation of location 2HBC-83-2 on the service water return to the emergency cooling pond documented a degradation on the line greater than assumed in in plant calculations that would maintain integrity for another 10 months. A failure effects analysis demonstrated sufficient margin so that the piping would maintain integrity until 2031 at the expected wear rate.	Condition Report ANO-2-2021-02633

Date	Discussion	Reference
12/8/2021	From review of video crawler results for the inside of the unit 2 supply piping, the licensee identified ponding of water about 98 feet downstream of the first elbow. This inspection assessed the interior pipe conditions to support using carbon fiber reinforced polymer wrap to rehabilitate the piping in spring 2026 (2R32). The licensee delayed plans to excavate and assess this section of the piping until the next unit 2 outage to ensure more complete contingency planning and preparations for completion in spring 2023 (2R29).	Condition Report ANO-C-2021-03142
12/22/2021	<p>Independent review confirmed that performance of volumetric inspections and fitness-for-service evaluations were needed to support the repair/replacement implementation dates (2026 through 2031) for the service water supply pipes.</p> <p>The review (1) identified the need to revisit interim actions once the repair projects were deferred; (2) confirmed that prior corrective actions were not timely nor comprehensive to address pipe wall thinning / pitting concerns; and (3) determined a lack of clear ownership and accountability of microbiologically influenced corrosion monitoring by the station.</p> <p>An Organizational & Programmatic review identified organizational problems with execution of needed repairs for a problem known to exist since 2005 related to enterprise risk and conflicting work group priorities. Specifically, the condition analysis identified: (1) site engineering had been concerned with the supply and return piping since 2005 and (2) microbiologically influenced corrosion program owners had changed at least nine times since 2010, which led to missed opportunities and a lack of an advocate to collect data.</p>	Condition Report ANO-C-2021-03247
May 2022	Entergy approved long term corrective action to replace center sections of the unit 1 and unit 2 supply piping and connect to pipe rehabilitated with carbon fiber reinforced polymer wrap from the termination points to the emergency cooling pond outlet and to the service water intake structure.	Scope Document – ANO-1 & ANO-2 Buried ECP Supply Pipe Projects