Turkey Point Unit 3
ICW Pipe Leak Repair Plan
Potential Relief Request

NRC NRR Turkey Point PM and Tech Staff Briefing

August 25, 2021

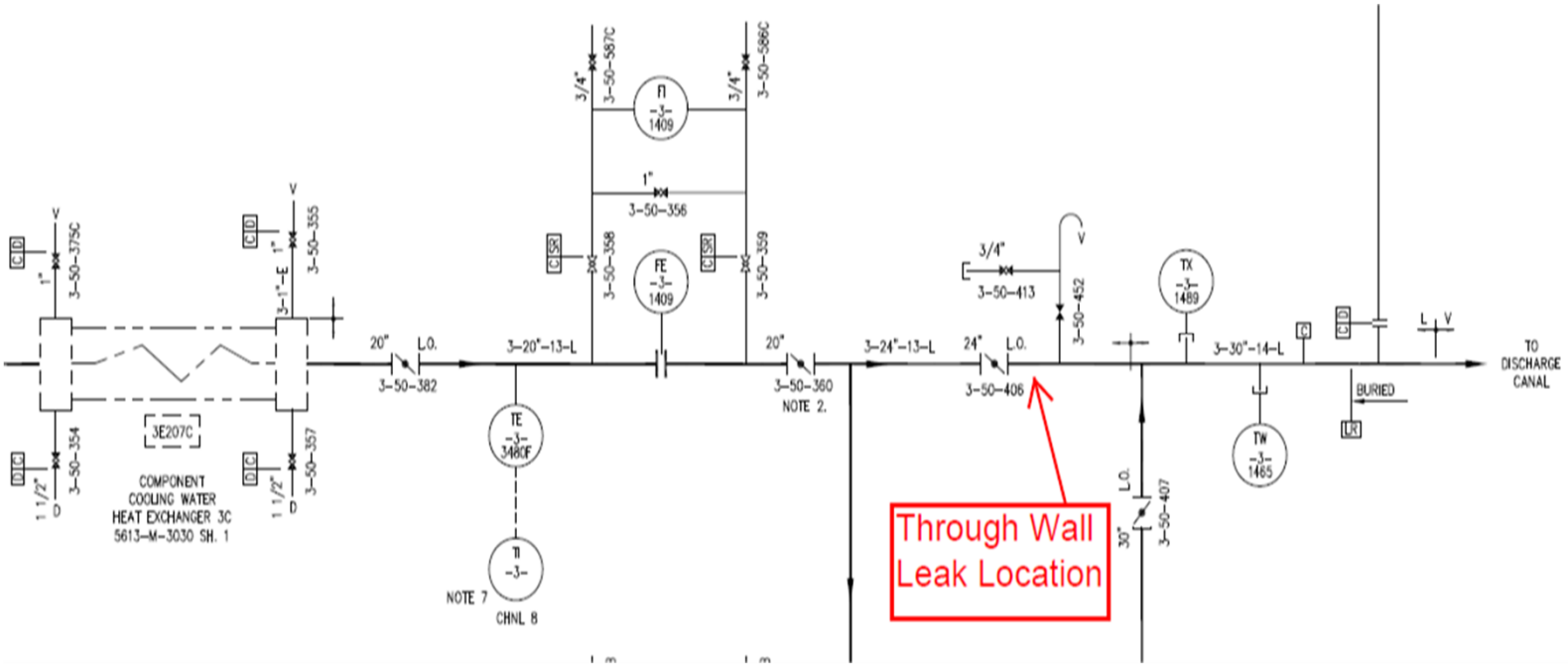
Leak Discovery

- On 3/5/2020, during surface preparation for metalizing / coatings applications, a through-wall leak was discovered on a 24” diameter Intake Cooling Water (ICW) safety related piping.

- The non-planar wall loss was identified under the pipe coatings, downstream of valve 3-50-406, the ICW manual isolation valve from the CCW heat exchangers.

