UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 20, 2017

Mr. Anthony Vitale
Site Vice President, IPEC
Entergy Nuclear Operations, Inc.
450 Broadway, GSB P.O. Box 249
Buchanan, NY 10511-0249

SUBJECT: SERVICE WATER INTEGRITY AGING MANAGEMENT PROGRAM AUDIT REPORT FOR THE INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3, LICENSE RENEWAL APPLICATION (CAC NOS. MD5407 AND MD5408)

Dear Mr. Vitale:

By letter dated April 23, 2007, (Agencywide Documents Access and Management System (ADAMS) Accession Package No ML071210507), as supplemented by letters dated May 3, 2007 (ADAMS Accession No. ML071280700), and June 21, 2007 (ADAMS Accession No. ML071800318), Entergy Nuclear Operations, Inc., submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54, to renew the operating licenses for Indian Point Nuclear Generating Unit Nos. 2 and 3, to the U.S. Nuclear Regulatory Commission.

The NRC staff conducted a supplemental, onsite regulatory audit from August 1-3, 2017 (the audit plan can be found at ADAMS Accession No. ML17207A165), to gain a better understanding of Entergy's response to the request for additional information (RAI), submitted by letter dated May 8, 2017 ADAMS Accession No. ML17132A175), and new plant-specific operating experience related to the Service Water Integrity aging management program. In addition, based on the incidental availability of both Entergy and NRC personnel, in lieu of the staff issuing follow-up RAIs, the staff also resolved questions related to Entergy's RAI response, submitted by letter dated July 27, 2017 (ADAMS Accession No. ML17216A030), for the Buried Piping and Tanks Inspection aging management program. The audit report is enclosed.

If you have any questions, please contact me by telephone at 301-415-6332, or by e-mail at william.burton@nrc.gov.

Sincerely,
/RA/

William Burton, Senior Project Manager
Projects Management and Guidance Branch
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-247 and 50-286

Enclosure:
As stated
cc: Listserv

SUBJECT: SERVICE WATER INTEGRITY AGING MANAGEMENT PROGRAM AUDIT REPORT FOR THE INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3 LICENSE RENEWAL APPLICATION (CAC NOS. MD5407 AND MD5408) DATED SEPTEMBER 20 2017

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U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION, DIVISION OF LICENSE RENEWAL

Docket Nos.:	50-247 and 50-286
License Nos.:	DPR-26 and DPR-64
Licensee:	Entergy Nuclear Operations, Inc.
Facility:	Indian Point Nuclear Generating Unit Nos. 2 and 3
Location:	450 Broadway, GSB Buchanan, NY 10511-0249
Dates:	August 1 – 3, 2017
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Enclosure

1. Introduction

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a supplemental audit at Indian Point Nuclear Generating Units Nos. 2 and 3 (IP2 and IP3) from August 1-3, 2017 (the audit plan can be found at ADAMS Accession No. ML17207A165). The purpose of the audit was to gain a better understanding of Entergy Nuclear Operations, Inc.'s (Entergy's) response to the request for additional information (RAI) submitted by letter dated May 8, 2017 (ADAMS Accession No. ML17132A175), and new plant-specific operating experience information related to the Service Water Integrity aging management program. While onsite, staff also resolved questions about Entergy's response (submitted July 27, 2017, ADAMS Accession No. ML17216A030) to a different RAI concerning the Buried Piping and Tanks Inspection aging management program. In doing so, staff was able to avoid issuing a follow up RAI on the topic.

The regulatory bases for the audit were the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54 (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." Guidance is provided in NUREG-1800, Rev. 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," NUREG 1801, Rev. 2, "Generic Aging Lessons Learned (GALL) Report," License Renewal Interim Staff Guidance (LR-ISG) 2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tank, and Corrosion under Insulation," and LR-ISG-2015-01, "Changes to Buried and Underground Piping and Tank Recommendations."

2. Service Water Integrity Aging Management Program

Audit Activities. During this supplemental audit, the NRC staff reviewed Entergy's Service Water Integrity aging management program, operating experience, site implementing procedures, other relevant documents, and related references provided by Entergy; interviewed various Entergy representatives; conducted breakout sessions on several issues; and walked-down selected components within the scope of the Service Water Integrity program.

