FENOC™
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Perry Nuclear Power Plant
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David B. Hamilton
Vice President

440-280-5382

August 20, 2017
L-17-278

10 CFR 50.55a

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Proposed Alternative to Use ASME Code Case N-513-4

In accordance with the provisions of 10 CFR 50.55a(z)(2), FirstEnergy Nuclear Operating Company (FENOC) hereby requests Nuclear Regulatory Commission (NRC) approval of a proposed alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," for use at the Perry Nuclear Power Plant.

On August 18, 2017, a through-wall leak was identified on a 14-inch elbow on B emergency service water (ESW) piping. The elbow is on the outlet of the B emergency closed cooling (ECC) heat exchanger, immediately downstream of valve 1P45F0541B, "ECC HX B ESW OUTLET." Subsequently, it was determined that Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," could not be applied to piping elbows where the leak was located. As a result, the ESW B train was declared inoperable on August 19, 2017 at 18:22.

To address this issue, FENOC requests approval to use ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," with limits on leakage and temporary acceptance of flaws in moderate energy ASME Code Class 3 piping in lieu of the ASME Code, Section XI, requirements in paragraph IWD-3120(b) and article IWD-3400. The proposed alternative and supporting information are presented in Enclosure A. ASME Code Case N-513-4 and the technical basis for changes in this most recent revision of the code case are provided in Enclosures B and C, respectively. Excerpts from a calculation that evaluates the structural integrity of the ESW piping in accordance with the guidance of ASME Code Case N-513-4 is provided in Enclosure D. A sketch of the location of the leak is provided in Enclosure E.

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FENOC requests approval of the proposed alternative by August 21, 2017.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330) 315-6810.

Sincerely,

David B. Hamilton

Enclosures:

A. 10 CFR 50.55a Request to Use ASME Code Case N-513-4
B. ASME Code Case N-513-4, Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1
C. Technical Basis for Proposed Fourth Revision to ASME Code Case N-513
D. Excerpts from Evaluation of Through-wall Leak on Emergency Service Water Piping - Condition Report 2017-08581
E. Sketch of Location of Leak

cc:
NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager

Enclosure A
L-17-278

10 CFR 50.55a Request to Use ASME Code Case N-513-4

(Nine Pages Follow)

Proposed Alternative In Accordance with 10 CFR 50.55a(z)(2)

--Hardship Without a Compensating Increase in Quality and Safety--

1. ASME CODE COMPONENT(S) AFFECTED

A pinhole leak was identified on a 14-inch elbow on B emergency service water (ESW) piping. The elbow is on the outlet of the B emergency closed cooling (ECC) heat exchanger, immediately downstream of valve 1P45F0541B, "ECC HX B ESW OUTLET."

2. APPLICABLE CODE EDITION AND ADDENDA

The applicable ASME Code, Section XI, edition and addenda is the 2013 Edition for Perry Nuclear Power Plant fourth ISI interval.

3. APPLICABLE CODE REQUIREMENT

For ASME Code Class 3 components, paragraph IWD-3120 of ASME Code, Section XI, 2013 Edition states that the requirements of IWC-3120 may be used.

4. REASON FOR REQUEST

On August 19, 2017 at 18:22, the B emergency service water (ESW) system was declared inoperable, which resulted in entry into a number of Limiting Conditions for Operation (LCO) not being met, including, but not limited to LCO 3.7.1, "Emergency Service Water (ESW) System – Divisions 1 and 2," and 3.8.1, "AC Sources – Operating."

ASME Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," provides criteria to allow temporary acceptance of flaws, including through-wall flaws in moderate energy Class 2 or 3 piping without performing repair or replacement activities. Code Case N-513-3, (Revision 3, January 26, 2009) is approved for generic use by licensees in Nuclear Regulatory Commission (NRC) Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17 (ADAMS Accession No. ML13339A689), with the condition that the repair or replacement activity temporarily deferred under the provisions of this Code Case shall be performed during the next scheduled outage.

