Exelon Generation

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Kennett Square, PA 19348
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10 CFR 50.55a

August 13, 2015

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

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: Response to Request for Additional Information Regarding Proposed Relief Request associated with the Common Emergency Service Water (ESW) System Piping for Peach Bottom Atomic Power Station, Units 2 and 3

References:
1) Letter from D. P. Helker (Exelon Generation Company, LLC) to the U.S. Nuclear Regulatory Commission, "Proposed Relief Request associated with the Common Emergency Service Water (ESW) System Piping," dated July 29, 2015.

2) E-mail correspondence from R. Ennis (U.S. Nuclear Regulatory Commission) to S. J. Hanson (Exelon Generation Company, LLC), "Peach Bottom Atomic Power Station – Request for Additional Information Regarding Proposed Relief Request I4R-56 Emergency Service Water Leak Repair Deferral (ML15223A515)," dated August 6, 2015.

By letter dated July 29, 2015, Exelon Generation Company, LLC (Exelon) submitted a Relief Request to the U.S. Nuclear Regulatory Commission (NRC) for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. Specifically, Exelon requested that the NRC authorize relief from Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1" of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) and the condition placed on Code Case N-513-3 as listed in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17, dated August 2014.

In the Reference 2 e-mail correspondence, the U.S. NRC requested additional information. Attached is our response.

There are no regulatory commitments in this letter.

If you have any questions concerning this response, please contact Stephanie J. Hanson at 610-765-5143.

Respectfully,

D. P. Helker

David P. Helker
Manager, Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachment: Response to Request for Additional Information Regarding Proposed Relief Request Concerning I4R-56

cc: USNRC Region I, Regional Administrator
USNRC Senior Resident Inspector, PBAPS
USNRC Project Manager, PBAPS
R. R. Janati, Pennsylvania Bureau of Radiation Protection
S. T. Gray, State of Maryland

# ATTACHMENT 1

## Response to Request for Additional Information Regarding Proposed Relief Request Concerning I4R-56

By letter dated July 29, 2015, Exelon Generation Company, LLC (Exelon) submitted a relief request to the U.S. Nuclear Regulatory Commission (NRC) for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. Specifically, Exelon requested that the NRC authorize relief from Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1" of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code) and the condition placed on Code Case N-513-3 as listed in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17, dated August 2014. Relief Request I4R-56 proposes an alternative that allows repair of leaking moderate energy Class 3 emergency service water (ESW) piping during the Unit 2 refueling outage (scheduled to begin in October 2016) in lieu of the Unit 3 outage (scheduled to begin in September 2015).

The NRC staff has determined that additional information is needed to complete its review. The specific request for additional information (RAI) questions, which were discussed in a conference call between the NRC staff and Exelon on August 4, 2015, are restated below along with Exelon's response.

**Question 1:**

Section 5 of the relief request states that "Based on the corrosion rate, the through-wall flaw is expected to increase by 34 mils before the start of the Unit 2 outage, for a final hole diameter of 0.0404 inches." Provide the expected leakage rate, under operating conditions, for a hole diameter of 0.0404 inches.

**Response:**

The expected leakage with an assumed round hole of 0.0404 inch results in a flow rate of 0.373 gpm. This value is based on conservative application of Equation 3-21 from Crane Flow of Fluids through Valves, Fittings, and Pipe (Technical Paper No. 410) as follows:

$Q=236 * d_1^2 * C * SQRT(\Delta P/\rho)$, where:

$d_1$ = 0.0404 inch
C = conservatively assumed to be 1
$\Delta P$ = 58 psi
$\rho$ = 61.996 lb/ft$^3$ for water at 100°F

**Question 2:**

Section 3 of the relief request provides the applicable requirements that the licensee seeks relief from. Other than the requirements listed in Section 3 of the relief request, for which the licensee seeks relief from, will the licensee meet all other requirements in Code Case N-513-3?

**Response:**

Exelon intends to meet all other requirements of Code Case N-513-3 and the submitted relief request.

**Question 3:**

Section 5 of the relief requests states that "The assurance of quality and safety in the extended period of time between September 2015 and October 2016 is based on: …5) Code Case N-513-3 required daily leak check and UT flaw examination every 30 days...." Provide the UT examination reports for examinations that have been performed subsequent to the UT examination detailed on pages 13 and 14 in Enclosure 2 of the relief request.

**Response:**

Successive 30-day UT inspections have been performed at the leak location. The exams have shown that no detectable growth in the flaw has been identified. All UT exams are provided in Enclosure 1.

**Question 4:**

Section 5 of the relief request states that "Corrosion analysis was also performed on surrounding and similar piping. Of the five areas inspected as extent of condition as required by ASME Code Case N-513-3, none have an expected life below nine years based on a low reading of 0.134."

a) Discuss the areas that were inspected and why these areas were appropriate and adequate to determine the extent of condition.

b) Given the close proximity of the leak to the ceiling/floor penetration, discuss how the structural integrity of the piping section that passes through the penetration was determined.

c) Discuss whether a leak in the pipe section that passes through the penetration would be detectable during required daily leak checks.

