Exit Notes

Introductions (name/title) - Holmberg,

Final portion of my Exit Meeting, For the baseline ISI and TI-150 and TI-152 inspections. This inspection began on April 5th and ends today.

- **Purpose/Scope:** - This inspection fulfilled the baseline inspection program requirements for the biennial review of the Unit 1 inservice inspection (ISI) activities (IP 7111108). The intent of this inspection was to confirm the effectiveness of your program for monitoring degradation of the reactor coolant system. To this end, we performed direct observations of your inservice inspection activities such as pzr spray line piping, fw piping weld ultrasonic examinations, and steam generator tube eddy current examinations. Our scope also included a review of your NDE records from past ISI examinations, Code component repair/replacement records and interviews with your NDE staff. Our finding and observations from this portion of our inspection were discussed at our interim exit held on April 23rd and will not be repeated today.

  In addition to the baseline ISI we completed the activities as identified in the NRC Temporary Instruction 152 focused on your lower vessel head examinations and TI-150 related to review of your upper head inspection activities. For our reviews in these areas I performed direct observations of your head inspection activities, review of non-destructive examination records, and interviews with your NDE staff. My observations for the TI 152 on the lower head were address on April 28th and will not be repeated today. Similarly, I covered each of my conclusions to the questions in TI-150 for the upper head on April 28th. However, due to continued NDE and repair activities on the upper head which have occurred after this date, I will readdress the major portion of the questions in TI-150 affected by these new activities. These observations and my inspection finding will be documented in the resident report 2004003. I will also discuss resolution of an unresolved item related to pole slippage in the rotating UT tool used during the previous Unit 1 outage head inspection.

Upper Vessel Head Examination (TI-150):

To evaluate the your efforts in conducting examination of the reactor vessel head and penetration nozzles, we performed a number of direct observations of your contractor staff and reviews of procedures and data. This examination is now complete and I will provide my answers to the questions in TI-150 which were affected by activities which occurred after April 28th.

a. For each of the examination methods used during the outage, was the examination performed by qualified and knowledgeable personnel? (Briefly describe the personnel training/qualification process used by the licensee for this activity.)

Under Head Manual Ultrasonic Examinations
Yes. Your staff conducted a manual UT examination of the lower portions of nozzle 32 and 33 below the J-groove weld a knowledgeable staff member certified to Level III as for UT examination in accordance with procedure procedure NDE-3 "Written Practice For Qualification And Certification For NDE Personnel" This qualification and certification procedures met the industry standard ANSI/ANST CP-189 "Standard for Qualification and Certification of Nondestructive Testing Personnel.

2. For each of the examination methods used during the outage, was the examination performed in accordance with demonstrated procedures?

Manual UT
Yes. Your staff performed the manual UT examinations of the lower portions of nozzle 32 and 33 below the J-groove weld in accordance with procedure NDE-141 "Manual Ultrasonic Examination of Reactor Head Penetrations." Your staff considered this procedure demonstrated based upon a blind test conducted at EPRI on a CRDM mockup containing EDM notches. EPRI considered this procedure qualified for detection but not sizing of flaws.

Automated UT
Yes. The your vendor performed automated UT examinations in accordance with Framatome ANP Nondestructive Examination Procedure 54-ISI-100-11, "Remote Ultrasonic Examination of Reactor Head Penetrations." Your vendor had successfully demonstrated this procedure on mockups containing cracks and simulated flaws as documented in EPRI MRP-89 "Materials Reliability Program Demonstrations of Vendor Equipment and Procedures for the Inspection of Control Rod Drive Mechanism Head Penetrations." I reviewed the revisions to procedure 54-ISI-100-11 implemented since the vendor had demonstrated this procedure to ensure that any equipment configuration changes would not affect the flaw detection capability. Additionally, the your vendor had demonstrated the capability to detect a leakage path in the interference zone using this procedure on a mockup with a simulated leak path and at other nuclear power plants with observed leakage paths such as the Oconee Units.

However, I did identify one procedure/practice weakness in your vendors automated UT data collection using the blade probe. Your vendor typically ran the blade UT probe to failure which meant that a final calibration check of the failed UT probe was not performed. If your vendor had elected to incorporate ASME Code Section V rules into this procedure, the examination data would have been considered invalid back to last known UT equipment calibration check. However, your vendor UT analyst typically accepted the UT data up to point of probe failure. Although, this practice was allowed by the procedure, the inspectors concluded that it placed greater reliance on the analyst which could increase the probability of human error resulting in failure to identify flaws.