ASME Code Case N-513-3 does not address the evaluation of flaws in certain locations of moderate energy piping components, such as elbows, bent pipe, reducers, expanders, and branch tees. ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," (Revision 4, May 7, 2014) contains several revisions to ASME Code Case N-513-3 including expanding the applicability of the code case beyond straight pipe to

include elbows, bent pipe, reducers, expanders, and branch tees. ASME Code Case N-513-4, provided in Enclosure B, has not been approved by the NRC for generic use by licensees. Use of ASME Code Case N-513-4 is proposed to allow temporary acceptance of the aforementioned through-wall flaw, which is in a moderate energy Class 3 piping elbow without performing repair or replacement activities, and thereby avoid a plant shutdown. Use of this alternative evaluation method in lieu of immediate action for such a degraded condition would allow FirstEnergy Nuclear Operating Company (FENOC) to perform additional extent of condition examinations while allowing time for safe and orderly long-term repair actions.

Plant shutdown activities result in additional plant risk, requiring use of a system that is in standby during normal operation. Such a shutdown would be inappropriate when an affected ASME Code component in a degraded condition is demonstrated to retain adequate margin to fulfill the component's function. Accordingly, compliance with the current code requirements results in a hardship without a compensating increase in the level of quality and safety.

5. PROPOSED ALTERNATIVE AND BASIS FOR USE

Proposed Alternative

Application of the evaluation methods of ASME Code Case N-513-4 to a Class 3 component that meets the operational and configuration limitations of Code Case N-513-4, paragraphs 1(a), 1(b), 1(c), and 1(d) is proposed in lieu of the requirements in IWC-3120, IWC-3130, IWD-3120(b), and IWD-3400 of ASME Code Section XI, as they relate to the evaluation, repair, and replacement of ASME Code Class 3 moderate energy piping systems with flaws. An ASME Code, Section XI, compliant repair or replacement will be completed at the next scheduled refueling outage or prior to exceeding the allowable flaw size, whichever comes first.

For a leaking flaw, the allowable leakage rate will be determined by dividing the critical leakage rate by a safety factor of four. The critical leakage rate is determined as the highest leakage rate that can be tolerated and will be based on the allowable loss of inventory or the maximum leakage that can be tolerated relative to room flooding, among others.

The design basis is considered for each leak and evaluated using the FENOC operability determination and functionality assessment process. The evaluation process must consider requirements or commitments established for the system, continued degradation and potential consequences, operating experience, and engineering judgment. As required by the code case, the evaluation process considers, but is not limited to, system make-up capacity, containment integrity with the leak not isolated, effects on adjacent equipment, and the potential for room flooding.

During the temporary acceptance period, leaking flaws will be monitored daily as required by paragraph 2(f) of Code Case N-513-4 to confirm the analysis conditions used in the evaluation remain valid. Significant change in the leakage rate is reason to question that the analysis conditions remain valid and would require re-inspection per paragraph 2(f) of the Code Case. Any re-inspection must be performed in accordance with paragraph 2(a) of the Code Case.

The NRC issued Generic Letter, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping (Generic Letter 90-05)," to address the acceptability of limited degradation in moderate energy piping. The generic letter defines conditions that would be acceptable to utilize temporary non-code repairs with NRC approval. The ASME recognized that relatively small flaws could remain in service without risk to the structural integrity of a piping system and developed Code Case N-513. NRC approval of Code Case N-513 versions in Regulatory Guide 1.147 allows temporary acceptance of partial through-wall or through-wall leaks for an operating cycle provided all conditions of the code case and NRC conditions are met. The code case also requires the owner to demonstrate system operability considering effects of leakage.

The ASME recognized that the limitations in Code Case N-513-3 were preventing needed use in piping components such as elbows, bent pipe, reducers, expanders, and branch tees and external tubing or piping attached to heat exchangers. Code Case N-513-4 was approved by the ASME to expand it for use at these locations and to revise several other areas of the code case. The following list provides a high level overview of the Code Case N-513-4 changes:

1. Revised the maximum allowed time of use from no longer than 26 months to the next scheduled refueling outage.
2. Added applicability to piping elbows, bent pipe, reducers, expanders, and branch tees.
3. Expanded use to external tubing or piping attached to heat exchangers.
4. Revised to limit the use to liquid systems.
5. Revised to clarify treatment of service level load combinations.
6. Revised to address treatment of flaws in austenitic pipe flux welds.
7. Revised to require minimum wall thickness acceptance criteria to consider longitudinal stress in addition to hoop stress.
8. Daily walkdown requirement for through-wall leaks changed to provide additional flexibility.
9. Other editorial changes to improve clarity.

