May 23, 2001

Mr. Mark E. Warner
Vice President - TMI Unit 1
AmerGen Energy Company, LLC
P.O. Box 480
Middletown, PA 17057

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1) - REQUEST FOR ADDITIONAL INFORMATION (TAC NO. MB0664)

Dear Mr. Warner:

In performing our review of your December 6, 2000, License Change Application No. 291 for once-through steam generator technical specification surveillance requirements following Cycle 13, the Nuclear Regulatory Commission (NRC) staff has determined that it will need the enclosed additional information to continue its review. These questions were discussed with your staff during a meeting in NRC headquarters on April 25, 2001, and in later telephone calls on May 8, 11 and 15, 2001. In order for the NRC staff to complete its review on schedule, please provide your response within 30 days of receipt of this letter.

If you have any questions, please contact me at (301) 415-1402.

Sincerely,

**/RA/**

Timothy G. Colburn, Senior Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION ON ALTERNATE REPAIR CRITERIA FOR VOLUMETRIC INNER DIAMETER INTERGRANULAR ATTACK DEGRADATION AT THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)

1. AmerGen stated in their submittal dated December 6, 2000, that "AmerGen has concluded that the inside diameter intergranular attack (ID IGA) indications are not growing in either size or depth." This statement is an apparent contradiction to the inspection findings listed in the following two paragraphs. These paragraphs indicate because tubes are being plugged, ID IGA indications are indeed growing. If eddy current analyst or technique uncertainty is the primary reason for apparent indication "growth", provide the Nuclear Regulatory Commission (NRC) staff with information on how you confirmed this to be the case as opposed to real indication growth. If you have measured analyst uncertainty, please provide the results of that study to the NRC staff.

   "In 1997, 100% of the inservice steam generator tubes were inspected with bobbin coil eddy current probes. While a number of tubes were plugged as a result of ID IGA indications that exceeded the 40% through-wall [TW] criterion, no ID IGA indications were found which exceeded the 0.52" circumferential extent criterion, and only one tube was found with an indication that required repair as a result of exceeding the 0.25" axial extent criterion."

   "In 1999, 100% of the inservice steam generator tubes were inspected with bobbin coil eddy current probes. No ID IGA indications were found which exceeded the 0.52" circumferential extent criterion; three ID IGA indications were found that exceeded the 0.25" axial extent criterion. Two ID IGA indications were removed from service based on bobbin probe depth estimates of 40% and 43% through-wall."

2. AmerGen provided the NRC staff with a table that compared eddy current results from the outage 13R inspection with results from previous inspections. This table, Table III-4, "Average Growth for ID IGA Indications," was contained in the January 7, 2000, "Report on the 1999 Outage 13R Eddy Current Examinations of the Three Mile Island Unit 1 (TMI-1) Once-Through Steam Generator (OTSG) Tubing."

   The staff discussed this table with the licensee during a January 12, 2001, conference call. The licensee indicated that during 12R and 13R, they performed a 100-percent bobbin probe examination with follow-up motorized rotating pancake coil (MRPC) examinations of all the ID IGA identified by the bobbin probe. In previous outages, the licensee performed less than a 100-percent examination of all ID IGA flaws by MRPC.

   Please confirm that Table III-4 contains the subset of indications that have a measured voltage or length from a previous outage for comparison. Please discuss why the number of observed axial and circumferential extent indications for 12R to 13R was higher than the number of indications used to compare bobbin volts for the same period. Please discuss how the number of indications listed as "bobbin volts" compares with the list of indications listed as "bobbin % TW ." Please discuss the reasons for finding MRPC indications that do not have an associated bobbin indication.

Enclosure

In general, it is difficult for the NRC staff to determine from the information submitted for this license amendment and information submitted previously if the total number of ID IGA indications are increasing in each successive outage, or if the number is relatively stable. Because the information presented in the table is divided into subsets of what has been detected in each outage by an eddy current inspection, the NRC staff cannot assess the population of ID IGA indications found in each outage.

In order for the NRC staff to evaluate the numbers of new indications found each outage, in comparison to the previously detected ID IGA indications, the NRC staff needs the data presented in a different manner. For outages 11R to 13R, please provide the total number of ID IGA indications found below the kinetic expansion region of the steam generators during each outage in a table, separated into 0.2V (as measured by bobbin) bins. In addition to the number of indications, please provide the number of tubes that contain ID IGA indications found below the kinetic expansion region of the steam generators during each outage in a table. Please provide the number of tubes with known ID IGA indications and total number of ID IGA indications taken out of service by plugging for each outage listed above.