Relevant Documents Reviewed

Document	Title/Description	Revision/Date
SEP-SW-IPC-001	Indian Point Energy Center (IPEC), NRC Generic Letter 89-13 Service Water Program.	08/01/2016
IP-RPT-16-00046	IPEC Service Water Piping Weld Repair Process and Re-Inspection Frequency Guidelines	01/30/2017
IP-RPT-14-00022	External Lining for Safety Related for Service Water Piping	10/10/2014
IP3-UT-16-043	Four ultrasonic test readings 2 feet upstream and downstream of elbow in support of EC 61654	11/16/2016
EN-CS-S-008-MULTI	Pipe Wall Thinning Structural Evaluation	Revision 1
EC 61654	Engineering Change (EC) Package to Support Carbon Fiber Wrap Repair of PAB-204	Revision 2
ECN 72788	Engineering Change Notice (ECN) Field Fit-up of Fiber Wrap on Elbow Associated with PAB-204	06/20/2017
WO 00404774-01	Work Order (WO) implementing EC 61654 Repair/Replace Degraded Service Water Weld PAB-204	06/12/2017
9321-01-248-35	Specification for Service Water Piping at IP2	11/16/2013
CR-IP3-2016-03607, Corrective Action 27	Determine the proper statistical sample inspection size to provide 90% confidence in detecting flawed welds.	07/27/2017
CR-IP2-2016-05503	Service water leak between the 23 Zurn Strainer and valve SWN-2-2 appears to be coming from underneath the single layer of carbon fiber wrap coating.	09/06/2016
CR-IP3-2017-00142	Service water leak from #31 FCU at weld B297	01/12/2017

Document	Title/Description	Revision/Date
CR-IP3-2017-00835, Corrective Action 1	Perform “C” level disposition of #33 FCU weld B878 that repair cannot be deferred due to thickness readings below 2-year acceptance criteria	03/09/2017
CR-IP3-2017-00856, Corrective Action 3	Perform Extent-of-Condition examinations of five similar and susceptible welds as required by code case	03/08/2017
F15565-R-001	LPI, Inc. Report “Evaluation of Wall Thinning of Fan Cooler Unit Elbow – Indian Point Entergy Center – Unit 2”	07/22/2016
IP-CALC-14-00004	2R21 GL 89-19 Service Water Piping Inspection Minimum Wall Thickness Evaluations	02/24/2014
IP-CALC-15-00001	3R18 GL 89-19 Service Water Piping Inspection Minimum Wall Thickness Evaluations (Includes EOC for PAB-168 Leak)	01/29/2015
IP-CALC-16-00001	2R22 GL 89-19 Service Water Piping Inspection Minimum Wall Thickness Evaluations	02/17/2016
IP-CALC-17-00003	Pipe Stress Analysis of line 405, 509 and 410 for replacement of pipe spool upstream of valve SWN-35-2	02/27/2017
IP-CALC-17-00004	3R19 GL 89-19 Service Water Piping Inspection Minimum Wall Thickness Evaluations	05/31/2017
IP-CALC-17-00009	Code Case N-513 Evaluation for Weld B1155 on 34 FCU	03/08/2017
LER 247/2013-004	Technical Specification Prohibited Condition Due to an Inoperable Essential Service Water Header as a Result of Pin Hole Leaks in Code Class 3 Service Water Piping	11/12/2013
LER 247/2015-001-01	Technical Specification Prohibited Condition Due to an Inoperable Containment Caused by a Service Water Pipe Leak with a Flaw Size that Results in Exceeding the Allowable Leakage Rate for Containment	09/29/2016
LER 247/2015-004	Safety System Functional Failure Due to an Inoperable Containment Caused by a Flawed Elbow on the 21 Fan Cooler Unit Service Water Motor Cooling Return Piping	02/18/2016
LER 247/2016-010	Safety System Functional Failure Due to an Inoperable Containment Caused by a Through Wall Defect in Service Water Supply Pipe Elbow to the 24 Fan Cooler Unit	12/21/2016
LER 286/2016-001	Safety System Functional Failure Due to an Inoperable Containment Caused by a Flaw on the 31 Fan Cooler Unit Service Water Return Coil Line Affecting Containment Integrity	01/26/2017
LRA-9321-2722-0	Indian Point Unit 2, Flow Diagram Service Water System	11/27/2006
LRA-9321-20333-001-0	Indian Point Unit 3, Flow Diagram Service Water System	10/13/2006
NL-07-120	Response to Request for Additional Information Regarding Relief Request 3-43 for Temporary Repair to Service Water Pipe (ML072890132)	10/3/2007
NL-16-122	Reply to Request for Additional Information for the Review of the Indian Point Nuclear Generating Unit Nos. 2 and 3 License Renewal Application, Set 2016-01 (ML16350A005)	12/02/2016
NL-17-052	Reply to Request for Additional Information for the Review of the Indian Point Nuclear Generating Unit Nos. 2 and 3, License Renewal Application, Set 2017-01 (ML17132A175)	05/08/2017
NL-17-074	Supplemental Information Regarding Reply to Request for Additional Information Set 2017-01 for the Review of the Indian Point Nuclear Generating Unit Nos. 2 and 3 License Renewal Application (ML17187A140)	06/27/2017