Significant changes in Code Case N-513-4 when compared to NRC approved Code Case N-513-3 are discussed in Enclosure C, "Technical Basis for Proposed Fourth Revision to ASME Code Case N-513."

For the analysis, the pinhole leak in the 14-inch elbow is combined, as described below, with a pinhole leak in a 3-inch ESW pipe containing 1P45F5466B, "ECC HX B ESW OUTLET BYPASS," downstream of the Emergency Closed Cooling (ECC) B Heat Exchanger . The pinhole leak in the 3-inch pipe was temporarily accepted in accordance with the requirements of Code Case N-513-3.

Effect on ESW B Loop System Flow

The leak is located at the 14-inch piping on the downstream side of valve 1P45F0541B. This piping is on the downstream side of the ECC B Heat Exchanger (ESW tube side). The location of the leak cannot be isolated from the return side of the ESW B Loop.

There is currently no effect on ESW Loop B system flow, because the leak is approximately 0.02 gallon per minute (gpm). While in operation, the flow at this point in the ESW system is approximately 2425 gpm going through the ECC B Heat Exchanger, and flow can range between 2400-2730 gpm. However, this flow can be increased by throttling open valve 1P45F0541B. The majority of this flow goes through 14-inch valve 1P45F0541B, with a small percentage going through the 3-inch bypass line (estimated at 50 gpm). The leak has negligible effect on total ESW Loop B system flow, as it is currently measured at approximately 0.02 gpm.

If leakage would become greater than the current 0.02 gpm leak, the effect on the cooling capability of ESW Loop B to cool the B ECC Heat Exchanger (or any other heat load on the B Loop) would be "no effect." The reason is the location of the leak is on the downstream side of the ECC B Heat Exchanger. ESW water has already cooled its designated heat loads. The net effect would be a greater amount of water would leak on the floor to the 4-inch floor drains, and less water would exit the plant through ESW Loop B discharge pipe.

Leakage Effect of ESW Loop B

There is currently no effect on ESW Loop B in standby readiness, because the leak is currently approximately 0.02 gpm.

A permissible leakage rate from the ESW Loop B, while the loop is in operation, has been defined as 5.625 gpm, and a permissible leakage rate from the loop while the loop is in standby/keepfill has been defined as 3 gpm. These leakage rates are conservatively determined by assigning the maximum allowable standby/keepfill leakage rate from plant calculation to system operating conditions, determining the corresponding leakage at standby/keepfill conditions, and applying a safety factor of

four. It is noted that during system operation, any increase in leakage beyond 5.625 gpm would not impact the cooling capacity of ESW, as the leak location is downstream of all heat loads. However, leakage of this magnitude could challenge the system standby/keepfill capacity, potentially introducing conditions in which the system would be susceptible to water hammer upon future pump start.

The existing cumulative area of the pinholes identified in the ESW B Loop is less than the permissible total area of the pinholes. The existing cumulative area is approximately 0.00011 square inches, where the permissible area is approximately 0.0165 square inches. This permissible area equates to the permissible leakage rates identified above.

The evaluation of acceptable leakage, though performed considering two existing pinholes in the ESW B Loop piping, would remain applicable if additional pinholes were to occur prior to the restoration of the piping containing the existing pinholes. Essentially, the leakage limitations of 5.625 gpm while the ESW B loop is operating, or approximately 3 gpm while the ESW B loop is in standby/keepfill is applicable regardless of the number of pinholes. Any additional pinhole would require individual evaluation for structural integrity, as well as a cumulative review for structural integrity if the new pinhole were in the vicinity of an existing pinhole.