**Response:**

a) See Enclosure 2 – Excerpt from corrosion evaluation including detailed basis for extent of condition selection.

b) The structural integrity of the piping that passes through the floor penetration above the discovered leak was not quantitatively assessed for structural integrity as part of the evaluation of the subject leak because it is not possible to obtain wall thickness data for that portion of the pipe. However, the piping above the floor was examined for wall thickness (see Enclosure 3) and it was found that the examined piping did not include any areas below minimum wall thickness. Even if the piping included in the floor penetration has a thin-walled or leaking section similar to the one discovered as the original flaw, then it would most likely have similar, acceptable structural integrity as the evaluated area.

c) The penetration adjacent to the current leak is sealed with a Link-Seal, as it is a secondary containment penetration. This seal prevents any leaks through the penetration, either from one side of the penetration to the other or from a leak in the piping wall to the penetration. Therefore, daily leak checks would not identify any leaks

from the piping within the penetration. However, due to the tight seal around the piping within the penetration, it is also unlikely that any significant volume of water would be able to escape any current through-wall flaws; therefore, no impact to system flow rates would be expected.

**Question 5:**

Section 6 of the relief request limits system leakage to 5 gallons per minute (gpm).

a) Discuss any administrative controls, including corrective actions, which would be implemented prior to the leak rate increasing to 5 gpm.

b) Provide a flooding analysis based on the maximum allowable leak rate of 5 gpm. The flooding analysis should include discussions of whether any safety related components, such as electrical equipment, will be affected by leaking water.

**Response:**

a) Currently, there is substantial margin above the 5 gpm ESW system leakage to assure operability in the normal configuration. The leak has been closely monitored daily by qualified Operations personnel with no increase in leakage noted. It is expected that Operations personnel would quickly detect any substantial increase in leakage which would indicate an increase in the degradation rate of the piping. Any substantial change in the piping condition or any sudden large failure (which is not expected) would result in a new Issue Report being entered into the Corrective Action Program (CAP) and would drive prompt review by Engineering and licensed Operations personnel. If the change would indicate conditions degrading beyond what is assumed in the existing open Operability Evaluation, the piping would either be declared inoperable or a revision to the Operability Evaluation would occur. If an Operability Evaluation could not justify continued system operability, it would be necessary to isolate the leak. However, because of the leak-through of the MO-2-33-2972 valve, it would require that a broader blocking boundary be established. This would result in the isolation of the Emergency Core Cooling System room coolers, which would require a Technical Specification required plant shutdown. However, due to the configuration of the ESW, isolation of the leak and subsequent plant shutdown would not prevent cooling flow to the Emergency Diesel Generators (EDGs). Additionally, as stated in Relief Request I4R-56, Section 6 (Duration of Proposed Alternative), if system leakage exceeds 5 gpm, the relief request will no longer be applied.

b) At a leak rate of 5 gpm, given the room's floor surface area of approximately 487.5 $ft^2$, it would take approximately 19 hours for the water level to reach a level at which safety related equipment may begin to be affected.

The Unit 2 Reactor Building Sump Room is equipped with two 100 gpm sump pumps. These pumps can be credited during normal, non-accident conditions. These pumps also have alarm indications which notify the control room of high sump levels. At that time, Peach Bottom response procedures would dispatch an operator to determine the cause of the high sump level. Therefore, adequate capacity exists to prevent excessive flooding in the sump room which would lead to damage of the safety related equipment.

If flooding did occur in the room and the sump pumps are unavailable, the equipment in the room necessary to mitigate the accident have mission times less than 19 hours, and therefore would not be adversely affected by the leak.

**Question 6:**

As discussed in Section 4.6 of NRC Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-102, "Relief Request Reviews," Revision 2 (ADAMS Accession No. ML091380595), the NRC staff may grant verbal authorizations of proposed alternatives when, due to unforeseen circumstances, licensees need NRC authorization before the staff is able to issue its written safety evaluation (SE). The relief request indicates that the leak was identified on May 3, 2015. However, the relief request was not submitted until July 29, 2015, with a requested review completion date of September 21, 2015. Due to the compressed schedule for this review, and other work currently in-house, the staff may have difficulty completing a written SE by the requested review completion date. As such, verbal authorization will be considered. Please explain the unforeseen circumstances associated with the delay in submitting the relief request from the time the leak was first identified.

**Response:**

Due to the location of the flaw within the ESW system, there were initial discussions as to whether or not the flaw was considered to be on common piping. The flow at the location of the flaw goes directly to the Unit 2 ECCS room coolers. Due to the flow path, the leak was originally considered a Unit 2 leak location. However, upon further review of plant piping and instrument drawings, and discussions between Site and Corporate Engineering, it was established that the leaking spool is classified as common to both units. Valve MO-2972 is the boundary between common piping and Unit 2 piping; therefore, given that the leak is upstream of the valve, it is classified as common.