3. In a September 15, 1997, response to an NRC Request for Additional Information Regarding Technical Specification Change Request No. 268, the licensee stated that a growth study of ID IGA indications using MRPC data would be performed (question #4). The licensee indicated that approximately 100 indications would be used, comparing 10R and 11R MRPC data with 12R MRPC data. In Table III-4, "Average Growth for ID IGA Indications," which was contained in the January 7, 2000, "Report on the 1999 Outage 13R Eddy Current Examinations of the TMI-1 OTSG Tubing," only 11 indications (10 in OTSG 'A' and 1 in OTSG 'B') are used from 10R for the growth study. How were the other indications dispositioned?

4. In the one-cycle License Amendment No. 209 issued April 13, 1999, the NRC identified areas of weakness in the licensee's ID IGA growth rate study. A number of variables were identified which were not specifically addressed in the growth rate studies and are as follows: (1) bobbin probe wear, (2) calibration practices and standards, (3) differences in data acquisition hardware, and (4) data analyst uncertainty.

   Please provide the staff with a discussion as to how each of the above listed variables have been addressed in the growth rate studies. This discussion should include any procedural changes that were made, what hardware was affected, and acceptance criteria for the above variables. For example, how will the probes, techniques, and analyst guidelines to be used in the outages to follow be consistent with the above variables.

   In the April 25, 2001, meeting between AmerGen and the NRC staff, you discussed a pre-13R study of examination technique and analyst variability. Have the results of this study been previously provided to the NRC staff? If not, please provide the results.

5. The December 6, 2000, submittal states that the results of the growth assessments showed no statistically significant growth in the ID IGA, and that the changes were less than the statistical uncertainty of the measurement techniques. Please discuss the

methodology used for assessing growth in each outage. What statistical tests are being used to make this growth assessment, and what is the acceptance criteria?

The best measure of growth in any tube is the change in measured indications between inservice inspections. What statistical tests will be carried out on the data set of all such changes? How will the results of the tests above be used to draw a conclusion about growth in the ID IGA population? How sensitive is the procedure used to determine the hypothetical growth in the ID IGA population? What is the probability of detecting significant growth if it occurs, i.e. what is the power of the tests? What statistical outlier tests will be performed and how will the results be interpreted? Has this statistical methodology been used on data from previous outages? If so, provide the results of this analysis.

If you provide numbers of indications detected with the bobbin probe from previous outages to show the change in measured indications between inservice inspections, please provide the bobbin inspection scope for the previous outages cited.

6. In License Amendment No. 209 which also approved a one-cycle alternate repair criteria (ARC) for ID IGA, the NRC staff strongly encouraged the licensee to pursue the development of a qualified eddy current technique which can reliably depth size ID IGA in accordance with the original 40-percent tube repair limit. The NRC staff stated that if this path were pursued, further technical specification (TS) amendments would not be required to address this mode of degradation.

   In response, AmerGen indicated in the December 6, 2000, submittal that they have developed a bobbin coil examination technique for depth sizing inside diameter IGA/IGSCC (intergranular stress corrosion cracking) indications that provide an eddy current signal of sufficient strength and clarity. Further, Amergen stated that ID IGA that can be reliably depth sized using the bobbin coil probe will be depth sized with the site qualified bobbin coil technique and repaired if it measures greater than or equal to 40-percent TW or is measured to exceed either the circumferential- or axial-length criteria.

   Please provide information on the Electric Power Research Institute (EPRI), Appendix H, qualification of this bobbin coil technique, especially the data that supports a 0.89 POD (probability of detection) at 42-percent TW for freespan ID IGA with the bobbin probe. Discuss the specifics of how the data set that supports this qualification is representative of the conditions at TMI-1 (e.g., noise levels, signal-to-noise ratios, flaw signal characteristics, etc.). Describe the data set in detail. Describe in detail the performance demonstration techniques applied to ID IGA removed from TMI-1 OTSGs and the results of the performance demonstration. Discuss how sizing of indications is relied upon to assure leakage integrity.

7. AmerGen has concluded in previous submittals that MRPC and Plus Point probe inspections are able to conservatively assess the axial and circumferential extents of TMI-1 IGA flaws. However, AmerGen stated in the December 6, 2000, submittal that it may be possible for AmerGen to use probes other than bobbin and MRPC to conservatively assess the morphology and extents of the ID IGA flaws. For this ARC, the NRC staff will review bobbin and rotating pancake coil (RPC)/Plus Point qualification

data. Use of any other probes for this ARC would require additional approval from the NRC staff.

