February 12, 2002

Mr. Oliver D. Kingsley, President
and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: SAFETY EVALUATION OF PROCEDURES FOR PERFORMING AND EVALUATING THE REACTOR BUILDING TENDON SURVEILLANCE, THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1) (TAC NO. MA9460)

Dear Mr. Kingsley:

By letter dated February 25, 2000, in accordance with TMI-1 Technical Specification 4.4.2.1.6.a, you submitted Topical Report No. 136, Revision 00, "25th Year Reactor Building Tendon Surveillance (Period 7)" for TMI-1. Attachment 3 of the report included the three-volume contractor report by Precision Surveillance Corporation entitled, "25TH Year Physical Surveillance of the Three Mile Island Unit 1 Containment Building, Post Tensioning Surveillance Report," which provided procedures used by the licensee to perform its 25th year tendon surveillance and the methods used in evaluating the surveillance results. During a conference call on March 7, 2001, the Nuclear Regulatory Commission (NRC) staff questioned the approach of normalizing forces to the individual as-found tendon lift-off forces when plotting vertical, hoop, and dome tendon forces versus time trend plots described in Attachment 1 to the above Topical Report. In response to the NRC staff's request, you provided Revision 01 of Topical Report No. 136 by letter dated September 17, 2001, in which the normalizing forces were removed.

The NRC staff has completed its review of Topical Report 136. Based on its review, the NRC staff finds that the procedures used for conducting the surveillance and the methods used in evaluating the results are in accordance with the NRC staff's recommendations in the safety evaluation dated August 28, 1997. Additionally, the report serves to provide the engineering evaluation report required by Title 10 of the *Code of Federal Regulations*, Section 50.55a, and paragraph IWL-3300 of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI. The NRC staff concludes that the procedures and method of evaluations used for examination of concrete and the post-tensioning system are acceptable.

Enclosed is our safety evaluation of the report. This action closes our review effort under TAC No. MA9460.

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: Safety Evaluation

cc w/encl: See next page

Enclosed is our safety evaluation of the report. This action closes our review effort under TAC No. MA9460.

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO PROCEDURES FOR PERFORMING AND EVALUATING

CONTAINMENT TENDON SURVEILLANCE

AMERGEN ENERGY COMPANY, LLC

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

DOCKET NO. 50-289

1.0 INTRODUCTION

In Reference 1, dated August 28, 1997, the Nuclear Regulatory Commission (NRC) staff evaluated the licensee's (then GPU Nuclear Corporation) 20th year reactor building (containment) tendon surveillance results for the Three Mile Island Nuclear Station, Unit 1 (TMI-1). In that safety evaluation (SE), the NRC staff observed that the loss of prestress in hoop tendons was more than predicted, and it might reduce the hoop tendon force below the minimum required force at about 25-years after the plant's initial structural integrity test. In Reference 1, the NRC staff also recommended that the licensee modify its procedure for the tendon force regression analysis and future grease inspections.

By letters dated February 25, 2000, and September 17, 2001, the licensee (now AmerGen Energy Company, LLC) provided the results of its 25th year reactor building tendon surveillance in Topical Report No. 136 (TR 136), Revision 00 (Reference 2) in accordance with Section 4.4.2.1.6.a of the TMI-1 Technical Specifications. This SE reviews the content of the topical report, and assesses (1) the adequacy of the surveillance procedures being used for the containment concrete and post-tensioning system, and (2) the results of the surveillance in terms of the containment tendon system integrity.

2.0 EVALUATION

The 25th year tendon surveillance and associated inspections (i.e., containment Inservice inspection (ISI)) were performed between August 27, 1999, and October 26, 1999. The licensee followed the requirements of the 1992 Edition and the 1992 Addenda of Subsection IWL of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) in performing these inspections. Although the topical report is titled "25th Year Tendon Surveillance (Period 7)," the licensee stated that it also serves as the Engineering Evaluation Report required by paragraph IWL-3300 of the ASME Code. Accordingly, this SE includes an evaluation of (1) the concrete examination, and (2) the post-tensioning tendon system examination.

2.1 Concrete Examination

The licensee performed the concrete visual examinations in accordance with IWL-2510 of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Plants," in conjunction with alternatives authorized pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3). Because Subsection IWL does not provide explicit acceptance criteria for concrete examinations, the licensee established its acceptance criteria based on Section 5.1 of ACI 349.3R-96. The licensee identified five areas where Tier 1 acceptance criteria of ACI 349-3R were not met. The licensee performed the engineering evaluations of these areas and determined that no immediate repairs were required. However, it will be monitoring these areas during subsequent inspections. The licensee identified three additional areas of grease leakage or grease stains. The licensee determined that these grease leakages and stains will not adversely impact the containment concrete. However, the licensee states, "the Mechanical/Structural Engineer shall perform continued monitoring of the grease leakage as part of its Repetitive Preventive Maintenance Task No. 9641."