In addition to the time required to correctly characterize the flaw location and condition, additional time was also dedicated to exhausting any possible means of repair to avoid the need for this relief request. This included attempts to quantify the leak rate through the degraded MO-2972 valve, as well as investigating repair methods via the use of a freeze seal, branch connection, and pipe sleeve, among others. The determination of feasibility for these repair options required input from various groups and in the end it was determined that none of the considered options were possible for repair of the leak. Concerns regarding the timeliness of this submittal have been entered into CAP to identify opportunities for improvement.

## Enclosure 1 – ESW Leak NDE UT Results, Response to Question 3

ExelonGeneration.

**RAW WATER CORROSION ULTRASONIC EXAMINATION REPORT FORM**

**WORK ORDER # C0257348-06**

**NDE SUPPORT GROUP**

| | | | | |
|---|---|---|---|---|
| STATION / UNIT | PBAPS UNIT 2 | EXAM AREA ( X - ONE ) | WELD [ ] | STRAIGHT [ X ] |
| EXAM LOCATION ID# | ISO-2-33-17 | | | |
| PIPE NOMINAL WALL | .375" | EXAM POSITION ( X - ONE ) | HORIZ [ X ] | VERT [ ] |
| PIPE MINIMUM WALL | .063" | | | |
| PIPE DIA. | 12" | | ROOM | Sump Room |

INSTRUMENT: Mfgr: Olympus Model: 38DL Plus Serial: 140875705

SPECIAL GRIDING: N/A

SEARCH UNIT: Mfgr: Panametrics S/N: 810220 Make: D799

Size: .434" Frequency: 5 Mhz

Couplant: Humex / 04165 Reference Block: 0002812581

CALIBRATION TIMES: Initial: 10:30 Final: 14:30 Other: N/A

THERMOMETER: 0002834215 Due 6/5/15 CAL TEMP 80° COMP TEMP 70°

DRAWING ( If Applicable )

**IS0-2-33-17 Leak Upstream of MO-2972**


MEASUREMENT / RESULTS

| Grid | BAND A | BAND B | BAND C |
|---|---|---|---|
| 1 | 0.268" | 0.353" | 0.270" |
| 2 | 0.327" | 0.307" | 0.264" |
| 3 | 0.249" | 0.276" | 0.206" |
| 4 | 0.247" | 0.136" | 0.180" |
| 5 | 0.275" | 0.105" | *0.034" |
| 6 | 0.168" | 0.254" | 0.289" |
| 7 | 0.256" | 0.248" | 0.300" |
| 8 | 0.288" | 0.151" | 0.255" |
| 9 | 0.303" | 0.268" | 0.124" |
| 10 | 0.280" | 0.248" | 0.300" |
| 11 | 0.294" | 0.245" | 0.297" |
| 12 | 0.305" | 0.245" | 0.273" |

*A thru wall leak was identified on IS0-2-33-17 upstream of MO-2972. Mapping was performed as per ASME Code Case N-513-3. Although the low in C5 is a thru wall leak, the lowest recordable reading of the leak was found to be .034" for continuous monitoring purposes.

See Attached Page For ISO Bar.

COMMENTS:

Grid location C5 was identified as below Engineering Min. Wall criteria. See attached iso bar.

Material: A-106 GR. B Carbon Steel.

Examination Perormed in Accordance with ER-AA-335-004 REV. 7

Reference Min Wall Acceptance Criteria per A1998930-E01

Surface Condition = Prepped, Paint Removed.

| Calibration | |
|---|---|
| Actual | Meas. |
| .500" | .500" |
| .300" | .300" |
| .200" | .200" |
| .100" | .100" |

