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## Primary Water Stress Corrosion Cracking in Control Rod Drive Mechanism Nozzle Welds at the Shearon Harris Nuclear Plant

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Duke Energy  
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### General Overview of the Event

- In April 2013, the 2012 UT scan data is sent to a third party for review in preparation for upcoming outage
- Scan review identified previously unidentified suspect indication in Nozzle 49 from the 2012 scan data.
- The original vendor confirmed a recordable PWSCC-like indication in Nozzle 49 that may extend into the J-groove weld.
- Shearon Harris Nuclear Plant begins shutdown to Mode 6.
- Root Cause Team formed including experts from Dominion, NextEra Energy, and EPRI

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### Cause of the Event

Current Process Analysis Design

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graph TD; A[Analyst 1 receives the data and determines if sufficient quality] --> B[Analyst 1 analyzes the data]; A --> C[Analyst in other qualified L-1 or L-2]; B --> D[Analyst 1 fills out report]; C --> E[Analyst 2 analyzes the data]; D --> F[Analyst 2 reviews the report and discusses if any conflicting interpretations]; E --> F; E --> G[Reviewer uses qualified L-1]; F --> G;
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### Cause of the Event

- Analysis Method: Interviews
  - Thirteen questions
  - 15 interviewed
  - 7 in oversight roles
  - 5 Analysts
  - 1 Industry Peer
  - 2 Industry Experts

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### Cause of the Event

- Interview Results
  - Inconsistency between analysts regarding data analysis reviews being done in parallel or independently, and occasionally worked collaboratively
  - No time pressure was noted
  - Primary analyst had the least experience
  - Some analysts were not recording all fabrication flaws that were more than 10% of penetration wall thickness (procedure requirement loosely worded as a "should")
  - Tight work quarters, noise, and distractions cited by most oversight personnel, but not by personnel analyzing data
  - Most analysts did not have any recommendations to prevent this type of event
  - All oversight personnel indicated that a trained "qualified" individual performing an independent and sequestered review of data would minimize recurrence

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### Cause of the Event

- Root Cause
  - Lack of programmatic governance to specify process independence and fatigue/distraction controls
    - No mandate for independent vendor analyses of the data
    - Analysts were potentially fatigued
      - Analyst 1 worked 17 days without time off
      - Analyst 2 worked 24 days without time off
    - Analysts distracted by noisy active environment

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### Corrective Actions to Prevent Recurrence

- Provide Process Independence

The flowchart, titled "Proposed Process Analysis Design", outlines a two-analyst process. It begins with a box stating "Both analysts review the data and determine if sufficient quality". This leads to two parallel paths: "Analyst 1 reviews the data" and "Analyst 2 analyzes the data". Each path includes a note: "Analyst is either qualified L1 or L10" and "Reviewer was qualified L10". Both paths converge at "Analyst 1 fills out report" and "Analyst 2 fills out report". A central box notes: "Both Overight persons review the preliminary documents for consistency". This leads to "Final report is finalized and signed by both analysts and night Overight person". A final note states: "Any issues are to be resolved with the analysts in concert."

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### Corrective Actions to Prevent Recurrence

- Fatigue controls
  - Vendor to develop, submit and receive Duke Energy approval for work-hour restrictions for vendor analysts
  - Exceptions to the fatigue management plan will require site concurrence
- Distraction mitigation
  - Require an environment conducive to independence and analysis
  - Provide separate areas for the analysts
  - Minimize distractions.

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### Questions?

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