Based on its review of the documentation identified above and discussions with Entergy staff members, the NRC staff identified several areas where the aging management activities for the service water system require additional clarification or further information.

Installation of External Carbon Fiber Wrap on Zurn Strainer Pit Service Water Piping. Based on information provided by NRC regional and resident staff members, the applicant had applied a nonstructural external coating of composite (carbon fiber epoxy) material on portions of the service water piping in the Zurn strainer pits. According to the applicant, this was done to protect the pipe from mechanical damage or loss of material due to external corrosion. The applicant recognized the potential that with installation of the external coating, leakage as a result of internal corrosion might not be evident through the external coating. The applicant had previously sponsored a test to show that leakage from a small hole in the pipe would be detectable through the coating. The staff was concerned that some of the Service Water Integrity program's periodic visual inspections would no longer be effective if leakage could be masked by the coating, because a significant precursor to loss of structural integrity would be lost.

In order to evaluate the coating's effect on visual inspection effectiveness, the staff reviewed the associated test report, IP-RPT-14-00022, "External Lining for Safety Related Service Water Piping." The test included: (a) two test pieces with either a 0.375-inch or a 0.500-inch drilled hole; (b) a single layer of unidirectional carbon fiber material applied with primer, wet-out, and top coat epoxies; (c) a 24 hour curing time; (d) a beginning hydrostatic test pressure of 70 pounds per square inch gauge (psig), with increases in 10 psig increments up to 100 psig; and (e) periodic observations looking for loss of hydrostatic test pressure. The test report indicated that leakage from the 0.500-inch hole occurred between 8 hours and 23 hours, and leakage from the 0.375-inch hole occurred after approximately 12 days. The leak path for both tests was identified not as penetrating through the coating itself but as extending from the drilled holes along the axis of the pipe to the edge of the coating.

During discussions, the plant staff acknowledged that the operating pressure, at locations where the carbon fiber material was installed, is lower than the pressure (100 psig) at which leakage occurred during the test. In addition, during its walkdown of the installations, the NRC staff noted that some overlapping of the carbon fiber material occurred on elbows, such that it was no longer a single layer of material. The NRC staff also noted that the installed length of the coating in some cases appeared to be greater than the coating length in the test. In addition, because it took considerably longer for leakage to be detected from the 0.375-inch hole compared to the 0.500-inch hole, the ability to detect leakage from much smaller holes (which have provided the bulk of the past operating experience where structural integrity has not been challenged) is uncertain.

Based on the above, it was not clear to the staff that the test parameters bounded the parameters of the installed coating locations and configurations. As a result, the staff questioned whether the effectiveness of the Service Water Integrity program's visual inspections was substantially diminished by the installation of the external, nonstructural carbon fiber coating. In order to address the potential masking effect of the carbon fiber coating, the staff needs additional information describing alternative inspection techniques, including the quantity, frequency, and extent, to compensate for the inability to credit periodic visual inspections.