Based on this description, the NRC staff finds that the licensee's procedures for examination of concrete of the TMI-1 Reactor Building are in accordance with the requirements of Subsection IWL of the ASME Code as modified by 10 CFR 50.55a(b)(2)(ix).

2.2 Post-Tensioning System

The post-tensioning system examination is evaluated in three areas: (1) examination of post-tensioning tendon components (e.g., tendon wires, tendon-anchorage components), (2) examination of corrosion-inhibiting medium (i.e., grease), and (3) analysis to determine the containment prestressing forces.

1. Examination of Post-Tensioning Tendon Components: All accessible grease caps were visually examined for grease leakage and for grease cap deformations, in accordance with 10 CFR 50.55a(b)(2)(ix)(A). The licensee identified several hoop and vertical tendons with grease leakage from the grease caps. Twenty-three hoop tendons were identified requiring grease cap modifications and gasket replacements, and six hoop tendons were identified requiring only gasket replacements. Five vertical tendons were identified requiring gasket replacements.

   The licensee also examined the anchor-heads, shims, and bearing plates of the sampled 13 tendons. No evidence of cracking or degradations were noted on any of these components. One tendon in each group of tendons was detensioned for removal of a sample wire. The sample wires were found to be free of physical damage. Their ultimate strengths and elongations were found to meet or exceed the minimum specified values. The NRC staff finds the procedures used in the examination of post-tensioning tendon components in accordance with IWL-2523.

2. Examination of Corrosion-Inhibiting Grease: Samples of grease were obtained and analyzed in accordance with Table IWL-2525.1. In one sample, the licensee identified nitrate concentration greater than the acceptance limit of 10 parts-per-million (ppm). The examination of a back-up sample met the acceptance criterion. The water content in the grease samples was found to be less than the 10-percent limit established in

10 CFR 50.55a(b)(2)(ix)(D)(1). The NRC staff finds the procedure for examining the grease and documenting the results to be adequate.

3. Determination of Prestressing Force Level: Lift-off forces of 4 vertical, 5 hoop, and 3 dome tendons were determined using the "feeler gage pull out method." The licensee had estimated the lower predicted prestressing force limits (PPLs) for these tendons. The licensee compared these PPLs with the corresponding measured lift-off forces and determined if they met the acceptance criteria of IWL-3221.1. A review of Table 1, "Tendon Forces, Acceptance Limits & Margins," in Attachment 1 of the report indicates that the measured prestressing forces met the acceptance criteria.

   In order to perform the tendon force trending analysis, the licensee established the minimum required (prestressing force) value for each group of tendons. In developing the trends, the licensee disregarded the measurements recorded prior to the 10th year surveillance, considering them as unreliable. The licensee used the 10th, 15th, 20th, and the 25th year measured tendon data for evaluating the adequacy of the prestressing forces in each of the three directions, i.e. hoop, vertical and dome.

   In the conference call on March 7, 2001, the NRC questioned the approach of applying a normalization process (used for adjusting the estimated tendon forces to account for elastic shortening losses, etc.) to the measured tendon forces. The licensee revised TR 136 and submitted Revision 01 of the report with the non-normalized measured prestressing forces on September 17, 2001 (Reference 3).

In Section 4 of Revision 01 of the topical report, the licensee identifies the areas of follow-up examination to be performed during the next tendon surveillance. Overall, the NRC staff finds the procedures utilized, documentation prepared, and description of the follow-up examination in accordance with the containment ISI requirements in 10 CFR 50.55a and are acceptable.

3.0 CONCLUSION

Based on this review, the NRC staff finds that the procedures used by the licensee to perform the 25th year tendon surveillance and the methods used in evaluating the surveillance results are in accordance with NRC staff's recommendations in the NRC staff's SE of August 28, 1997. Additionally, the report also serves to fulfil the requirement of 10 CFR 50.55a and IWL-3300 of the ASME Code to provide an engineering evaluation report. Based on the review of the report, the NRC staff concludes that the procedures and method of evaluations used for examination of concrete and the post-tensioning system are acceptable

4.0 REFERENCES

1. Letter from B. Buckley, NRC, to J. Langenbach, GPU Nuclear Corporation, "Three Mile Island Nuclear Station, Unit 1 (TMI-1) Review of Twenty-Year Reactor Building Tendon Surveillance Report (TAC NO. M92045)," August 28, 1997.

2. Letter from AmerGen Energy Company to NRC, "Twenty-Fifth Year Reactor Building Tendon Surveillance (Period 7), Three Mile Island, Unit 1 (TMI Unit 1)," February 25, 2000.

3. Letter from AmerGen Energy Company to NRC, “Additional Information - TMI Unit 1 25th Year Reactor Building Tendon Surveillance Report,” September 17, 2001.

Principal contributor: H. Asher

Date: February 12, 2002

Three Mile Island Nuclear Station, Unit No. 1

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