

March 6, 2006

Mr. Christopher M. Crane
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SUBJECT: SUMMARY OF CONFERENCE CALL WITH AMERGEN ENERGY COMPANY,
LLC REGARDING THREE MILE ISLAND NUCLEAR STATION, UNIT 1, FALL
2005 STEAM GENERATOR INSPECTION RESULTS (TAC NO. MC8120)

Dear Mr. Crane:

On November 7, 2005, the Nuclear Regulatory Commission (NRC) staff participated in a conference call with representatives of AmerGen Energy Company, LLC (the licensee) regarding the Three Mile Island Nuclear Station Unit 1 fall 2005 steam generator (SG) tube inspection activities. A follow-up call with the licensee was made on November 8, 2005, regarding the outside diameter circumferential crack found near the upper tubesheet secondary face in SG B. The NRC follows the results of the industry's SG inspections in order to maintain an awareness of the condition of the SGs and the types of tube degradation mechanisms that are active. A summary of the phone calls is enclosed for your information. If you have any questions, please contact me at (301) 415-1447.

Sincerely,

/RA/

Farideh E. Saba, Project Manager
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Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosure:
Summary of Conference Calls

cc w/encl: See next page

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SUMMARY OF CONFERENCE CALLS WITH
AMERGEN ENERGY COMPANY, LLC REGARDING
THREE MILE ISLAND NUCLEAR STATION, UNIT 1
FALL 2005 STEAM GENERATOR INSPECTION RESULTS

November 7, 2005, Conference Call

Background

On November 7, 2005, Nuclear Regulatory Commission (NRC) staff participated in a conference call with AmerGen Energy Company, LLC (the licensee) representatives regarding the Three Mile Island Unit 1 (TMI-1) fall 2005 steam generator (SG) tube inspection activities. The issues discussed included those listed in a letter dated September 7, 2005, from the NRC to the licensee, documenting the arrangement of this conference call (Agencywide Documents Access and Management System (ADAMS) Accession No. ML052300459). The conference call is summarized below.

Summary of Conference Call

Primary-to-Secondary Leakage: It was reported that primary-to-secondary leakage during Cycle 16 was below the limit of detection (< 1 gallon per day).

Secondary-Side Pressure Tests: The licensee did not perform any secondary-side pressure tests due to the low leak rate during Cycle 16.

Electric Power Research Institute (EPRI) Guideline Exceptions: The licensee indicated that it took seven exceptions to the EPRI SG Examination Guidelines, Revision 6, during the end-of-cycle (EOC) 16 refueling outage (RFO). These guidelines do not constitute NRC requirements. The seven exceptions are listed below.

1. The tubes in the kinetic expansion transition region in the upper tube sheet (UTS) to the roll expansion transition in the lower tube sheet (LTS) are part of the full-length tube inspection. Rotating probe sampling was performed to check bobbin probe performance in the crevice kidney region. There is evidence from other plants that shows the bobbin probe's ability may be diminished in the crevice kidney region. The licensee stated that although it feels that the bobbin probe is qualified, it takes a conservative approach and uses a rotating probe on a sampling basis. The rotating probe did not reveal any additional indications beyond those detected by the bobbin probe.
2. Inspection expansions are not performed in areas where small and newly-detected inner-diameter intergranular attack (IDIGA) is identified using a rotating probe due to the licensee's operating experience indicating that this degradation is the result of previous residual thiosulfate damage, and is not growing. The licensee believes the IDIGA flaws which are not detectable by bobbin probe are not significant from a structural or leakage integrity standpoint.

Enclosure

3. Categorization (C-1, C-2, and C-3) of the inspection results is not performed in accordance with EPRI SG Examination Guidelines, Section 3.5. The licensee uses Technical Specification (TS) Section 4.1.9 for categorization.
4. A site-specific performance demonstration is employed for analyst qualification regarding IDIGA length sizing. EPRI requires a sizing accuracy of ± 0.02 -inch for volumetric-type flaws such as those at TMI-1; however, the licensee requires analysts to demonstrate a site qualification of ± 0.043 -inch. Past eddy current performance data provided by the licensee in support of its IDIGA alternate repair criteria shows that eddy current is significantly over-predicting the length of the IDIGA flaws. The licensee concluded this is not a significant item.
5. Dual independent data analysis is not required for sludge profiling.
6. The licensee is using its inventory of older probes which do not have certificates of conformance in accordance with EPRI SG Examination Guidelines, Revision 6. The licensee indicated that all probes perform well and satisfy data quality requirements.
7. Sixty-three LTS thimble plugs in SG A are inspected using a rotating probe. This technique is not fully qualified in accordance with the *Code of Federal Regulations*, Title 10, Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements" (i.e., sample size, flaw representation). These thimble plugs are 23-inches long and are unique to TMI-1.

The licensee also indicated that it would take one exception to the EPRI Water Chemistry Guidelines in its SG inspection program. The licensee does not perform continuous SG blowdown for sodium sampling, however, it does perform periodic grab samples to measure sodium content.