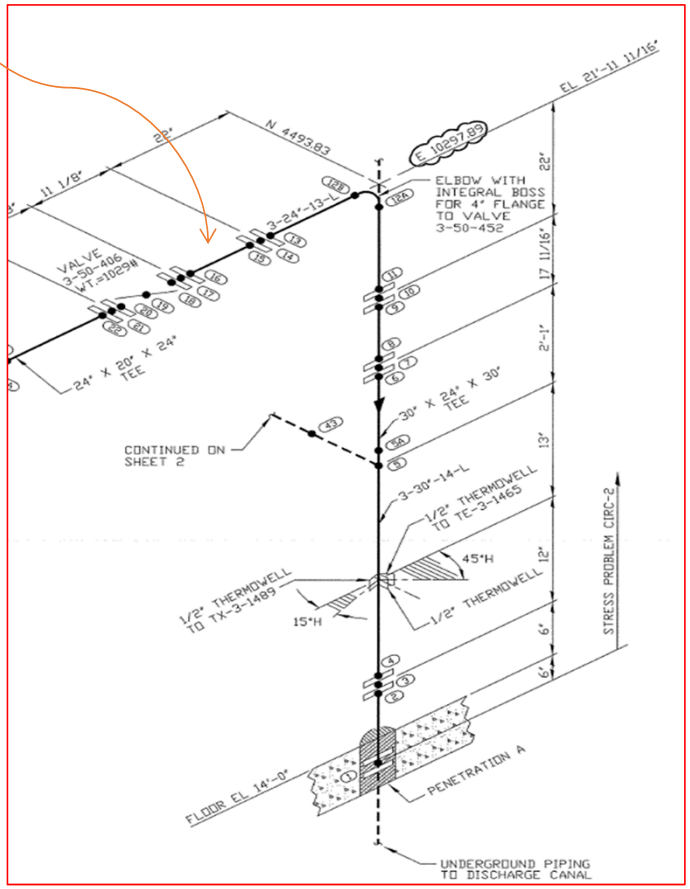
- The flaw is approximately 12 feet from the underground piping directed to the discharge canal and is located in the Unit 3 CCW heat exchanger room.

ICW Leak Location



ICW Leak Location

See 11-1/8 inch-Long spool piece Directly Downstream of Valve 3-50-406 (5613-P-820-S, Sheet 1 of 2)