Installation of External Carbon Fiber Repair on Service Water Pipe Weld PAB-204. The staff reviewed engineering change (EC) 61654 and noted that the repair of the non-safety-related pipe was "designed to act as the original piping should the weld fail and structural integrity compromised." The EC specified that the installation include: (a) seven layers of wrap, (b) a 6-inch overlap, and (c) a minimum total wrap length of 6 feet upstream and downstream of the weld. The staff reviewed WO 00404774-01 and noted that, except for the specified overlap at the elbow, all installation parameters were met. For the overlap at the elbow, the staff reviewed ECN 72788 for allowing the field to fit-up the carbon fiber wrap with additional layers to compensate for the inability to uniformly obtain a 6-inch overlap.

Because the credited piping material changed from carbon steel to a nonmetallic composite, Entergy may need to address different aging effects with different inspection requirements. In addition Entergy may need alternate inspection techniques, because the inability to detect leakage through the composite material may not allow the detection of ongoing internal corrosion at locations where structural integrity is needed at the carbon steel-to-nonmetallic composite interface. To address the issues introduced by this repair, the staff needs additional information regarding: a) the aging effects that need to be managed for the nonmetallic composite material (with associated aging management program, if applicable) and b) confirmation that degradation of cement-lined service water piping has not occurred at locations other than at welds (e.g. mid-span between welds) such that alternate inspection requirements would be needed to confirm the structural integrity near the carbon steel to nonmetallic composite interface locations.

Use of 6 Percent Molybdenum Stainless Steel (AL-6XN). LER 247/2013-004 addresses pitting corrosion of 300 series stainless steel service water piping that was replaced with 6 percent molybdenum stainless steel (AL-6XN). Based on industry operating experience, the staff noted that, because AL-6XN has a more positive corrosion potential than 300 series stainless steels, the introduction of AL-6XN can increase the susceptibility of carbon steel to galvanic corrosion. During a breakout session, the applicant noted that the service water system contains dissimilar-metal flanged joints between carbon steel and AL-6XN, as well as 300 series stainless steel. Consequently, the staff questioned whether AL-6XN flanged components should be considered as a unique population within the Service Water Integrity program. During discussions, the plant staff stated that AL-6XN is sufficiently similar to 300 series stainless steels that components made from AL-6XN do not need to be considered as unique populations; however, the plant staff noted that the similarity is based on whether the surfaces of the stainless steel components have been passivated and the grade of 300 series stainless steel.

During its subsequent review of the Service Water Piping Specification (9321-01-248-35), the staff noted that the applicant had previously removed the requirement for the use of insulating kits on dissimilar-metal flanged joints. Because the absence of insulating kits increases the susceptibility of carbon steel to loss of material due to galvanic corrosion, it was not clear to the staff that the condition or absence of insulating kits on dissimilar-metal flanged joints could be disregarded. In order address the issues introduced by these changes, the staff needs additional information to determine whether current inspection of dissimilar-metal flanged connections can be credited by the Service Water Integrity program and whether AL-6XN needs to be considered as a unique population for these activities. The information needed by the staff includes:

a) the difference in the corrosion potential of the stainless steel alloy(s) used in the service water system and the corrosion potential of AL-6XN, b) the environment in the vicinity of the 300 series stainless steel/carbon steel and AL-6XN/carbon steel joints, c) the coatings in the vicinity of the 300 series stainless steel/carbon steel and AL-6XN/carbon steel joints, and d) whether current inspections account for greater susceptibility to galvanic corrosion when insulating kits are not used.

Assessment of Through-Wall Leak Discussed in Relief Request 3-43. The staff had previously asked about changes made to the Service Water Integrity program as a result of situations like relief request 3-43, where the applicant's predictive monitoring methodology did not appear to be conservative. In its response dated May 8, 2017, the applicant stated that a contributing cause of the leak associated with relief request 3-43 was a less than adequate repair of a previous leak. The applicant also stated that it had recently implemented a program improvement to prevent recurrence of events related to inadequate repairs through the development of engineering report IP-RPT-16-00046, "IPEC Service Water Piping Weld Repair Process and Re-Inspection Frequency Guidelines." (See below for the staff's review of this document.)

As part of its responses to RAIs for relief request 3-43, by letter dated October 3, 2007, (ADAMS Accession No. ML072890132) the applicant stated that a "final assessment of why a new through-wall leak developed near the area of the prior repair has not been completed." The staff requested a copy of the referenced assessment in order to determine whether changes to the program addressed all of the potentially non-conservative aspects of the predictive monitoring methodology associated with the relief request. However, the applicant could not locate the referenced assessment while the audit team was on site. During breakout sessions, the applicant indicated that changes made to the program since the 2007 event, including the recently issued engineering report IP-RPT-16-00046, have addressed all of the issues related to the event. It was not clear to the staff whether additional changes to the program were warranted based on the circumstances surrounding the relief request, without additional information from the applicant to support its position.

