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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Three Mile Island, Unit I (TMI Unit 1)
Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Additional Information – Cycle 15 Refueling Outage Steam Generator Inspection Summary Report (TAC No. MC4619)

Reference: 1) AmerGen Energy Company, LLC letter to NRC, dated February 24, 2004 (5928-04-20063), "Cycle 15 Refueling (T1R15) Inservice Inspection (ISI) Summary Report."

This letter provides additional information in response to the NRC draft request for additional information received via NRC email, dated July 12, 2005, regarding the TMI Unit 1 Cycle 15 Refueling Outage Once-Through Steam Generator Inspection Summary Report submitted in Reference 1. The additional information is provided in Attachment 1.

No new regulatory commitments are established by this submittal. If any additional information is needed, please contact David J. Distel at (610) 765-5517.

Respectfully,

Pamela B. Cowan
Director, Licensing & Regulatory Affairs
AmerGen Energy Company, LLC

Attachment: 1) NRC Questions and AmerGen Responses

cc: S. J. Collins, USNRC, Administrator Region I
D. M. Kern, USNRC, Senior Resident Inspector, TMI Unit 1
P. S. Tam, USNRC, Senior Project Manager, TMI Unit 1
File No. 02032

ATTACHMENT 1

NRC Questions and AmerGen Responses

Request For Additional Information
Related to TMI-1 Cycle 15 Refueling Outage Steam Generator Inspection Summary Report

1. **NRC Question**

How were the indications identified in the lower tubesheet region, including those located above the expansion region, factored into condition monitoring assessment for structural and accident leakage integrity? This description should include a description of the loads considered for the structural assessment (axial load and differential pressure) and the loads considered for the accident leakage assessment. Include the methodology for assessing accident induced leakage.

Response

Indications identified in the lower tubesheet region were factored into the TMI Unit 1 Condition Monitoring (CM) analysis along with the indications from the other areas of the TMI Unit 1 tubes.

The TMI Unit 1 CM was consistent with the requirements of the EPRI Guidelines. Structural integrity requirements for the CM analyses included a minimum degraded tube burst pressure of 3*NOP and an axial tensile tube load of 1340 lbs. For leakage integrity, the Steam Line Break delta pressure of interest was 2575 psi. Uncertainties were taken into account, and condition monitoring structural integrity requirements were demonstrated at 0.95 probability at 50% confidence for all degraded tubes at TMI Unit 1. (Note that for tubing within the lower tubesheets by more than 2" from the tubesheet secondary face, burst is prevented by the presence of the tubesheets and, hence, leakage integrity is the concern.) Leakage from indications in the expanded tubing of the lower tubesheet was estimated using the Tube End ARC used at other B&W plants (Reference 4). Sections 5 and 6 of Reference 4 provide the loads, tubesheet dilations, pressures, temperatures, lab test results, and other parameters from which those leak rates were derived.

All crack-like indications in the lower tube end and lower tubesheet region were plugged on detection.

All volumetric indications less than 2.5" from the lower tube ends were coded "SVI" and were plugged on detection because these indications were located in or near expanded tubing. ID volumetric indications 2.5" or more from the lower tube ends were analyzed in accordance with the plant's NRC-approved Management Program for ID Volumetric Degradation (i.e., ECR TM 01-00328) (Reference 5). ECR 01-00328 contains a prescribed program for growth assessments, structural integrity, and leakage assessment that is used for ID-initiated volumetric indications (ID IGA) only. For leakage assessment of volumetric ID IGA, these indications are assumed to form axial cracks that would have decreased crack opening area under tensile load. Therefore, tensile loads were not assumed in order to conservatively increase the calculated leakage results (Section 6.3 of ECR 01-00328).

The following table provides a summary of the methodology by which hypothetical accident-induced leakage from volumetric, circumferential, and axial lower tubesheet indications were estimated in the Outage T1R15 CM:

Type of Indication	Surface of Initiation	Location of Indication	Summary of Treatment Methodology for Accident-Induced Leakage Estimate in Outage 1R15 CM
Volumetric	I.D.	Unexpanded Tubing	--Indications 2.5" or more from the lower tube end were evaluated using the ECR 01-00328 methodology. --As described above, tubes with indications within 2.5" of the lower tube end were plugged.
Volumetric	I.D.	Expanded Tubing	--80% TW was assumed leakage threshold. --Assumed leakrate per indication was 95th percentile leak rate for maximum tubesheet dilation from the tube end Alternate Repair Criteria (ARC) document from other B&W plants (Reference 4). --As described above, all of these tubes with indications were plugged.
Volumetric	O.D.	Unexpanded Tubing	N/A (None were detected)
Volumetric	O.D.	Expanded Tubing	N/A (None were detected)
Axial	I.D.	Unexpanded Tubing	N/A (None were detected)
Axial	I.D.	Expanded Tubing	--Plus-Point Voltage of 2.0 Volts was used as a leakage threshold. --Assumed leakrate per indication was 95th percentile leak rate for maximum tubesheet dilation from the tube end ARC document from other B&W plants (Reference 4).
Axial	O.D.	Unexpanded Tubing	N/A (None were detected)
Axial	O.D.	Expanded Tubing	N/A (None were detected)
Circumferential	I.D.	Unexpanded Tubing	N/A (None were detected)
Circumferential	I.D.	Expanded Tubing	--Plus-Point Voltage of 2.0 Volts was used as a leakage threshold. --Assumed leakrate per indication was 95th percentile leak rate for maximum tubesheet dilation from the tube end ARC document from other B&W plants (Reference 4).
Circumferential	O.D.	Unexpanded Tubing	N/A (None were detected)
Circumferential	O.D.	Expanded Tubing	N/A (None were detected)