James Martin / III 5/4/15 n/a n/a

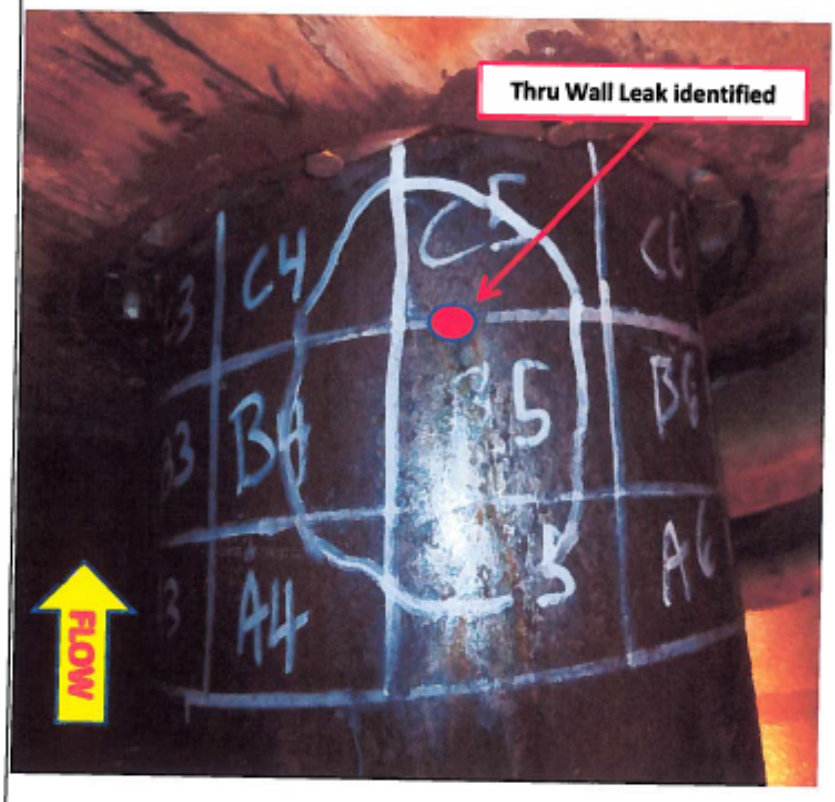
NAME / LEVEL DATE NAME / LEVEL DATE

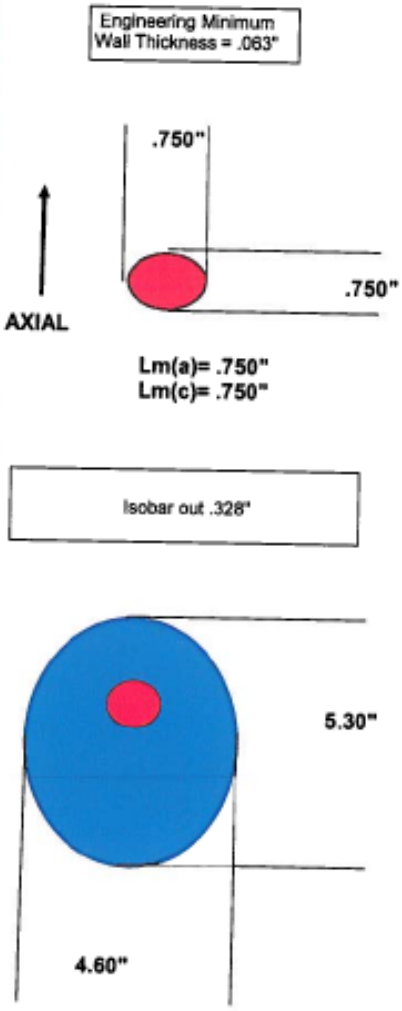
ExelonGeneration

**ULTRASONIC EXAMINATION PHOTO SHEET**

**NDE SUPPORT GROUP**

**IS0-2-33-17 Leak Upstream of MO-2972**




**COMMENTS: Area below Engineering Minimum Wall Thickness is .750" rounded, with the area below .328" approximately 4.6" x 5.30".**

| James Martin / III | 5/4/15 | n/a | n/a |
|---|---|---|---|
| NAME / LEVEL | DATE | NAME / LEVEL | DATE |

Exelon Generation.

**RAW WATER CORROSION ULTRASONIC EXAMINATION REPORT FORM**

**WORK ORDER # C0257348-07**

**NDE SUPPORT GROUP**

| | | | | | |
|---|---|---|---|---|---|
| STATION / UNIT | PBAPS UNIT 2 | EXAM AREA (X - ONE) | WELD [ ] | STRAIGHT [X] | |
| EXAM LOCATION ID# | ISO-2-33-17 | | | | |
| PIPE NOMINAL WALL | .375" | EXAM POSITION (X - ONE) | HORIZ [X] | VERT [ ] | |
| PIPE MINIMUM WALL | .063" | | | | |
| PIPE DIA. | 12" | | ROOM | Sump Room | |

**INSTRUMENT:** Mfgr: Olympus Model: 38DL Plus Serial: 140875705

**SPECIAL GRIDING:** N/A

**SEARCH UNIT:** Mfgr: Panametrics S/N: 810220 Make: D799

Size: .434" Frequency: 5 Mhz

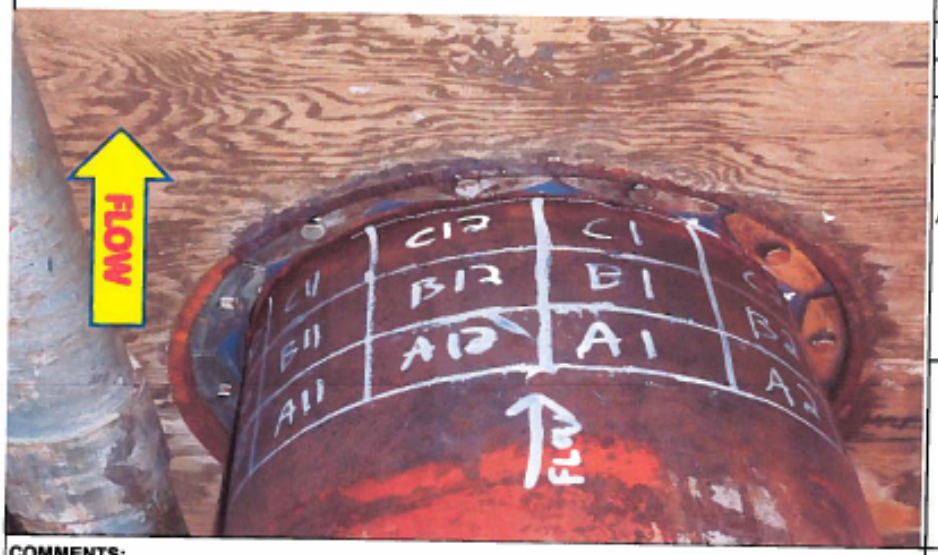
Couplant: Humex / 04165 Reference Block: 0002812581

