

NRC Pre-Submittal Call

Relief Request:
Reactor Vessel Head Nozzle #74 Repair
Catawba Nuclear Station Unit 2
April 22, 2021



Agenda

- ▶ Introductions and Opening Remarks
- ▶ Objectives and Scope
- ▶ Current Inspection Requirements
- ▶ Inspection History of the Catawba Unit 2 RVCH
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- ▶ Supplemental NDE Results
- ▶ Proposed Alternative Repair
- ▶ Embedded Flaw Repair History
- ▶ Nozzle #74 Embedded Flaw Repair
- ▶ Plan for Relief Request
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Objectives and Scope

- ▶ Objectives:

- ▶ Present Duke's need for relief due to repair of a relevant indication on nozzle #74 of the Reactor Vessel Closure Head (RVCH) without defect removal per ASME Section XI requirements

- ▶ Scope:

- ▶ Proposed alternative is to repair the j-groove weld of nozzle #74 using an embedded flaw repair process as an alternative to the defect removal and weld repair provisions of ASME Section XI

Current Inspection Requirements

- ▶ The Catawba Unit 2 head operates at reactor cold leg temperature (T_{cold})
- ▶ RVCH was volumetrically examined during the current refueling outage in accordance with 10 CFR 50.55a(g)(6)(ii)(D) and ASME Code Case N-729-6, Item B4.20, which requires volumetric or surface examinations of all penetrations prior to RIY = 2.25 or 8 years, whichever is sooner
- ▶ Per Note (6) of Table 1 of ASME Code Case N-729-6, the volumetric or surface examination of each penetration must include a volumetric and/or surface leak path assessment examination

Inspection History

Catawba Unit 2 RVCH

- ▶ Reactor Vessel Closure Head (RVCH) is original and fabricated by CE with Alloy 600 nozzle material supplied by Huntington attached to the inside of the head with Alloy 82/182 J-groove welds
- ▶ Previous volumetric examinations and leak path assessments of all penetrations performed using UT in 2007 and 2013 with no detected PWSCC indications
- ▶ Other than nozzle #74, volumetric examinations and leak path assessments completed on all penetrations during the current outage with no PWSCC detected.
- ▶ UT leak path assessment on nozzle #74 revealed a change in back-wall reflectivity from prior assessments in 2007 and 2013
- ▶ Bare metal visual examinations performed of the head during the current refueling outage with no detection of head penetration leakage

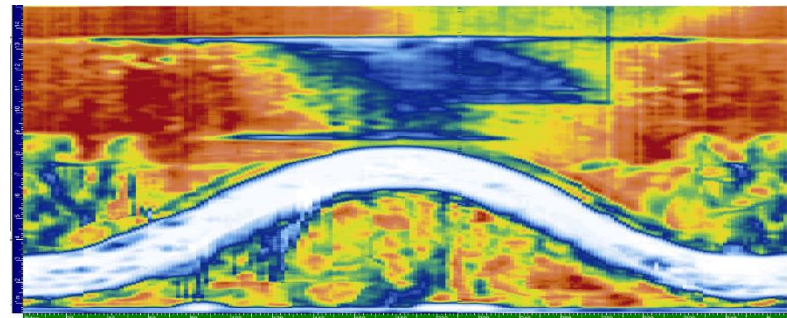
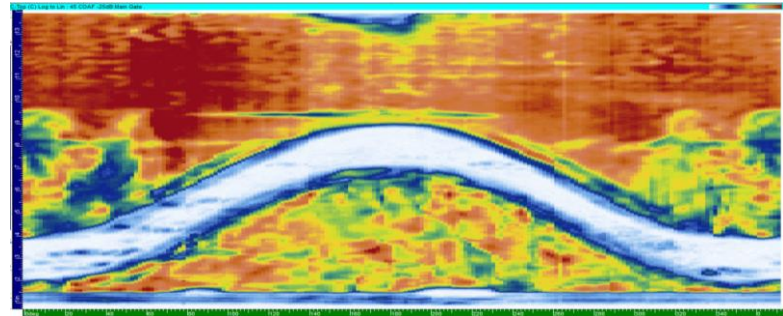
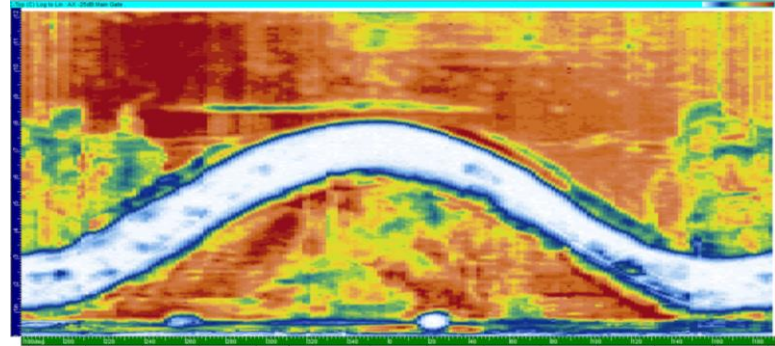
Inspection History

