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STAFF EXHIBIT 2

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Supp. No. 1

SAFETY EVALUATION BY THE

OFFICE OF NUCLEAR REACTOR REGULATION

FACILITY OPERATING LICENSE NO. DPR-50

GPU NUCLEAR CORPORATION, ET AL

THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)

DOCKET NO. 50-289

STEAM GENERATOR TUBE REPAIR

AND RETURN TO OPERATION

1. INTRODUCTION

On August 25, 1983, the Nuclear Regulatory Commission issued NUREG-1019, its Safety Evaluation dealing with the steam generator tube repair and return to operation of TMI-1. The staff concluded that the steam generator repair program was acceptable, that appropriate General Design Criteria (GDC) had been met, and that subject to resolution of open items identified in Section 5.3, there is reasonable assurance that the health and safety of the public will not be endangered by operation of TMI-1 with the repaired steam generators.

Since issuance of NUREG-1019, the licensee has provided additional information in Revision 3 to its Topical Report 008 and in its letter of September 30, 1983, which included Revision 2 of TDR-406 (SGTR Guidelines) as well as GPU comments on NUREG-1019. Updated versions of Emergency Procedures 1202-5 (OTSG Tube Leak/Rupture)) and Emergency Plan Implementing Procedure 1004.7 (Offsite/Onsite Dose Projections) have been made available to the staff. In addition, by letter of October 25, 1983, the licensee submitted TDR-488, TMI-1 OTSG Hot Testing Results and Evaluation.

The purpose of this Supplement is to update NUREG-1019 by addressing the above information.

In the SER, we provided a description of the repair method which focused on the 22-inch kinetic expansions which are limiting in determining that tube pullout from the tubesheet cannot occur under design basis accident conditions as a consequence of severance of the tubes at the tube repair transition zone. By letter dated September 30, 1983, the licensee noted that our SER did not clearly indicate that tubes were repaired using both 22-inch and 17-inch kinetic expansions. We agree with the licensee's comments.

The majority of tubes were repaired using a 17-inch expansion because the vast majority of defects were located near the top of the upper tubesheet. The 17-inch expansions provided for repair of tubes with defects down to 11 inches from the top of the tubesheet while retaining the 6-inch qualification zone. Tubes with defects between 11 inches and 16 inches were repaired using 22-inch expansions. Because the 22-inch expansion, which is the limiting case, was already addressed, the information does not alter the conclusions in our SER.

3 EVALUATION OF REPAIR

3.1 Determination of Causative Agent(s)

In the SER, at the top of page 8, we stated that "The thiosulfate tanks have also been physically removed." By letter dated September 30, 1983, the licensee pointed out that the lines which connect the thiosulfate tank to the reactor coolant system have been physically severed and sealed but the tank has not been removed. This information does not alter our conclusion in the SER.

3.2 Examination and Repair of the Remainder of the RCS

In the SER on page 9, we stated that "all corrosion-affected sections in the waste gas system have been replaced." By letter dated September 30, 1983, the licensee noted that only sections of the waste gas system with unacceptable corrosion have been replaced. Piping with minor corrosion indications will be placed on an augmented inspection list. We agree with the licensee, because sections of this low pressure system in which the corrosion indications were not significant need not be replaced.

to a maximum of approximately 2.6 GPH during the third cooldown transient when tube tension was maximized. If a throughwall crack of sufficient length to propagate due to flow induced vibration existed, a minimum leakage rate of 23 GPH is predicted for the most limiting tube. Leakage rates for nonlimiting tubes are predicted at up to 80 GPH. Therefore, because of the low primary to secondary leakage rates during steady state and transient conditions, we find that there is reasonable assurance that the OTSG's do not contain critical size defects which could jeopardize the tube integrity when subjected to postulated accident design basis tube loadings.

In Attachment No. 7 to this supplement, our consultant indicated that the effect on crack propagation of residual stress fields in the formed tubes and the effect during heatup of tube bowing on vibrational charac teristics should be further addressed by the licensee. As discussed below, the staff finds that additional discussion of the topics by the licensee is not required.

In Section V.C.1.c of the Topical Report 008, Rev. 3, the licensee stated that a transition length between 0.125 and 0.25 inch would be a goal, with a minimum acceptable transition length of 0.1 inch for the kinetically expanded tubes. This transition length is significantly longer than the original as-fabricated transition length of 0.0625-inch stated in Reference 17 of the Topical Report. The increase in transition length will cause a corresponding decrease in strain in the transition zone. Therefore, we find that the residual stresses in the transition zone of the kinetically expanded tubes would be lower than in the as-fabricated condition. Consequently, we conclude the transition zones should not be more susceptible to failure than the original as-fabricated transition zones.

Tube bowing is only of concern during plant heatup because the OTSG tubes which are relatively thin reach temperatures in thermal equilibrium with the coolant more rapidly than the OTSG shell and thus expand proportionally more rapidly than the shell during heatup. By letter dated September 30, 1983, the licensee indicated that tubes which have experienced a loss of pre-tension may exhibit bowing deflections during heatup which may allow them to touch adjacent tubes. During heatup, stress in bowed tubes will remain compressive and, therefore, the loading will not accelerate crack propagation. Since there is little or no flow during heatup, little or no flow-induced vibration exists. Consequently, the excitation force is miminal during heatup, and the flow-induced vibration of these tubes should remain below the levels exhibited by nominal tubes at full power.

Based on the above evaluation the staff finds:

1. Cracks which are large enough, i.e., critical size, to propagate due to flow-induced vibration are readily detectable by ECT;

2. Cracks which are below the threshold of ECT detectability will not propagate under combined cyclic, flow-induced and thermal loadings;

3. The maximum crack size which will remain stable during a MSLB has been determined;

4. Through-wall defects which may propagate during operation can be detected well below the threshold size that could fail during a MSLB.

coolant is continuously removed by the letdown system purification ion-exchangers and the actual concentrations of sulfur should remain at less than 0.1 ppm. The staff, therefore, finds that there is reasonable assurance that the peroxide treatment has effectively reduced the sulfur contamination of the reactor surfaces to an acceptable extent. The potential for sulfur-assisted corrosion during subsequent reactor operation is further diminished by the measures described in the Safety Evaluation for monitoring the sulfate concentration and adding lithium to the coolant.

Subsequent to the desulfurization treatment, the licensee carried out a pre-critical steam generator hot functional test program, the results of which were reported in TDR-488, TMI-1 Hot Testing Results and evaluation. This program included a series of rapid cooldown tests of the steam generators from 530°F to 350°F. Axial stress on the steam generator tubes is at a maximum during cooldown. Therefore, through-wall circumferential cracks which may exist can be predicted to open wider and increase in leakage rate. The condenser exhaust was monitored for Krypton-85, which had been added to the primary coolant as a leak indicator using two calibrated independent analyzers and grab samples analyzed off-site. The primary-to-secondary leak rate was well below the Technical Specification limit during all phases of the pre-critical steam generator hot functional test. The rapid cooldown did not result in significant additional leakage, as indicated by Krypton-85 analyses and by analyses of the steam generator water for boron and other primary coolant constituents. We independently verified the licensee's analytical results, the method of calculation and the degree of agreement among the different measurement methods. We find that the licensee's leak detection methods will detect primary to secondary leakage at levels significantly below the shutdown limit of 0.1 GPM above background.

These results provide added assurance that the repaired tubes are leak-tight and the contaminant has been reduced to concentrations