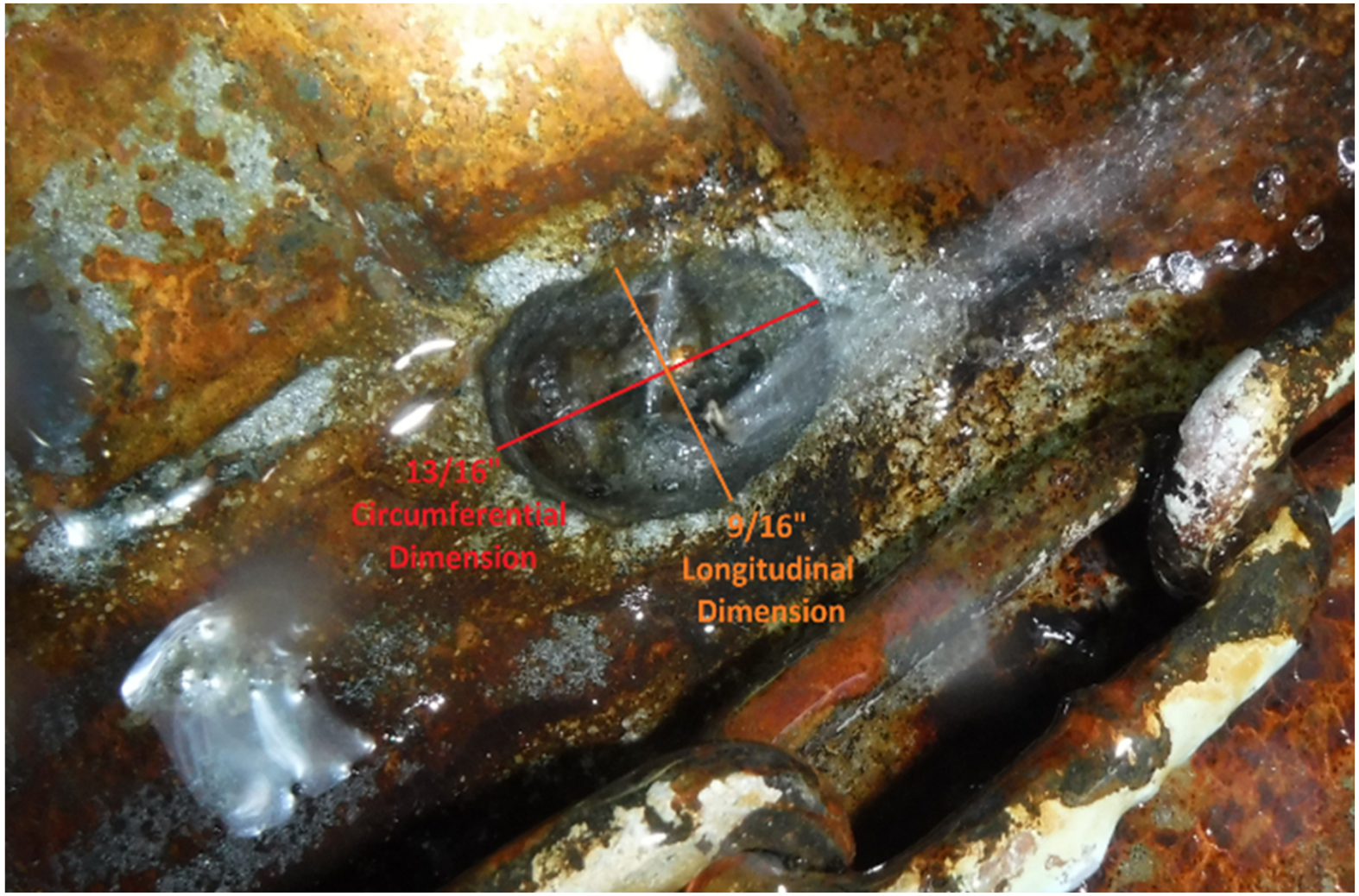
ICW Leak Location

- This section of piping directs the water exiting the CCW heat exchanges back to the discharge structure and the ultimate heat sink. It does not include any valves or any other components that could possibly fail and prevent delivery of the ICW fluid back to the discharge location.

- The safety significance of this section of pipe is low as the safety significant heat removal function is complete as the ICW fluid exits the CCW heat exchangers.

Pipe characteristics

- The ICW safety related piping affected is classified as Quality Group C and treated as ASME Section XI Class 3 piping
- The ICW piping section of concern is 24” nominal diameter, with a specified nominal wall thickness of 0.73”.
- The pipe is Cast Iron ASA 21.6, Class 150, Cement Lined ASA 21.4 with .25” thickness.
- Maximum operating parameters are T = 120 degF and P = 25 psig.


13/16"
Circumferential
Dimension
9/16"
Longitudinal
Dimension

Flaw size

- The flaw is shaped like a crater with two small, through-wall weep holes inside. The size of the flaw OD is 9/16” longitudinal and 13/16” circumferential
- Measured leakage is ~ 5 GPH with the subject ICW line pressurized. Leak fluctuates between 0 and 10 GPH (depending on system cleanliness and lineup).
- Both leakage rate and the flaw size are monitored in accordance with ASME XI code case N-513 and have not grown since initial identification in March 2020

Flaw Evaluation

- Condition Report AR 2347348 was initiated following this identified condition; The latest POD, Rev. 3, issued on 4/16/21 with the conclusions being “Operable but Degraded” with no compensatory measures required.
- Our initial assessment concluded that the reason for the thru-wall was due to a combination manufacturer’s casting defect and ID wall loss .
- The subject ICW pipe piece is confirmed as being an original installation, being in operation from initial plant startup.
- Historical site OE was not able to find a same or similar condition regarding this physical anomaly.

Field NDE Measurements

- Following the initial field walkdown, ultrasonic (UT) measurements were taken ½” away from the circumference of the flaw which corresponds to approximately one diameter length from the flaw center point.
- Subsequently, full circumferential UT readings were obtained at the flaw location and at the 5 additional locations selected for the Augmented Examination.
- No adverse values revealed in the surrounding locations selected.

Leak Monitoring

- UTs are performed within a 90-day interval per an assessment documented in AR 2347348-14. The assessment utilized Code Cases N-513-3 and N-513-4
- All augmented locations had UT readings above nominal wall thickness. Pipe circumferential readings at flaw location were all at or above nominal wall thickness.
- UT readings 1/2” from flaw averaged greater than the code case 513 minimum allowable and are monitored every 90-days for further loss.
- Our recent readings concluded an inconsequential reduction of cast iron wall thickness.