Catawba Unit 2 RVCH

- ▶ Eddy current test (ECT) surface examination confirmed a relevant indication in the j-groove weld on the low hill side of nozzle #74
 - ▶ ECT Indication notification report (INR) described as “a relevant single circumferential linear indication”
- ▶ Liquid penetrant test (PT) surface examination was performed and identified a surface-connected indication at the same location as the relevant indication detected with ECT
 - ▶ PT INR described as a “rounded liquid penetrant indication 1/16 inch in diameter”
- ▶ As a result of the change in UTLP from prior examinations and the relevant surface indication detected with both ECT and PT, repair will be required during the current refueling outage

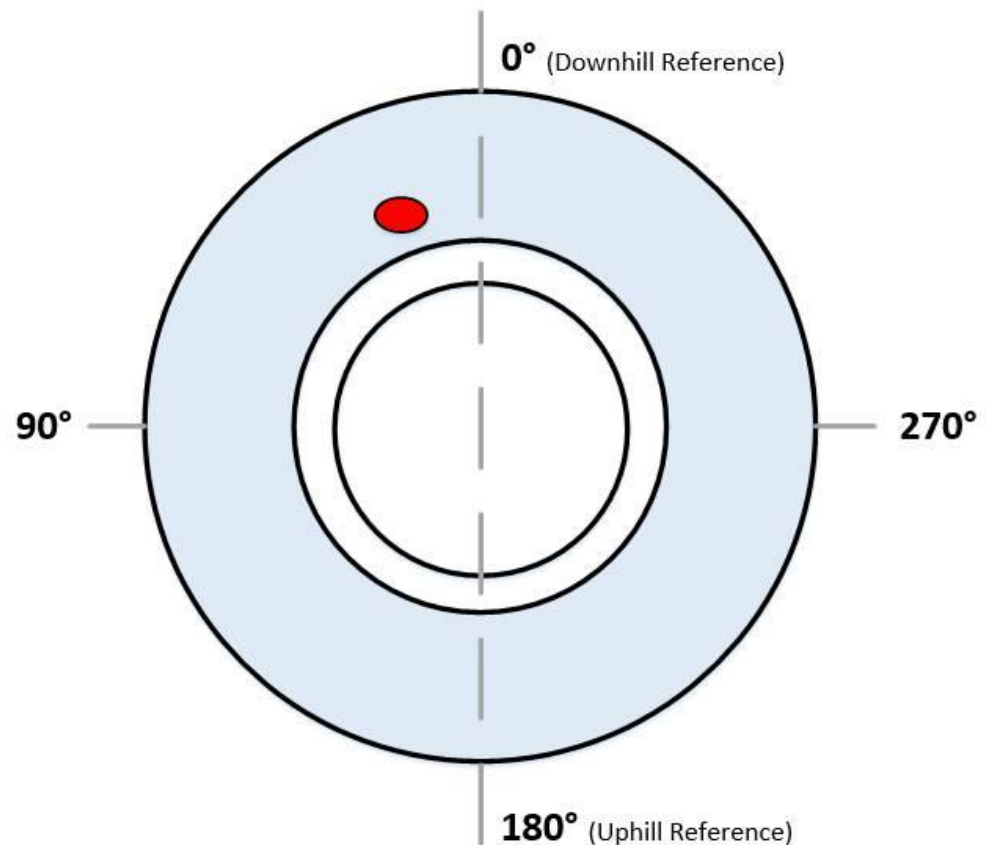
UTLP Response

- ▶ UTLT of nozzle#74 performed in 2007 (top), 2013 (middle), and 2021 (bottom)
- ▶ 2021 data indicates clear change in backwall reflectivity typically associated with UTLT



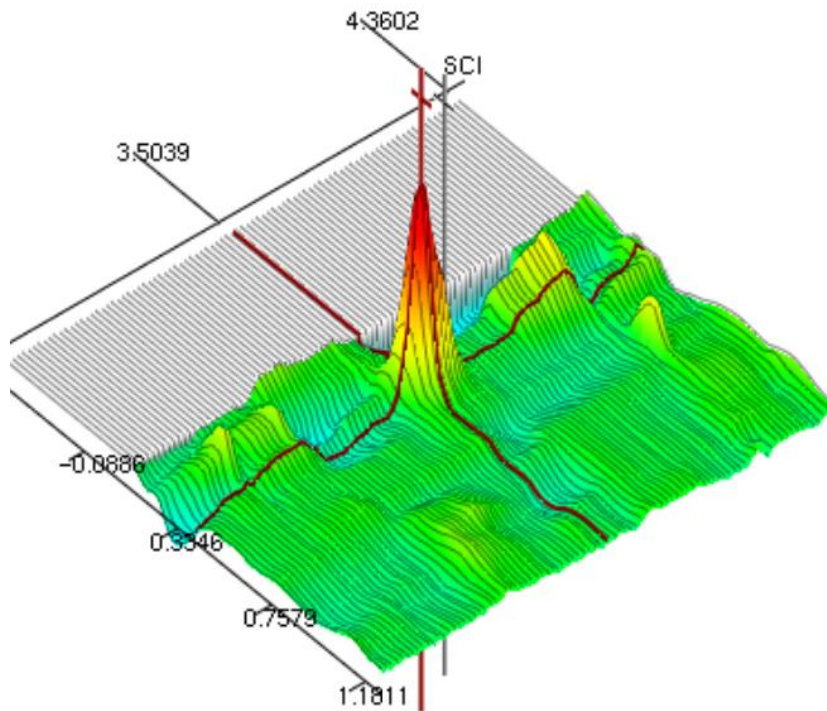
Surface Indication Location

- ▶ ECT and PT surface indication was identified on the surface of the weld
- ▶ Indication was identified the on the low hill side of the weld
 - ▶ ECT identified indication as approximately 0.8" from the low hill side (counterclockwise looking up) and 0.5" from the weld toe
 - ▶ PT identified location as approximately 0.8" CCW from the low hill side and 0.6" from the weld toe