Inspection Scope: The licensee's SG inspection scope for the EOC 16 RFO consisted of the following:

1. 100-percent bobbin probe inspection of inservice unexpanded tubing between the kinetic expansion transition in the UTS to the roll expansion transition in the LTS.
2. 100-percent rotating probe inspection of the kinetic expansion inspection zone, including the transition region.
3. 100-percent rotating probe inspection of the lower tube ends.
4. 33-percent bobbin probe inspection of the installed sleeves in the unexpanded portion of the sleeve.
5. 33-percent rotating probe inspection of the sleeve roll transition.
6. 33-percent rotating probe inspection of the sleeve upper rolls.
7. 100-percent rotating probe inspection of the sleeve lower roll expansions.

8. 100-percent rotating probe inspection of the inservice unsleeved tubes adjacent to sleeved tubes between the 15th tube support plate and the UTS secondary face. This inspection criteria was used to address a high cycle fatigue concern.
9. Approximately 20-percent of the UTS thermally-treated Alloy 600 Westinghouse rolled plugs were inspected. All plugs are over 60 effective full-power months, but have not been identified to have any degradation to date.
10. Special interest inspections using a rotating probe included the following:
 - a. Inspect all of the flaw-like indications reported by bobbin probe exams with a rotating probe.
 - b. 33-percent rotating probe inspection of tubes in the LTS kidney region from +5-inches to -4-inches (623 tubes in SG A and 815 in SG B).
 - c. All dents above the LTS that have a voltage ≥ 2.5 volts.
 - d. 33-percent inspection of dents at the LTS secondary face and below.
 - e. Visual inspection of all inservice tube plugs.
 - f. 33-percent inspection of LTS thimble plugs.
 - g. Inspection of approximately 30 Babcock & Wilcox rolled Alloy 690 plugs that are susceptible to the diode effect.

Preliminary Inspection Results: At the time of the conference call, the plant was in the process of performing inspections in both SGs. Bobbin probe exams of the tubes and sleeves were complete. Inspections within the kinetic expansion region and kidney region were complete. The special interest inspections were nearing completion. The in-situ pressure test candidate list was still being generated.

The licensee indicated that during the examination of the kinetic expansion transition that two axial indications and five circumferential indications were identified in six tubes. The largest axial indication was 0.98 volts, 75-percent through-wall (TW), and 0.17-inch axial length while the largest circumferential indication was 1.6 volts, 54-percent TW, and 0.22-inch circumferential length. These indications were determined to be newly discovered degradation and attributable to service-induced primary water stress-corrosion cracking (PWSCC). A single inside diameter (ID) circumferential indication (1.72 volts, 86-percent TW, 0.17-inch circumferential length) was identified with a rotating probe 0.86 inches below the kinetic expansion transition. The indication appeared planar rather than volumetric and was located in a region of a tube not previously inspected with a rotating probe.

Eleven new volumetric indications in five tubes were identified in the kinetic expansion. The largest volumetric indication was 0.7 volts, 40-percent TW, and had a short length (i.e., actual size of flaw so small that sizing was not completed). A total of eight volumetric IDIGA indications were identified in unexpanded tubing. Each of these indications was greater than 0.25 inches long (largest indication was 0.33 inches long) and was plugged. In addition to the

eight volumetric IDIGA, eight groove IDIGA indications were identified in five tubes. These indications were plugged and characterized as 0.17 volts to 0.31 volts, 12-percent TW to 76-percent TW, and 0.15 inches to 0.37 inches long. The licensee attributes the finding of these indications to smaller noise levels than existed in the previous inspections.

The licensee stated that the dent inspection revealed no change in the number of dents or in the dent voltages. A single axial freespan (0.16 volts and 1-percent TW) indication between the 3rd and 4th tube support plates (TSP) was identified using a bobbin probe. The licensee plugged the tube. In addition, the licensee reported that three single outside diameter (OD) axial indications at three single dents in three different tubes were identified with a rotating probe above the LTS (i.e., 10th to 11th, 12th to 13th, 13th to 14th TSPs). The indications were rotated up into the flaw plane and characterized to be 0.48 volts to 1.0 volts and 0.17 inches to 0.5 inches axial length.

The licensee reported that 14 circumferential indications attributable to PWSCC were identified between the lower tube end and the clad interface. The maximum indication was characterized to be 0.38 inches in circumferential length and 12 volts. These indications were plugged on detection. No axial indications have been identified in this location and everything has been in the region of the tube adjacent to the cladding.

The licensee reported that an OD circumferential indication near the UTS secondary face was detected with a rotating probe (was not detected with a bobbin probe) in SG B. The indication was characterized as a 1-volt, 70-percent TW, and 0.2-inch circumferential length indication and was located at the edge of a 1-volt dent indication. The indication was identified due to using the tubesheet lower face as a landmark to ensure the entire kinetic expansion transition region was examined. At the time of the conference call, the licensee speculated that the indication may be associated with denting.