Review of Service Water Piping Weld Repair Process and Re-Inspection Frequency Guideline, (IP-RPT-16-00046). In its RAI response dated May 8, 2017, the applicant stated that, as a program improvement to prevent recurrence of events related to inadequate repairs, it had recently implemented IP-RPT-16-00046. As part of the audit, the staff reviewed the cited guideline and noted that the document provides guidance related to:

- ensuring ultrasonic inspection data sufficiently characterizes the extent of degradation (e.g., extent of readings, grid size) through coordination between inspection personnel and design engineers,
- developing formal calculations in accordance with EN-CS-S-008-MULTI to determine the extent of repairs and the timing of follow-on inspections,
- determining the number and extent of required repairs,
- considering the impact of welding on the integrity of the pipe internal lining, and
- determining the re-inspection interval based on weld repair configuration (e.g., full penetration weld, partial penetration weld, weld overlay), minimum wall thickness requirements, and corrosion allowance.

Although the staff did not identify any issues with this new guidance, the staff noted that the current version of the Service Water Integrity program, which was issued prior to the new guidance, does not cite IP-RPT-16-00046. During subsequent discussions, the applicant acknowledged that the program should be enhanced to credit the newly implemented guidance.

Review of Structural Integrity Calculations. The NRC staff reviewed several service water piping minimum wall thickness calculations in order to determine if the applicant's Service Water Integrity program provides reasonable assurance that corroded piping will be repaired or replaced prior to a loss of intended function. During its review, the staff noted that EN-CS-S-008-MULTI, IP-CALC-17-00003, and IP-CALC-17-00009 used the methods and analytical techniques found in American Society of Mechanical Engineers (ASME) Code Case N-513-3 or B31.1 "Unreinforced Opening Methodology" to evaluate piping where ultrasonic test data fell below the minimum required wall thickness. The staff considered the applicant's methodology to be appropriate for evaluating structural integrity of piping that has experienced loss of material.

As part of this effort, the NRC staff reviewed EN-CS-S-008-MULTI and noted that the guidance includes screening criteria that will cause the applicant to take certain actions (i.e. accept as is, evaluate, or repair/replace) if the predicted pipe wall thickness falls below specified values. The staff also noted that if a calculation shows that the predicted minimum wall thickness falls below the specified requirements, then it will be treated as a condition adverse to quality and captured in the site's corrective action program. The staff also noted that EN-CS-S-008-MULTI provides guidance for determining the corrosion rate through several methods based on the local conditions in the service water piping as well as the availability of previous inspection documentation.

During discussions, the applicant stated that water hammer loads had been incorporated into the minimum wall thickness calculations, where applicable. The NRC staff indirectly evaluated the applicant's statement by independently reviewing IP-CALC-17-00004, and IP-CALC-15-00001 and comparing the minimum required wall thickness values for 10-inch piping inside containment (which would see the largest water hammer loads), to comparable 10-inch piping outside containment. In the sample reviewed by the staff, it was noted that the minimum wall thickness values were higher for the 10-inch service water piping inside containment, indicating that additional loads were incorporated into the calculations.

Corrective Actions for Inoperable Containment Due to Leaks in Service Water Piping. In its RAI response dated May 8, 2017, the applicant addressed LERs 247/2015-001, 247/2015-004, 247/2016-010, and 286/2016-001 that all relate to inoperable containment due to leaks in service water system fan cooler unit piping. For the two Unit 2 events in 2015, the applicant stated that flow rates were higher than necessary leading to flow-accelerated corrosion at the weld joint, and the program was not changed because the issues did not involve deficiencies in the Service Water Integrity program.

Since service water systems are not susceptible to flow-accelerated corrosion, but are susceptible to erosion, and because the Service Water Integrity program includes inspections for erosion, it was not clear to the staff that the Unit 2 events did not involve deficiencies in the program.