Supplemental NDE Results

Eddy Current

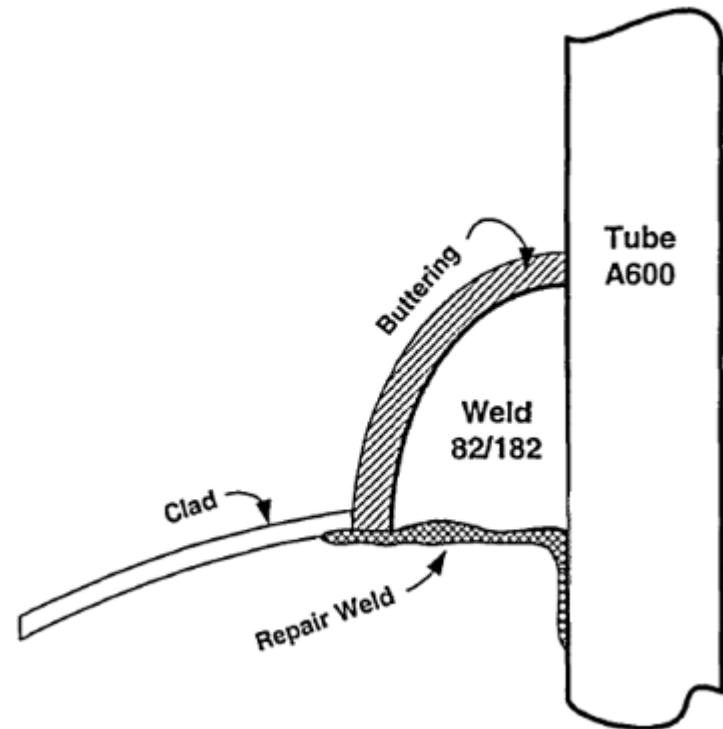


Liquid Penetrant



Proposed Alternative Repair

- Proposed alternative is to repair the j-groove weld of nozzle #74 using an embedded flaw repair process
- Repair is an alternative to the defect removal and weld repair provisions of ASME Section XI
- Defect will remain in the j-groove weld, but will be isolated from primary water environment thus no longer susceptible to PWSCC



Embedded Flaw Repair History

- ▶ The embedded flaw repair process has been used extensively within the industry for RVCH nozzle repairs
- ▶ No PT inspection of an overlay to date has shown evidence of PWSCC from plants that have implemented the repair
- ▶ Technical basis of the repair process is documented in WCAP-15987-P Revision 2-P-A and has been reviewed and accepted by the NRC
- ▶ Prior fracture mechanics evaluations at plants which have implemented the repair, assuming a postulated flaw encompassing the j-groove weld cross-section, have been demonstrated as acceptable for at least 10 years using Section XI flaw evaluation rules
- ▶ Indian Point 2 provides recent precedence in 2018 for the Catawba 2 relief request {ML18142A431}

Nozzle #74 Embedded Flaw Repair

- ▶ J-groove weld will be completely covered by at least three layers of Alloy 52 or 52M deposited 360° around the nozzle
- ▶ The seal weld on the Alloy 600 tube will consist of at least 2 layers of Alloy 52 or 52M weld metal
- ▶ Volumetric examination from nozzle tube ID and surface examination performed after repair to verify seal weld integrity and monitor changes in flaw and leak path
 - ▶ Surface examination of the repair will satisfy ASME Section III, NB-5350 acceptance standards
 - ▶ Preservice volumetric inspection to be consistent with 10 CFR 50.55a(g)(6)(ii)(D) which requires Code Case N-729-6 with conditions
- ▶ Technical basis for one-cycle operation will be produced, which will include discussion of significant experience of embedded flaw repairs using NRC approved WCAP-15987-P-A and Section XI flaw analysis

Plan for Relief Request

- ▶ A relief request will be submitted and will request verbal approval to support plant start-up
- ▶ Qualitative technical basis in the relief request will be provided to support one cycle of plant operation with the repair
- ▶ During the following operating cycle (cycle 25), a detailed site-specific fracture mechanics assessment will be performed for acceptability of the repair for long-term operation
- ▶ An additional relief request will be submitted during refueling cycle 25 for long-term operation with the repair, including the fracture mechanics assessment for acceptability

Timeline

- ▶ Relief request to be submitted – Friday, 4/23 2000
- ▶ Weld overlay repair activity complete – Sunday, 4/25 1400
- ▶ RVCH placed on vessel – Sunday, 4/25 1900