Leak Management

- The leakage is captured and routed to a nearby floor drain
- There is no nearby safety related equipment that could be impacted with the leakage condition or should leakage capture be challenged.
- No FME effects are probable as a result of this leak condition.
- Should any lining material disassociate from the pipe, negligible flow restriction is expected since the piping downstream is 30 inches in diameter.

Code Compliance and Repair Options

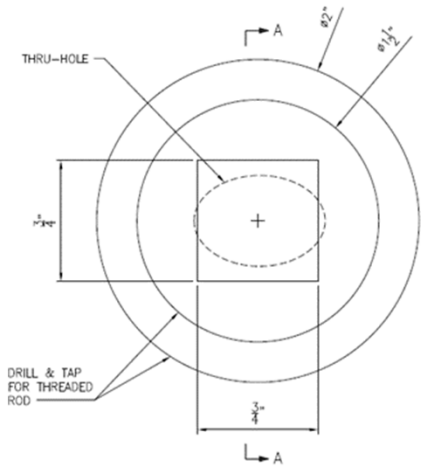
Compliance with Code Case N-513 allows for one operating cycle to implement a viable repair. A total of seven options were considered. The three most viable options are presented below:

1. Remove thru-wall flaw by drill & tap pipe for installation of a standard male threaded solid plug.
2. Remove the degraded flanged spool and install a new spool, i.e., direct replacement.
3. Install a high strength, corrosion resistant bolted clamp assembly design atop the affected pipe spool, which will be the new code boundary (i.e., PM-Cap Design)

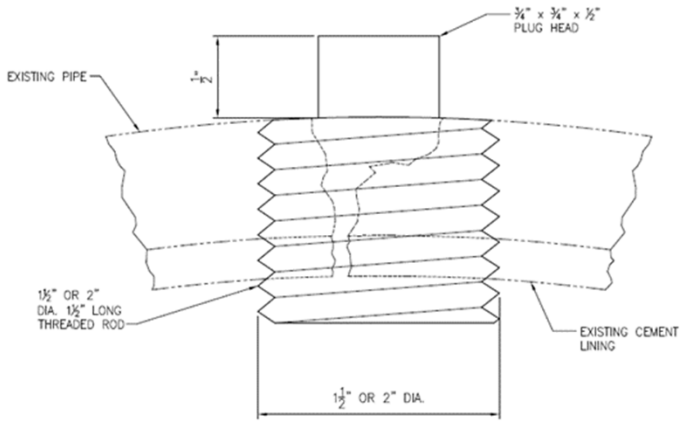
Option 1: Drill and Tap

- Option 1 involves the removal of the thru-wall flaw by drill & tap of the cast iron pipe followed by the installation of a standard male threaded solid plug.
- Operational and Repair Risks:
    1. Leakage will need to be minimized as-much-as possible to perform this repair option. As such, a U3 CCW Hx will need to be placed OOS with a limited time to perform the thru-hole drilling, tapping & installing fitting.
    2. Field implementors indicated that there is a potential to crack the ICW spool piece when drilling into cast iron material.
    3. Additionally, a minor leak could develop, or total loss of the plug/fitting could occur due to thread degradation.

Option 1-Removal of the thru-wall flaw by drill & tap of the cast iron pipe followed by the installation of a standard male threaded solid plug



PLAN VIEW



SECTION A

Option 2: Full Flange Spool Replacement

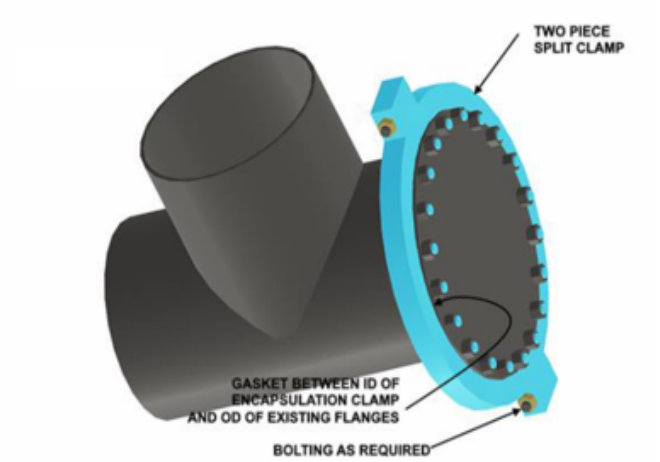
- Option 2 places the piping back to its original design by the direct replacement of the degraded bolted flange spool.
- Operational and Repair Risks:

1. The leak location is un-isolable and would require the entire U3 ICW system to be placed out of service (OOS) for repairs. The CCW system would also be OOS.
2. This option would need to be done during the defueled window when the only heat load remaining is the CCW heat load from the SFP HXs.
3. Option 2 has significant risk due to the establishment of temporary heat exchanger and temporary flow-paths of the ICW and CCW systems prior to the replacement of the spool piece. Access points on existing piping for the temporary tie-ins require additional back up plans and the involvement of various departments to ensure station readiness for implementing these changes during a refueling outage.

Option 3: Bolted Encapsulation Clamp Assembly

- Option 3 would install a high strength, corrosion resistant bolted clamp assembly design atop the affected pipe spool that will become the new code boundary (i.e., PM-Cap Design).
  - This option is considered unique in design and is only a conceptual model at this time. The proposed design, which is expected within the next 4 weeks, is being developed by the same vendor used in the recent Turkey Point CCW piping PM-Cap modification.
  - The repair is considered a Permanent Repair that will satisfy applicable ASME B31.1 design and construction criteria in accordance with the original design requirements for the Turkey Point ICW System.

ICW Pipe Leak Repair



Option 3 Conceptual Design Details

- Outer edge surface (approximately 1 7/8” wide) of each 32” OD Pipe Spool flange will be gasketed (360o circumferential direction). Clamp will be approximately 12” wide (spanning between the 2 end flanges) and will have the longitudinal direction mating surfaces gasketed.
  - Gasket material – Elastomeric or other – TBD
- Existing Pipe Spool flange bolting will be replaced using Single Thru Bolts that bridges between Pipe Spool flanges, and or replaced using Short (approximate same length as existing) replacement Bolts having clip angles that are bolted to Elbow side flange and Valve side flange. The clip angles will be welded to the Clamp Assembly.
- Material of Bolting and Clamp Assembly will be Inconel 625, AL6XN or other FPL approved salt water resistant material.

Option 3 Conceptual Design Details

- Clamp Assembly gaskets will provide for primary pressure integrity and leak tightness of the repair. An additional, secondary backup pressure integrity and leak tightness will be provided by filling the Internal interstitial encapsulated area of Pipe Spool with an approved sealant to assure all gaskets areas are backed up. The sealant will provide saltwater corrosion protection of the encapsulated surfaces of the Cast Iron Pipe Spool flange surfaces.

- Wall thickness readings will be taken of the pipe spool piece flanges that will be evaluated for continued use. The 24” pipe portion of the spool piece between the flanges, that is to be encapsulated, will be considered as having completely wasted away and thus would provide no pressure retention or structural integrity contribution to the piping system.

Relief Request Need

Repair Option	Type of Repair	Repair Schedule?	NRC Relief Request Needed?	Submit RR by?	NRC RR approved by
Threaded fitting installed at tapped affected hole. **"Remove thru-wall flaw by drill & tap pipe for installation of a standard male threaded fitting/plug; Belzona can be applied at time of fitting installation.**	ASME Section XI Code Repair.	Online, or during the Upcoming Unit 3 CY-32 outage	No	N/A	N/A
Replace ICW Flanged Spool. **Remove degraded flanged spool, and install a new spool**	ASME Section XI Code Repair.	During the Unit 3 CY-33 RFO.	Yes, the replacement in PT3-33 will exceed the Code Case N- 513 allowed time (by one cycle).	9/30/2021	Prior to the end of Unit 3 CY-32 RFO. (11/5/2021)
Install Vendor designed and fabricated bolted Clamp assembly over existing Pipe Spool/Threaded Flange. Conceptual model in development.	Non-Code Repair	Online or during the Upcoming Unit 3 CY-32 outage	Yes: 1) Non-code permanent repair 2) Completion of repairs might exceed Code Case N-513 allowed time	9/30/2021	Prior to the end of Unit 3 CY-32 RFO. (11/5/2021)

Q&A

- Ask for questions/comments