**CALIBRATION TIMES:** Initial: 10:30 Final: 14:30 Other: N/A

**THERMOMETER:** 0001359088 Due 8/5/15 CAL TEMP 88° COMP TEMP 87°

**DRAWING** ( If Applicable )

**IS0-2-33-17 Leak Upstream of MO-2972**




| MEASUREMENT / RESULTS | | | |
|---|---|---|---|
| Grid | BAND A | BAND B | BAND C |
| 5 | | | *0.034 " |

*A thru wall leak was identified on IS0-2-33-17 upstream of MO-2972. Mapping was performed as per ASME Code Case N-513-3. Although the low in C5 is a thru wall leak, the lowest recordable reading of the leak was found to be .034" for continuous monitoring purposes.

**30 Day inspection was performed on Grid Location C5. No change in the flaw dimension was observed.**

**COMMENTS:**

Grid location C5 was identified as below Engineering Min. Wall criteria. See attached Iso bar.

Material: A-106 GR. B Carbon Steel.

Examination Performed in Accordance with ER-AA-335-004 REV. 7

Reference Min Wall Acceptance Criteria per A1998930-E01

Surface Condition = Prepped, Paint Removed.

| Calibration | |
|---|---|
| Actual | Meas. |
| .500" | .500" |
| .300" | .300" |
| .200" | .200" |
| .100" | .100" |

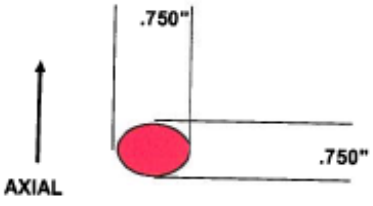
James Martin / III / 6/1/15 — NAME / LEVEL / DATE

n/a / n/a — NAME / LEVEL / DATE

| ExelonGeneration. | ULTRASONIC EXAMINATION PHOTO SHEET | NDE SUPPORT GROUP |
|---|---|---|

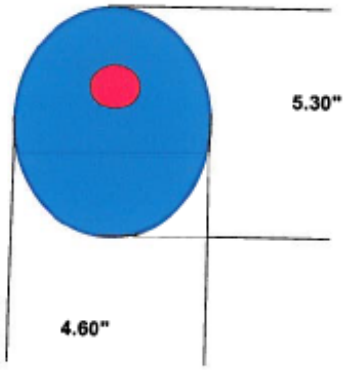
**IS0-2-33-17 Leak Upstream of MO-2972**


Engineering Minimum Wall Thickness = .063"




Lm(a)= .750"
Lm(c)= .750"

Isobar out .328"




**COMMENTS: Area below Engineering Minimum Wall Thickness is .750" rounded, with the area below .328" approximately 4.6" x 5.30".**

| James Martin / III | 6/1/15 | n/a | n/a |
|---|---|---|---|
| NAME / LEVEL | DATE | NAME / LEVEL | DATE |

Exelon Generation.

**RAW WATER CORROSION ULTRASONIC EXAMINATION REPORT FORM**

**WORK ORDER # C0257348-08**

**NDE SUPPORT GROUP**

| | | | | |
|---|---|---|---|---|
| STATION / UNIT | PBAPS UNIT 2 | EXAM AREA (X - ONE) | WELD [ ] | STRAIGHT [ X ] |
| EXAM LOCATION ID# | ISO-2-33-17 | | | |
| PIPE NOMINAL WALL | .375" | EXAM POSITION (X - ONE) | HORIZ [ X ] | VERT [ ] |
| PIPE MINIMUM WALL | .063" | | | |
| PIPE DIA. 12" | | | ROOM | Sump Room |

INSTRUMENT: Mfgr: Olympus Model: 38DL Plus Serial: 140875705

SPECIAL GRIDING: N/A

SEARCH UNIT: Mfgr: Panametrics S/N: 733781 Make: D799

Size: .434" Frequency: 5 Mhz

Couplant: Humex / 04165 Reference Block: 0002812581

CALIBRATION TIMES: Initial: 10:30 Final: 14:30 Other: N/A

THERMOMETER: 0003076376 Due 12/19/15 CAL TEMP 84.1° COMP TEMP 79.9°

DRAWING ( If Applicable )

**IS0-2-33-17 Leak Upstream of MO-2972**


| Grid | MEASUREMENT / RESULTS BAND A | BAND B | BAND C |
|---|---|---|---|
| 5 | | | *0.034 |

*A thru wall leak was identified on IS0-2-33-17 upstream of MO-2972. Mapping was performed as per ASME Code Case N-513-3. Although the low in C5 is a thru wall leak, the lowest recordable reading of the leak was found to be .034" for continuous monitoring purposes.

**30 Day inspection was performed on Grid Location C5. No change in the flaw dimension was observed.**

COMMENTS:

Grid location C5 was identified as below Engineering Min. Wall criteria. See attached Iso bar.