8. Discuss how in-situ testing is relied upon to assure leakage integrity. Discuss, as applicable, the statistical evaluation of in-situ testing as it relates to the confidence it provides to ensuring tube integrity. Were the 12R in-situ tests still bounding for the 13R outage in the context of ID IGA? Is the selection criteria consistent with the latest revision to the "EPRI Steam Generator In-Situ Pressure Test Guidelines?" Please provide the inspection data for the bounding 12R in-situ test, and compare with the bounding values found for the 13R inspection data.

9. How is ID IGA evaluated for the condition monitoring and operational assessment for the TMI-1 OTSGs? If ID IGA degradation is not found to be dormant, how will the leakage and structural integrity be assessed for the upcoming cycle?

10. From the "Report on the 1999 Outage 13R Eddy Current Examinations of the TMI-1 OTSG Tubing," you identified five tubes that had outer diameter (OD) volumetric "Patch-Like" IGA typical of OD volumetric IGA found in other OTSGs. Discuss whether this is an active mechanism, and in which outages it has been detected. Where has OD IGA been found, and what was the root cause for this degradation? How was the OD IGA detected? Discuss detection capability of OD IGA. Discuss how tubes with OD IGA indications are dispositioned. Discuss how OD IGA is addressed in condition monitoring and operational assessments, including the case of OD and ID IGA occurring at the same location.

Other issues:

During the May 8, 11 and 15, 2001, conference calls, discussions were held regarding other issues which the NRC staff wishes you to address. The NRC staff discussed proposed changes to the TMI-1 TSs with your staff which would address the following areas: (1) defining the region of the tube to be inspected and dispositioned under the alternate repair criteria to which you proposed to add a new paragraph as TS 4.19.2.c to discuss the scope and the region of the inspection; (2) defining the inspection methodology that will be used to identify and disposition the ID IGA to which you proposed some modifications, following discussions with the NRC staff, to the proposed TS changes in your December 6, 2000, application, that would be included as part of your response; (3) defining the acceptance criteria for growth rate, and actions if the criteria were exceeded to which you indicated that a stand-alone reference document would be included with your response that would be used for referencing the growth rate acceptance criteria in the TSs; and, (4) reporting requirements to which you indicated that some modifications may be made to the current reporting requirements to eliminate the verbal reporting requirement of TS 4.19.5.a and include those with the 90-day reporting requirement of TS 4.19.5.b. You indicated that to the extent practical, many of the TS changes you would make to respond to the above issues would be similar to those approved recently for Arkansas Nuclear One, Unit No. 1 on March 28, 2001. Additionally, you indicated that the table in the 90-day report required by TS 4.19.5.b would include those indications found by MRPC, but not by bobbin.

Questions/comments on the April 25, 2001, meeting handout:

Draft question 1 discussion -

Referring to page 29 of the April 25, 2001, meeting handout, have you measured analyst uncertainty? If so, please provide the results of that study to the NRC staff.

Draft question 2 discussion -

Referring to page 10 of the April 25, 2001, meeting handout, please revise the second line in the table to reflect that the row refers to all volumetric ID IGA indications found with bobbin coil inspection.

Draft question 3 discussion -

Referring to page 16 of the April 25, 2001, meeting handout, please discuss the difference in the numbers of indications listed in the table with those provided on page 10 of the handout.

Draft question 4 discussion -

Referring to page 30 in the April 25, 2001, meeting handout, please indicate that probe wear is assessed for 0.540" bobbin probe only. Please revise the last bulleted statement to reflect your practice of reexamining tubes with a probe that has passed calibration.

Referring to page 32 in the April 25, 2001, meeting handout, provide reference for the pre-13R study. If the results of this study have not previously been provided to the NRC staff, please provide the results.

Draft question 5 discussion -

Referring to page 21 in the April 25, 2001, meeting handout, please provide the percent of bobbin scope for each of the rows (each outage from 5M [mid-cycle] to 11R).

Draft question 6 discussion -

Referring to pages 42 and 43 in the April 25, 2001, meeting handout, please correct the tabular information given under the graphs. Please discuss how IGSCC is representative (or bounding) the ability of the technique to size ID IGA.

Three Mile Island Nuclear Station, Unit No. 1

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