The staff reviewed Report No. F15565-R-001, "Evaluation of Wall Thinning of Fan Cooler Unit Elbow, Indian Point Unit 2," that determined the nature and root cause of the associated leaks. The report concludes that the "leakage of the elbow occurred as a result of flow accelerated corrosion attack as a direct consequence of high flow rates and turbulence created by the sharp ridge on the inner surface at the intrados of the elbow." The staff noted that the loss of material occurred only on the side of the elbows.

As part of its review, the staff independently noted that industry guidance in NSAC-202L, "Recommendations for an Effective Flow-Accelerated Corrosion Program," excludes systems with high levels of dissolve oxygen (greater than 1000 ppb) such as service water systems because they are not susceptible to flow-accelerated corrosion. Consequently, the staff did not agree with the root cause report's conclusion that the leak was caused by flow-accelerated corrosion. In addition, based on the leak locations (on the sides of the elbows), the staff noted the similarity with re-circulation cavitation, which appear to be associated with the broader issues addressed in LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms."

The applicant's RAI response dated May 8, 2017, describes the corrective actions for the leak as adjusting system flow rates to lower the fluid velocity in the affected piping. The staff agrees that this change to the system operating parameter would reduce the loss of material rate, but as noted in the above cited LR-ISG, the effectiveness of the corrective actions, which eliminate the source of an erosion mechanism, should be verified. During the audit, the applicant acknowledged that additional activities would be needed to verify that the reduced flow rates resolve the loss of material issue.

For the Unit 3 event in 2016, corrective actions specified in LER 286/2016-001 included revising the Generic Letter 89-13 program to include a requirement to conduct a definitive number of volumetric inspection for welds made of 904L material each pre-outage interval. Although specified in the LER (dated December 21, 2016), the applicant's RAI response discussing this LER (dated May 8, 2017), did not include any information about this change to the program.

During its review of the associated corrective action document (CR-IP3-2016-03607, CA No. 27), the staff noted that the applicant will inspect 13 of the 904L welds each pre-outage interval. However, the corrective action document also states that the acceptance criteria for the selected sample will be that specified in ASME Code Case N-513-3. As previously discussed in RAI 3.0.3-10-2a (see Entergy's RAI response dated May 8, 2017), loss of structural integrity, which is the basis for the Code Case N-513-3 acceptance criteria, may not be an appropriate acceptance criteria for all situations.

Given that the service water system leak causing the containment to be inoperable apparently met structural integrity criteria, it was not clear to the staff that criteria from Code Case N-513-3 would be appropriate acceptance criteria for the periodic inspections of 904L welds. Since Code Case N-513-3 allows leakage and specifically does not address the consequences of leakage, the specified acceptance criteria for the periodic sample of 904L welds would not maintain intended functions consistent with the current licensing basis. In order to complete its review of the Service Water Integrity program, the staff needs additional information that clarifies the adequacy of the acceptance criteria for the 904L weld inspections.

In a related area, the staff noted that in its RAI response dated May 8, 2017, the applicant described the cause of pin-hole leaks in LER 247/2013-004 as “improper material use.” As clarified by its letter dated June 27, 2017 (ADAMS Accession No. ML17187A140), the applicant stated that the term was intended to refer to the inability to characterize degradation associated with the configuration of socket welded fittings. The applicant also stated that 300 series stainless steel material remains in use in the service water system and the “requirements for NDE [non-destructive examination] of 300 series stainless steel piping are already included in the scope of the Service Water Integrity program.”

The staff notes that, while stainless steel piping is included within the scope of the program, the program’s only NDE “requirements” would be periodic visual inspections of the piping looking for leakage. Similar to the previous discussion for the 904L welds, if there is stainless steel service water piping inside containment, then the detection of aging effects by only using visual inspections (based on past operating experience) would not maintain intended functions consistent with the current licensing basis. In order to complete its review, the staff needs additional information to clarify whether the Service Water Integrity program includes sufficient non-destructive requirements of stainless steel piping where leakage due to localized corrosion (e.g., pitting) can cause a loss of intended function.