Material: A-106 GR. B Carbon Steel.

Examination Performed in Accordance with ER-AA-335-004 REV. 7

Reference Min Wall Acceptance Criteria per A1998930-E01

Surface Condition = Prepped, Paint Removed.

| Calibration | |
|---|---|
| Actual | Meas. |
| | |
| .500" | .500" |
| .300" | .300" |
| .200" | .200" |
| .100" | .100" |

William Carrasquillo Jr / II / 6/29/15 — NAME / LEVEL / DATE

n/a / n/a — NAME / LEVEL / DATE

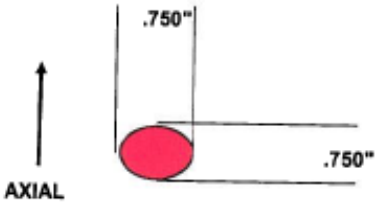
ExelonGeneration.

**ULTRASONIC EXAMINATION PHOTO SHEET**

**NDE SUPPORT GROUP**

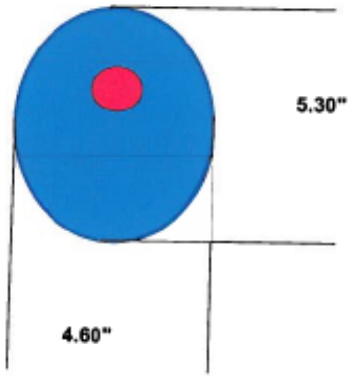
**IS0-2-33-17 Leak Upstream of MO-2972**


Engineering Minimum Wall Thickness = .063"




Lm(a)= .750"
Lm(c)= .750"

Isobar out .328"




**COMMENTS: Area below Engineering Minimum Wall Thickness is .750" rounded, with the area below .328" approximately 4.6" x 5.30".**

| William Carrasquillo Jr / II | 6/29/15 | n/a | n/a |
|---|---|---|---|
| NAME / LEVEL | DATE | NAME / LEVEL | DATE |

Exelon Generation.

**RAW WATER CORROSION ULTRASONIC EXAMINATION REPORT FORM**

**WORK ORDER # C0257348-09**

**NDE SUPPORT GROUP**

| | | | | |
|---|---|---|---|---|
| STATION / UNIT | PBAPS UNIT 2 | EXAM AREA (X - ONE) | WELD [ ] | STRAIGHT [ X ] |
| EXAM LOCATION ID# | ISO-2-33-17 | | | |
| PIPE NOMINAL WALL | .375" | EXAM POSITION (X - ONE) | HORIZ [ X ] | VERT [ ] |
| PIPE MINIMUM WALL | .063" | | | |
| PIPE DIA. | 12" | ROOM | Sump Room | |

INSTRUMENT: Mfgr: Olympus Model: 38DL Plus Serial: 140875705

SPECIAL GRIDING: N/A

SEARCH UNIT: Mfgr: Panametrics S/N: 733781 Make: D799

Size: .434" Frequency: 5 Mhz

Couplant: Ultra Gel II / 12125 Reference Block: 0002812581

CALIBRATION TIMES: Initial: 13:30 Final: 15:00 Other: N/A

THERMOMETER: 0002608889 Due 06/03/16 CAL TEMP 87° COMP TEMP 82.5°

DRAWING ( If Applicable )

**IS0-2-33-17 Leak Upstream of MO-2972**


| MEASUREMENT / RESULTS | | | |
|---|---|---|---|
| Grid | BAND A | BAND B | BAND C |
| | | | |
| | | | |
| | | | |
| | | | |
| 5 | | | *0.034 |
| | | | |
| | | | |
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| | | | |

*A thru wall leak was identified on IS0-2-33-17 upstream of MO-2972. Mapping was performed as per ASME Code Case N-513-3. Although the low in C5 is a thru wall leak, the lowest recordable reading of the leak was found to be .034" for continuous monitoring purposes.

**30 Day inspection was performed on Grid Location C5. No change in the flaw dimension was observed.**

COMMENTS:

Grid location C5 was identified as below Engineering Min. Wall criteria. See attached Iso bar.

Material: A-106 GR. B Carbon Steel.

Examination Performed in Accordance with ER-AA-335-004 REV. 7

Reference Min Wall Acceptance Criteria per A1998930-E01

Surface Condition = Prepped, Paint Removed.

| Calibration | |
|---|---|
| Actual | Meas. |
| | |
| .500" | .500" |
| .300" | .300" |
| .200" | .200" |
| .100" | .100" |

Julio C Venegas / II 7/27/15 n/a n/a

NAME / LEVEL DATE NAME / LEVEL DATE

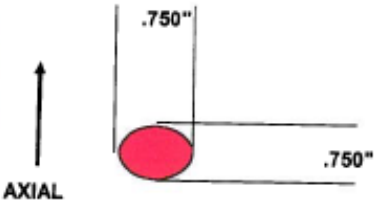
Exelon Generation.