The Outage T1R15 CM analysis concluded that total estimated accident-induced leakage, in both of the plant's steam generators, from all sources of lower tubesheet and tube end degradation is considerably less than 1.0 gpm.

2. **NRC Question**

Were the indications in the non-expanded portion of tubing in the lower tubesheet identified with the bobbin probe or only with the MRPC? If not identified with the bobbin, should the use of MRPC in this region be expanded during future steam generator inspections?

Response

Refer to Reference 2, the TMI Unit 1 responses to NRC staff questions related to the TMI Unit 1 Generic Letter 2004-01 response, for a discussion of O.D.-initiated indications that were identified in the lower tubesheet area during Outage T1R15.

During Outage T1R15 (Fall 2003), numerous MRPC examinations of the lower tube ends and expansions were performed in response to OPEX from another OTSG plant. These examinations were described on Page 17 in the Topical TR-181 of the TMI Unit 1 T1R15 outage report (Reference 1). Approximately 23,000 lower tube end examinations were performed.

The TMI Unit 1 minimum examination extent for the lower tube ends was from the lower tube end through the roll expansion transition. This examination extent resulted in an additional length of unexpanded tubing being examined to assure that the entire expansion transition region was examined. The length of unexpanded tubing that was examined varied from tube to tube depending on acquisition operator actions. The eddy current analysts evaluated the complete length of tubing for which data was acquired. Pages 38 and 39 of Topical Report TR-181 provide a summary of the indications that were detected during the lower tube end MRPC inspections.

These Outage MRPC inspections of the unexpanded tubing near the lower tube ends detected a number of I.D.-initiated indications that were undetected by bobbin coil probes. This was not an unexpected result since T1R15 was the first outage where a significant number of tubes were examined at their lower tube end region by MRPC. The TMI Unit 1 I.D.-initiated volumetric IGA degradation in this and other locations is frequently not detected during bobbin coil examinations, and then is subsequently detected by MRPC examinations. For example, during the 1997 tube pull campaign, a tube was pulled from the steam generators with 7 volumetric ID IGA indications that were detected by MRPC probes, and not detected by bobbin probes, in the field (i.e., prior to removal). These indications are summarized in Table 4 of Reference 3, and were inconsequential regarding structural and leakage integrity. At the time when Reference 3 was written, "...there were 1,123 MRPC-confirmed volumetric ID IGA indications in the TMI Unit 1 OTSGs. Of those 1,123 indications, 373 were detected with the bobbin probe." (Reference 3, Page 24) Indications detected with both the bobbin coil and MRPC examination techniques are generally larger in voltage and surface extent and these indications have not challenged structural or leakage criteria (See Reference 3, Section 5.2.1).

The bobbin coil is not qualified for detection at the lower tubesheet roll expanded region. MRPC examinations of the lower roll expansions, similar to those that were performed in T1R15, are planned for future inspections of the original TMI Unit 1 steam generators.

References

1. AmerGen Letter # 5928-04-20063, M. P. Gallagher to U.S. Nuclear Regulatory Commission, "Cycle 15 Refueling (T1R15) Inservice Inspection (ISI) Summary Report", February 24, 2004.

2. AmerGen Letter #5928-05-20139, P. B. Cowan to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information – TMI Unit 1 Response to NRC Generic Letter (GL) 2004-01, "Requirements for Steam Generator Tube Inspections", dated August 30, 2004 (TAC No, MC4859)", June 17, 2005.

3. ECR No. TM-01-00328, Rev.1, "Engineering Report: Three Mile Island – Unit One Management Program for Volumetric Inside Diameter Intergranular Attack (ID IGA) in Once Through Steam Generators", October 2001.

4. BAW-2346P, "Alternate Repair Criteria for Tube End Cracking in the Tube-to-Tubesheet Roll Joint of Once-Through Steam Generators," 1999.

5. TMI Unit 1, Technical Specification Amendment No. 237, dated October 5, 2001.