3. For each of the examination methods used during the outage, was the examination able to identify, disposition, and resolve deficiencies and capable of identifying the PWSCC and/or head corrosion phenomena described in Order EA-03-009?

Yes. For the manual UT examinations of the lower portions of nozzle 32 and 33 below the J-groove weld. The procedure was demonstrated during a blind test on a CRDM mockup at an EPRI facility. This CRDM mockup contained only EDM notches, but your inspector also performed examinations of samples of penetration nozzles removed from the Oconee plant with actual PWSCC. The EPRI staff confirmed that the your inspector was able to detect the PWSCC flaws in the Oconee sample. Therefore, I concluded that your manual UT method was qualified/capable of detecting PWSCC.

4. What was the physical condition of the reactor head (debris, insulation, dirt, boron from other sources, physical layout, viewing obstructions)?

Above Head Visual Examination

NRC order EA-03-009 dated February 20, 2004, requires you to complete a 95 percent surface area examination of the upper head including areas upslope and downslope of the support structure. The service structure and vertical insulation panels represented areas where the vessel head surface was not examined. I identified that your staff had not determined the percentage of uninspected coverage that these areas represent in advance of the visual inspection. My questions prompted your staff to document in CAP 056522 the need to develop a calculation to estimate the area of visual examination coverage in a formal calculation. Your staff subsequently decided to document coverage in an internal memorandums

dated May 17, 2004 and May 24, 2004. In the second memorandum you determined through review of drawings related to the head, head service structure and insulation package that the total head area not available for visual examination was just under 5 percent which confirmed that you had the capability to achieve greater than the 95 percent visual examination coverage required by the order.

5. Could small boron deposits, as described in Bulletin 2001-01, be identified and characterized?

Top of Vessel Head Visual Examinations
Yes. Based upon the quality and scope of your visual examination, and independent direct observations, I concluded that any boron deposits characteristic of coolant leakage would have been identified (if any had been present). No boric acid deposits were found on the 49 VHPs, including the 3/4" head vent. I independently observed the remote visual examination for portions of 12 VHPs and direct examinations of portions of 30 VHPs and did not observe white deposits (boric acid) with characteristics (popcorn like) indicative of reactor coolant system leakage.

6. What material deficiencies (i.e., cracks, corrosion, etc) were identified that require repair?

At penetration nozzle 26, your UT examination identified a circumferentially oriented indication (60-70 degree extent) located in the J-groove weld and which extended for 20 to 25 percent through-wall into the penetration tube. Your staff concluded determined that this indication was likely due to J-groove weld repair activities and was not a flaw. To confirm this conclusion, the your staff performed four PT examinations of the nozzle 26 J-weld with intermediate buffing/grinding steps to attempt to remove the axial indications. In the final PT examination your staff identified two patches of flaw-like axial indications at the surface of the J-groove weld. One area of linear indications measured 1.5 inch by 0.6 inch and the other area measured 2.5 inch by 0.6 inch. Your staff did not record the actual size, number or spacing of these indications.

Based upon the PT examination results which identified linear indications in the J-weld, your staff decided to repair nozzle 26. An inside diameter temper bead weld repair of nozzle 26 was completed in accordance with vendor travel "Ambient ID Temper Bead Repair for CRDM Nozzles" and the structural temper bead welding occurred in accordance with weld

procedure specification (WPS) 5S-WP3/43/F43TBSCA301. I reviewed weld repair records including the certified mill test reports for the weld filler metal and observed portions of the welding to confirm that the welding was conducted in accordance the vendors process traveler. I also reviewed the weld procedure to confirm that it met requirements of Section IX of the ASME Code. I have also reviewed final weld UT examination records to confirm that no flaws were identified in the nozzle No. 26 repair weld.

I identified that your vendor used non-structural attachment (tack) welds on the existing J-groove weld at nozzle No. 26 to mount tooling used in machining and welding and that the repair process steps did not include full removal and PT examinations for this tack weld. ASME Section III, NB-4435 requires a PT examination to be performed after removal of temporary tack welds. Initially your staff considered that the existing J-groove weld was no longer considered part of the pressure boundary and therefore, the ASME Code Section III requirements did not apply. However, based upon followup discussions with NRR staff, your staff subsequently submitted a supplement to the relief requests for nozzle No. 26 (MR 02-018-1 and MR 02-018-2) to request relief for this minor deviation from Code requirements.