Service Water Integrity Program Extent of Condition Inspections. The staff reviewed SEP-SW-IPC-001, “NRC Generic Letter 89-13 Service Water Program,” and noted that scope expansion (extent of condition) inspections used qualitative criteria. Examples include: engineering judgment, previous inspection history, materials, etc. The staff noted that the previous enhancement to the Service Water Integrity program, regarding minimum numbers of welds to be inspected, including extent of condition inspections, only applied to cement-lined piping. (See Entergy letter dated December 2, 2016, ADAMS Accession No. ML16350A005). Other types of materials in the service water system were not addressed in the enhancement. The staff noted that extent of condition inspections should be conducted whenever inspection results do not meet acceptance criteria. In order to obtain the information necessary to verify whether the Service Water Integrity program extent of condition inspections will be adequate to provide reasonable assurance that the service water system will meet its intended function, the staff requires the following information:

- The specific number of increased inspections that will be conducted when degraded conditions are detected; or

- The criteria for determining the number of increased inspections based on the degree of degradation detected during inspections.

3. Buried Piping and Tanks Inspection Aging Management Program

Audit Activities. Based on the incidental availability of both Entergy and NRC personnel during the audit, the staff resolved questions related to the applicant's RAI response, submitted by letter dated July 27, 2017, for the Buried Piping and Tanks Inspection aging management program. The RAI relates to Entergy's recent supplemental information associated with LR-ISG-2015-01, "Changes to Buried and Underground Piping and Tank Recommendations." The staff had questions about the applicant's response regarding (1) procedures for performing visual inspections of buried and underground piping and tanks; and (2) results of soil corrosivity testing. In lieu of the staff issuing follow-up RAIs, the applicant agreed to provide additional documentation during the audit. During this supplemental audit, the NRC staff reviewed site implementing procedures and other relevant documents related to Entergy's Buried Piping and Tanks Inspection aging management program.

Relevant Documents Reviewed

Document	Title/Description	Revision/Date
EN-EP-S-002-MULTI	Underground Piping and Tanks General Visual Inspection	09/19/2014
IP-RPT-13-000	GZA GeoEnvironmental Report, Results of Soil Corrosivity Testing Indian Point Energy Center	07/29/2013
NL-17-184	Reply to Requests for Additional Information for the Review of the Indian Point Nuclear Generating Unit Nos. 2 and 3, License Renewal Application RAI Set 2017-06 (ADAMS Accession No. ML17216A030)	07/27/2017

The staff reviewed EN-EP-S-002-MULTI, "Underground Piping and Tanks General Visual Inspection," and noted that visual inspections of buried and underground piping and tanks are (1) performed with sufficient illumination and resolution to assess of the component for indications of cracking, corrosion, and mechanical damage; (2) conducted by personnel having an annual eye examination and visual acuity specified in site procedure CEP-NDE-100. "Administration and Control of NDE," and/or ASME Code, Section XI, Paragraph IWA-2321; and (3) conducted by personnel who are VT-1 qualified.

The staff reviewed IP-RPT-13-000 and noted that eight soil corrosivity tests from a total of six locations were conducted in 2013. The staff reviewed the measured values of soil resistivity, pH, redox potentials, sulfides, chlorides, and moisture that were used to determine soil corrosivity at the six test locations. The staff noted that soil corrosivity in accordance with American Water Works Association Standard C105, "Polyethylene Encasement for Ductile-Iron Pipe Systems," ranged from 0 to 10 at the six locations.

4. Exit Meeting

The NRC staff held a final briefing with Entergy personnel on August 3, 2017, to discuss the results of the supplemental audit. Applicant representatives indicated that they would consider addressing the issues discussed above, by providing a separate response.

5. Audit Participants

The following personnel from the NRC and Entergy participated in this supplemental audit:

PARTICIPANTS:	**AFFILIATION**:
Brian Allik	U.S. Nuclear Regulatory Commission (NRC)
Alex Chereskin	NRC
Jim Gavula	NRC
Brian Haagensen	NRC
Bill Holston	NRC
Roger Kalikian	NRC
Kevin Mangan	NRC
Diane Render	NRC
Sarah Rich	NRC
Richard Burroni	Entergy Nuclear Operations, Inc. (Entergy)
Charles Caputo	Entergy
Allen Cox	Entergy
Mark Crosskey	Entergy
Richard Drake	Entergy
Richard Louie	Entergy
Steven Malinski	Entergy
Thomas Orlando	Entergy
Dennis Pennino	Entergy
Michael Vasely	Entergy