Crystal River Unit 3 (CR3) identified an OD axial indication in the un-expanded portion of tubing in the tubesheet near the expansion transition region with a rotating probe but not a bobbin probe. The licensee feels that it adequately covered the area in which CR3 identified this indication. The licensee inspected 2.8 inches below the upper tubesheet expansion transition for all tubes in SG B and 3.9 inches below the upper tubesheet expansion transition for all tubes in SG A. At the time of the conference call, the licensee was deciding how to expand the scope of the inspection to address the OD axial indication finding at CR3.

Tube Plugging and Stabilization: All defective tubes will be plugged and stabilized (i.e., 98 tubes in kinetic expansion transition region, 91 circumferential indications, 7 volumetric indications located close together, and 4 noisy tubes). Only non-sleeved tubes will be stabilized in the upper tube end because the sleeve serves as an upper stabilizer.

In-Situ Pressure Tests and Tube Pulls: No final decision had been made by the licensee at the time of the conference call regarding the number of in-situ pressure tests that would be performed. However, the licensee stated that at least two tubes with axial cracks at dent indications will be in-situ pressure tested. The licensee plans to review the variability of material properties and non-destructive examination uncertainties to determine if previous in-situ results bounds current conditions. At the time of the call, the NRC indicated the importance of in-situ pressure testing and urged the licensee to strongly consider conducting more. No tube pulls were planned at the time of the call.

Loose Parts: A piece of a fuel assembly spacer grid strap was found at the UTS of SG A in the periphery. This part was in the SG during Cycle 16. The piece was removed and did not appear to cause any damage. The 3rd burned fuel assembly from which the piece came was removed from the core. During this outage, when the man-way was opened, flexitallic gasket pieces fell onto the tubesheet. There does not appear to be any degradation associated with these pieces. If any of the gasket pieces fell into the tubes, all pieces will be recovered from the lower bowl of the SG.

Babcock & Wilcox Welded Plugs: All welded plugs were visually examined and no fatigue damage was found.

November 8, 2005, Conference Call

On November 8, 2005, NRC staff participated in a follow-up conference call to the conference call of November 7, 2005, with the licensee regarding the OD circumferential crack found near the UTS secondary face in SG B during the fall 2005 SG tube inspection activities.

The licensee reported during the November 7, 2005, conference call that an OD circumferential indication near the UTS secondary face was detected with a rotating probe (was not detected with a bobbin probe) in SG B. As discussed above, this indication was 1-volt, 70-percent TW, and 0.2-inch circumferential length indication and was located at the edge of a 1-volt dent indication. The indication was identified due to using the tubesheet lower face as a landmark to ensure the entire kinetic expansion transition region was examined. At the time of the call, the licensee did not know the cause of the indication but speculated that the indication was either (1) associated with denting, or (2) due to the indication being directly adjacent to the un-tubed lane which runs through the center of the tubesheet which had problems in earlier years due to the higher flow area.

During this conference call it was communicated that the dent which the indication was speculated to be associated with was further characterized to be a single 1.4-volt dent. The rotating probe demonstrated that the indication was very close to the edge of the dent (i.e., top edge of the dent). Since the indication was also determined to be directly adjacent to the un-tubed lane which runs through the center of the tubesheet, the licensee speculated this was not a random occurrence or fatigue, but rather that it may be stress corrosion cracking resulting from the high stress of the 1.4-volt dent combined with the high temperature and flow at this location.

In response to this indication, the licensee discussed its inspection expansion scope during the conference call which is summarized below.

1. A 5-tube swath around the un-tubed lane adjacent to the location of the indication was chosen to be inspected with a rotating probe in SG B (469 tubes). A 20-percent sample of the swath was inspected in SG A (94 tubes).
2. The inspection zone was 1 inch below the secondary face, up to the kinetic expansion transition.

3. TMI-1's dent recording criteria is \$2.5 volts, however, they conducted a data review and located all dents \$1 volt (i.e., this will bound the 1.4-volt dent that the OD circumferential indication may be associated with).
4. Examining all dents \$1volt from UTS secondary face down to the 15th TSP.

As a result of this inspection scope expansion, there were 128 dents examined in SG A and 80 dents examined in SG B. At the time of the conference call, no other similar indications had been identified, however, the dent exams were not complete.

As a result of the inspection scope expansion, two tubes with ID circumferential indications not associated with dents were identified 0.75 inches above the secondary face of the UTS and 1.7 inches above the secondary face of the UTS (i.e., part of the five-tube swath). The licensee plugged both tubes. One of the tubes will be in-situ pressure tested due to four small circumferential flaws being in the same general vicinity.

The NRC is aware of TMI-1's reasoning for defining the potential susceptible area for the OD circumferential degradation. However, since the cause of the indication is not known (i.e., stress-corrosion cracking, fatigue related, original wedge lane problem, or random indication), it is difficult to identify the most susceptible areas. The NRC commented that the licensee may want to review its TSs to ensure that they are meeting their sampling expansion requirements based on the detection of this indication.