Effect of Flooding

The leak is located on the 574'-10" elevation of the control complex (east side), lowest elevation of the building. This level of the control complex has numerous floor drains, which are routed to the floor drain sump. The leak location on the 14-inch ESW line is on the south side of the pipe, and 50 inches off the floor. A 4-inch floor drain is located approximately 3-feet from where water would drip off the 14-inch pipe, if leakage were to increase. This floor drain will route water to the control complex floor drain sump where two-50 gpm pumps are located, which auto start. However, based on the analysis presented in the Structural Integrity Section there is reasonable assurance that the leakage will not significantly increase such that flooding would be a concern. This leak is bounded by a flooding analysis calculation, which postulates a pipe rupture in a 14-inch pipe.

Effect of Water Spray

There currently is no effect of water spray, because leakage is approximately 0.02 gpm, and is oriented in the downward direction (approximately in the 4 o'clock position of the piping when viewed axially). If leakage were to increase (that is, when the ESW B loop is in operation) water would exit the piping and spray downward and to the south. An 8-inch thick wall constructed of drywall (that goes to the ceiling) is located 6 1/2-feet to the west of the leak location.

The nearest safety related piece of equipment that could possibly be affected by water spray is the three-way valve 1P42F665B, "ECC B HX OUT TEMP CONT," which has an electrically powered hydramotor actuator. However, the valve is located to the south of the leak and is approximately 10-feet away. Pressure at this point in the system is approximately 80 pounds per square inch guage (psig) with the system operating and the water spray would be directed toward the floor. Temperature at this point in the system is approximately 39 degrees Fahrenheit (°F). There is no other equipment in a 20-foot radius around the leaking pipe that would be affected by potential water spray.

However, based on the analysis presented in the following sections there is reasonable assurance that the leakage will not significantly increase such that water spray would be a concern.

Manual valve 1P45F5466B, "ECC HX B ESW OUTLET BYPASS," is currently being wetted by the identified leak but this has no effect on its operation because it is a manual valve.

Flaw Characterization

Nondestructive examination (NDE) was performed to characterize the flaw length and extent of the flaw inside the pipe wall.

Consistent with the flaw characterization described in ASME Section XI, IWA-3300, and by way of straight beam and angled beam ultrasonic testing (UT) NDE examination methods, the flaw in the 14-inch diameter ESW piping was characterized as a non-planar flaw (pinhole leak indicative of pitting corrosion). For the purposes of this evaluation, a conservative bounding flaw with a diameter of 0.125 inches will be used. This flaw is not crack like and thus it is not expected to be subject to further propagation, since only planar type flaws experience crack growth.

Thickness measurements were taken on the piping directly surrounding the leak. No pitting was observed. Additionally, circumferential readings were taken in three axial planes 0.5 inches apart, with readings taken every 1 inch around the entire circumference of the pipe. The minimum reading was 0.280 inches near the origin of the pinhole leak.

As discussed in the following sections, the piping thickness for the flaw analysis was very conservatively taken as 0.25 inches, which is below the minimum UT measurement (0.28 inches). In reality, the actual thickness in the immediate vicinity of the flaw exceeds 0.25 inches.

The minimum required piping thickness can be determined based on the larger of the wall thickness required to maintain internal pressure loads, the wall thickness required for imposed mechanical loading, and the Electric Power Research Institute guideline of 20 percent of the nominal pipe wall thickness.

The minimum required wall thickness is 0.139 inches. As discussed above, the actual thickness was measured to exceed the minimum required wall thickness in all locations other than the flaw. The localized area of the flaw is discussed in the section below. This also shows that the area of metal loss is highly localized at the point of the pinhole leak.

Structural Integrity

The structural integrity of piping system components that are designed to ASME Code requirements must be maintained in conformance with the ASME Section XI Code per 10CFR50.55a(g). This through wall pipe leak in the ESW piping is a degraded condition that would require repair prior to return to service in accordance with ASME Section XI requirements.

This piping meets the criteria for the Code Case N-513-4 because the maximum operating temperature is not above 200 °F and the operating pressure does not exceed 275 psig. The design pressure and temperature of this portion of ESW is 150 psig and 150°F, respectively.