**ULTRASONIC EXAMINATION PHOTO SHEET**

**NDE SUPPORT GROUP**

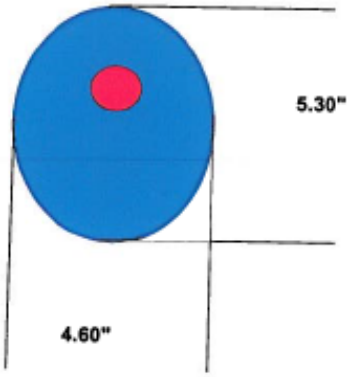
**IS0-2-33-17 Leak Upstream of MO-2972**


Engineering Minimum Wall Thickness = .063"




Lm(a)= .750"
Lm(c)= .750"

Isobar out .328"




**COMMENTS: Area below Engineering Minimum Wall Thickness is .750" rounded, with the area below .328" approximately 4.6" x 5.30".**

| Julio C Venegas / II | 7/27/15 | n/a | n/a |
|---|---|---|---|
| NAME / LEVEL | DATE | NAME / LEVEL | DATE |

## Enclosure 2 – Response to Question 4.a

ASME Code Case N-513-3 requires additional examination of five (5) susceptible locations. Guidance provided in Exelon Engineering procedures, along with the Raw Water Corrosion Program Guide were used to select the most susceptible and accessible locations consistent with the requirements of the Code Case. The selected locations were identified through drawing reviews, evaluation of previous exam results, consideration of flow mechanics in the reactor buildings' ESW system piping, and comparison with Raw Water Database Risk Rankings in PBAPS Safety-Related Piping database per Exelon Engineering requirements. In addition, consideration was given to the following corrosion risk factors from the leak location when selecting inspection locations:

1. ESW corrosion was investigated in the past and confirmed as driven by corrosion under deposits (CUD) influenced by microbiological activity (MIC). This is systemic for ESW. Isolated pitting initiated by either of the above will be driven by relative concentration changes in oxygen and chlorides resulting from batch chlorination. This is also systemic throughout ESW.

2. The leak occurred on piping that had not been replaced since the plant was initially constructed. Extent of condition should exclude previously replaced / repaired piping.

3. The leak was located several pipe diameters beyond an upstream elbow and theoretically beyond a flow-influenced region. Extent of condition should exclude obviously flow-influenced areas unless considered for bounding purposes.

4. The leak was located in a vertical section of pipe away from any welds. Extent of condition locations need not include weld areas or fittings.

5. Higher ambient temperatures in the reactor buildings allow the intermittently flowing water to heat up and accelerate corrosion rates by a factor of at least 2-3 times relative to cooler areas of the plant such as the Administration Building Pipe Tunnel or Pump Structure due to increased thermal energy available to support corrosion reaction kinetics. Extent of condition locations should consider higher ambient temperature locations.

6. Smaller-diameter piping is at increased risk due to lower surface area to volume ratios that accelerate MIC and intensify flow effects. Smaller-diameter piping is also of lower wall thickness, leaving lower margin in advance of leakage for a given corrosion rate. Extent of condition should exclude smaller-diameter piping.

7. The absence of chemical treatment (corrosion inhibitors) will also influence many of the above effects and needs be considered in location selection. Extent of condition should exclude chemically-treated piping.

8. Both 'B' and 'A' ESW piping contain in-plant piping and due to intermittent flow conditions, in-plant piping for either loop would be susceptible to the above effects to a similar extent. 'A' ESW contains a much longer length of buried (low ambient temperature) piping. 'B' ESW contains Off-gas Tunnel piping (high ambient temperature). However, Reactor Building Sump and RBCCW Room conditions are comparable / controlled. Within a matter of hours, ambient conditions would be the same for either loops in these rooms. Extent of condition need not be limited to 'B' ESW piping near RBCCW rooms.

9. ESW Return piping sees a continuous flow of service water from the ring headers and is not fully representative of this intermittent condition, though it will operate at elevated temperatures. Extent of condition for ESW Return piping could be used to bound the condition to intermittent flowing piping rather than all high temperature raw water.

10. HPSW piping sees similar conditions in the RBCCW room and has been recently inspected to show corrosion rates significantly lower than those in ESW. Extent of condition should exclude HPSW piping due to documented lower susceptibility.

Based upon the above corrosion mechanisms, the most susceptible corrosion areas for the ESW system are in the reactor buildings, particularly where ESW is branching off in smaller diameters but is not yet in the ring headers. All Units / Loops, including supply and return, are at comparable risk, so all are in-scope for extent of condition. Previous evaluations and corrective action investigations document these phenomena.

Augmented Inspection locations are recommended as follows with bases as noted:

1. Location 1 – NDE on 6" of straight pipe ~3 feet upstream of the stopple flange located on the mezzanine above the Unit 2 Condensate Backwash Tank Room. This location is ~15 feet upstream of the leak location with greater susceptibility due to being a horizontal straight pipe (greater corrosion under deposit risk). It also evaluates potential repair scope towards the Unit 2 Offgas Pipe Tunnel.