7. What, if any, impediments to effective examinations, for each of the applied methods, were identified (e.g., centering rings, insulation, thermal sleeves, instrumentation, nozzle distortion)?

Under Head Ultrasonic Examinations

NRC Order EA-03-009 dated February 20, 2004, required your staff to examine to at least 1 inch below the lowest point at the toe of the J-weld for each penetration and all areas with greater than 20 ksi tension residual and normal operating stress. For 17 nozzle locations your vendor was not able to obtain at least a full 1 inch below the J-weld. For these nozzles the maximum extent volumetrically scanned at the tube outside diameter below the downhill side of the weld was less than the 1 inch due to the short length of nozzle existing below the J-groove weld and the UT transducer configuration. The axially aligned transducer pair used on the blade probe resulted in a small volume (approximately 0.4 inch) of uninspected tube material at the inside corner of these sleeved nozzle locations. On May 14, 2004, your staff issued a letter requesting relaxation to Order EA-03-009, which identified the 17 nozzles to which this condition applied.

For penetration nozzles No. 32 and No. 33, your vendor was not able to get full 360 degree UT examination coverage with the blade UT probe due to insufficient clearance gap between the thermal sleeves and nozzles. You had replaced these thermal sleeves during the previous outage with sleeves that had a slightly larger outside diameter which prevented the UT blade probe from completing a full scan of the nozzle. Your staff determined that this previous replacement work would complicate another thermal sleeve removal and reinstallation activity which would be necessary to support additional UT examination coverage. The extent of uninspected area below the J-groove welds for nozzles No. 32 and 33 was 42 degrees and 306 degrees respectively. Your vendor also identified an additional 60 degrees of uninspected area in and above the J-groove weld for nozzle No. 33. On conference calls with NRR and Region based staff held on May 6, 2004 and May 11, 2004, you discussed your intent to justify this limitation in a relaxation request to the NRC Order EA-03-009. On May 14, 2004, your staff completed additional manual UT examinations on the lower end of nozzle No. 32 and No. 33 such that they obtained the minimum coverage required by the Order was met for Nozzle No. 32. On May 14, 2004, your staff issued a letter requesting relaxation to Order EA-03-009, for the limited UT coverage on nozzle No. 33 which included the a deterministic fracture mechanics analysis approach to support continued operation. On May 19, 2004, you elected to remove the thermal sleeve from nozzle No. 33 to permit access for the rotating UT probe to complete the examination coverage for nozzle No. 33 rather than pursue Order relaxation. On May 20, 2004, you completed the rotating UT probe examination for nozzle No. 33, such that this nozzle no longer required relaxation from Order EA-03-009 requirements.

8. What was the basis for the temperatures used in the susceptibility ranking calculation, were they plant-specific measurements, generic calculations, (e.g., thermal hydraulic modeling, instrument uncertainties), etc.?

   Previously covered.

9. During non-visual examinations, was the disposition of indications consistent with the guidance provided in Appendix D of this TI? If not, was a more restrictive flaw evaluation guidance used?.

   Not applicable.

10. Did procedures exist to identify potential boric acid leaks from pressure-retaining components above the RPV head?

Previously covered.

11. Did the licensee perform appropriate follow-on examinations for boric acid leaks from pressure retaining components above the RPV head?

Not applicable.

URI - Partial Data Acquisition Due To Coupling Slippage (11 nozzles)

On September 16, 2003, your contractor identified that, during the Unit 1 RPV head ultrasonic inspection in September 2002, stalling of the rotating ultrasonic probe head due to coupling slippage resulted in partial data acquisition in 10 of the 16 CRDM nozzles. Corrective actions to prevent recurrence included redesign of the coupling tool, and use of backup analysts which were implemented for the Unit 2 reactor vessel head examination. You also performed an analysis of the coverage limitations and determined that there was sufficient Unit 1 data for the examination results to remain valid. You have subsequently completed UT of the affected CRDM nozzles during the Unit 1 U1R28 outage and no flaws were detected. No violations of NRC requirements were identified. This URI (50-266/03-09-01) is considered closed.

Questions??

Proprietary???

This concludes my exit meeting. Thank you and your staff for there strong support of my inspection activities throughout this lengthy inspection.