A calculation (excerpts contained in Enclosure D) was completed to demonstrate the 14-inch diameter piping with a pinhole leak meets the structural integrity requirements of ASME Code Case N-513-4 and ASME Section XI, Appendix C. This structural analysis was completed to conservatively envelope all the UT measured pipe wall thickness values. Specifically, a pipe wall thickness of 0.25 inches was used as the overall pipe wall thickness of the piping in the analysis. This structural evaluation bounds the effects of any other areas of erosion/corrosion within this 14-inch diameter piping. Based on this analysis, this 14-inch diameter ESW system piping is structurally sound with this pinhole leak. This analysis takes into consideration both pressure and design basis bending stress on the piping and gives acceptable flaw sizes in both the circumferential and axial directions.

The maximum allowable flaw size is 0.58 inches in the axial direction and 1.35 inches in the circumferential direction to maintain structural integrity. As discussed above, the leak is a pinhole leak. Conservatively characterizing the through-wall extent as a circle with a diameter of 0.125 inches, the leak meets the acceptance criteria for structural integrity utilizing Code Case N-513-4, as it is bounded by the allowable flaw dimensions.

Based on this structural analysis and the characterization of the flaw as a pinhole leak and not a crack subject to further propagation, operability can be demonstrated for ESW B with this 14-inch diameter piping having a through wall leak. Since the pinhole leak is not subject to rapid growth and increased leakage, the ESW system will continue to perform its intended design function of delivering cooling water to plant components. Considering the ample available margin, this analysis also qualitatively indicates the ability to handle a substantial metal loss rate against current measured material thickness, although this is not anticipated.

Other Actions

ASME Code Case N-513-4 includes provisions for periodic NDE UT inspection of the flaw not to exceed thirty days since no flaw growth evaluation is being used in this case and daily walkdowns of the flaw to confirm the analysis conditions remain valid.

Twice daily plant rounds will be used to meet the daily walkdowns of the flaw action. The maximum cumulative leakage is 3 gpm while the ESW B loop is in keepfill and 5.625 gpm while the ESW B loop is in operation. The anti-sweat insulation on the elbow shall be removed until the leak has been repaired.

The periodic NDE UT inspection of the flaw (every 30 days) will be tracked through a corrective action or similar tracking mechanism.

The guidance also includes augmented inspections of at least five similar susceptible locations to that of the flaw. A corrective action or similar mechanism will track completion of this activity.

FENOC intends to repair or replace the elbow during the next scheduled refueling outage utilizing an ASME code approved method.

In summary, FENOC will apply ASME Code Case N-513-4 to evaluate the through-wall leak identified in a Class 3 emergency service water piping elbow at the Perry Nuclear Power Plant, which is within the scope of the code case. Code Case N-513-4 utilizes technical evaluation approaches that are based on principles that are accepted in other ASME Code documents already acceptable to the NRC. The application of this code case, in concert with safety factors on leakage limits, will maintain acceptable structural and leakage integrity while minimizing plant risk and personnel exposure by minimizing the number of plant transients that could be incurred if degradation is required to be repaired based on ASME Code, Section XI acceptance criteria only.

6. DURATION OF PROPOSED ALTERNATIVE

The proposed alternative is requested for the duration up to and including the 17th PNPP refueling outage that is scheduled to commence in March 2018.

7. PRECEDENT

1. Exelon Generation Company, LLC (Exelon) submitted a similar request to use ASME Code Case N-513-4 at Braidwood Station, Units 1 and 2; Byron Station, Unit Nos. 1 and 2; Calvert Cliffs Nuclear Power Plant, Units 1 and 2; Clinton Power Station, Unit No. 1; Dresden Nuclear Power Station, Units 2 and 3; LaSalle County Station, Units 1 and 2; Limerick Generating Station, Units 1 and

2; Nine Mile Point Nuclear Station, Units 1 and 2; Oyster Creek Nuclear Generating Station; Peach Bottom Atomic Power Station, Units 2 and 3; Quad Cities Nuclear Power Station, Units 1 and 2; R. E. Ginna Nuclear Power Plant; and Three Mile Island Nuclear Station, Unit 1. Exelon requested use of the code case for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of the same ASME Code requirements referenced herein. A September 16, 2016 NRC letter authorized use of ASME Code Case N-513-4 at each plant (ADAMS Accession Number ML16230A237).