2. Location 2 – NDE on the upstream weld of the elbow just upstream of the leak per IR 02494904 located in the Unit 2 Reactor Building Sump Room. This location is ~4 feet upstream of the leak location with greater susceptibility due to being a horizontal weld between a fitting and straight pipe (dissimilar weld with greater corrosion under deposit risk). It also evaluates potential repair scope.

3. Location 3 – NDE on 6" of straight pipe between MO-2-33-2972 and the Unit 2 RBCCW Room Floor. This location is ~2 feet downstream of the leak location on the opposite side of the floor penetration. This is directly similar to the leak and evaluates potential repair scope.

4. Location 4 – NDE on 6" of straight pipe immediately downstream of the west wall penetration / flange and upstream of HV-2-33-517 in the Unit 2 RBCCW Room. This location represents a horizontal pipe section from 'A' ESW piping to evaluate the extent of condition on the other ESW loop.

5. Location 5 – NDE on 6" of straight pipe located between a bottom drain fitting and the leading edge of the mezzanine above the Unit 3 Condensate Backwash Tank Room. This location is similar to Location 1 (greater corrosion under deposit risk). It also evaluates potential repair scope towards the Unit 2 Offgas Pipe Tunnel for 'B' ESW piping servicing the Unit 3 RBCCW Room with lower dose and accessibility challenges than for making a direct, parallel exam from the Unit 3 Reactor Building Sump Room.

The augmented examination locations represent five (5) of the most susceptible and accessible system locations for the corrosion phenomena displayed at leak location. While other locations are also similar and/or susceptible, these locations validate Engineering's characterization of corrosion risk factors as limiting the at-risk piping population to larger-bore piping with relevant flow characteristics in the reactor buildings' ESW piping systems.

## Enclosure 3 – EOC Examination to Question Response 4.b

Exelon Generation.

**RAW WATER CORROSION**
**ULTRASONIC EXAMINATION REPORT FORM**
**WORK ORDER # C0257418-01**

**NDE SUPPORT GROUP**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STATION / UNIT | PBAPS UNIT 2 | EXAM AREA | WELD | STRAIGHT | | MEASUREMENT / RESULTS | |
| EXAM LOCATION ID# | ISO-2-33-17 V01 D/S | ( X - ONE ) | [ ] | [ X ] | | U/S | Center | D/S |
| PIPE NOMINAL WALL | .375" | EXAM POSITION | HORIZ | VERT | Grid | BAND A | BAND B | BAND C |
| PIPE MINIMUM WALL | .063" | ( X - ONE ) | [ ] | [ x ] | 1 | 0.285 " | 0.305 " | 0.265 " |
| PIPE DIA. 12" | ELEV. 116' | AREA 33 | ROOM RBCCW | | 2 | 0.267 " | 0.259 " | 0.251 " |
| INSTRUMENT: Mfgr: Panametrics | Model: 37DL Plus | Serial: 041169405 | | | 3 | 0.285 " | 0.224 " | 0.274 " |
| SPECIAL GRIDING: N/A Panametrics | Model: 38DL Plus | Serial:140875705 | | | 4 | 0.271 " | 0.309 " | 0.340 " |
| SEARCH UNIT: Mfgr: Panametrics | S/N: 783711/733783 | Make: D791-RM / D799 | | | 5 | 0.254 " | 0.301 " | 0.288 " |
| Size: .434" | Frequency: 5 Mhz | | | | 6 | 0.218 " | 0.254 " | 0.303 " |
| Couplant: Humex / 04165 | Reference Block: 0002812581 | | | | 7 | 0.302 " | 0.323 " | 0.296 " |
| CALIBRATION TIMES: Initial: 1130 AM | Final: 1230 PM | Other: N/A | | | 8 | 0.222 " | 0.258 " | 0.181 " |
| THERMOMETER: 0001359088 Due 8/5/15 | CAL TEMP 81°F | COMP TEMP 81°F | | | 9 | 0.266 " | 0.276 " | 0.297 " |
| | | | | | 10 | 0.313 " | 0.304 " | 0.288 " |
| | | | | | 11 | 0.209 " | 0.311 " | 0.282 " |
| | | | | | 12 | 0.269 " | 0.299 " | 0.305 " |

DRAWING ( If Applicable )

**ISO-2-33-17 V01 U/S**


No Readings found below Min Wall.

Grid Band ends 10" D/S of Top of Pipe Collar.

**COMMENTS:**

Lowest reading found was 0.181" in Grid Box C8.

Grid Boxes were dynamically scanned with the lowest reading recorded at each location.

No readings were identified as below Engineering Min. Wall criteria.

Reference Procedures ER-AA-335-004 REV. 7 / Reference Drawing ISO-2-33-17 V01 U/S

Reference Acceptance Criteria per A1999898-E01

Surface Condition = Prepped, Paint Removed. Material: Carbon Steel.

| Calibration | |
|---|---|
| Actual | Meas. |
| .500" | .500" |
| .400" | .400" |
| .300" | .300" |
| .200" | .200" |
| .100" | .100" |

William Carrasquillo Jr / LII / 5/27/15 — NAME / LEVEL / DATE

James Martin / LIII / 5/27/2015 — NAME / LEVEL / DATE