2. Entergy Nuclear Operations, requested authorization of a proposed alternative to certain requirements of the ASME Code, Section X1, Article IWD-3000 for the Pilgrim Station. Specifically, it was proposed to use alternate analytical evaluation criteria for acceptance of through-wall flaws. The alternate analytical evaluation criteria were based on the draft Code Case N-513-4. The NRC granted verbal authorization of the proposed alternative on March 26, 2014. The safety evaluation associated with the authorization was provided via letter dated September 30,2014 (ADAMS Accession Number ML14240A603).

8. REFERENCE

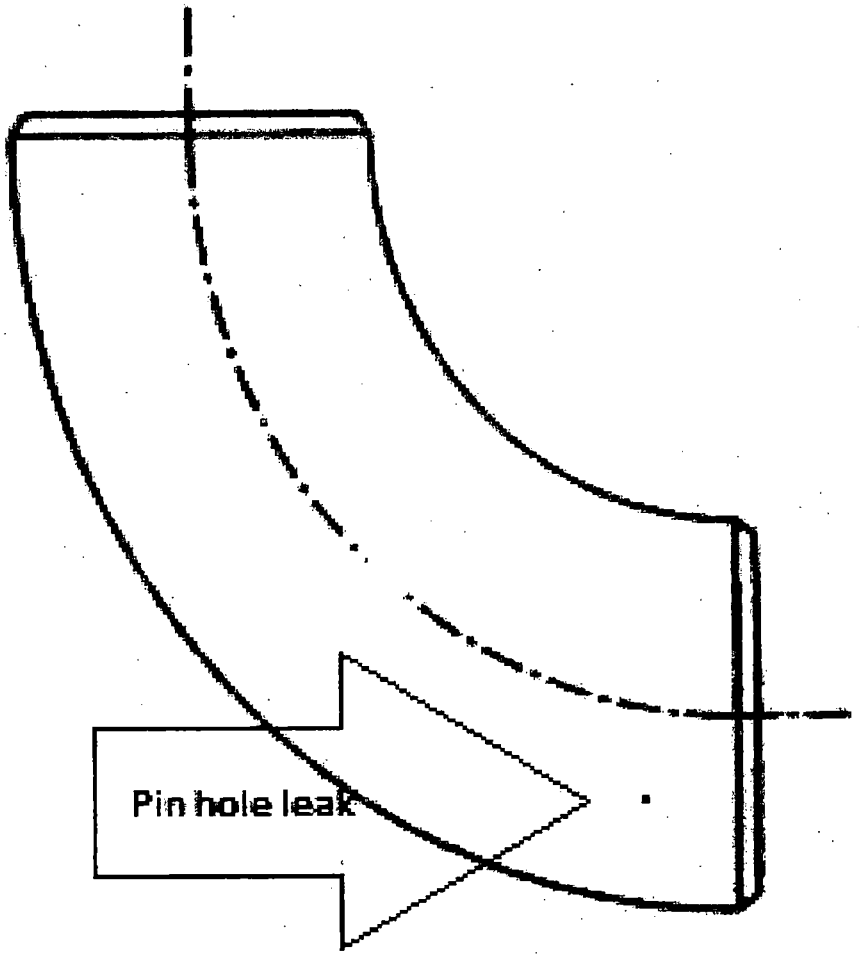
1. Letter from D. T. Gudger of Exelon to the NRC Document Control Desk, "Proposed Alternative to Utilize Code Case N-513-4, 'Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1'," dated January 28, 2016 (Accession No. ML16029A003)

2. Letter from J. A. Dent, Jr. of Entergy to the Document Control Desk, "Pilgrim Relief Request PRR-25, Proposed Alternative, Request for Relief for Temporary Acceptance of a Flaw in Salt Service Water (SSW) System Pipe Spool JF29-8-4," dated March 5, 2014 (Accession No. ML14073A059)

Enclosure E
L-17-278

Sketch of Location of Leak

(One Page Follows)


Pin hole leak