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INTERIM REPORT OF THIRD PARTY REVIEW OF THREE MILE ISLAND, UNIT 1, STEAM GENERATOR REPAIR

TO: RICK JACOBS

FROM: E.G. WALLACE

6 PAGES

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Prepared by

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date: 9/27/82

PURPOSE:

This is an interim report of the Third Party Review Group to evaluate a part of the TMI-1 Steam Generator Repair Program - that relating to the safety of conducting the proposed repair of the steam generators while the plant is in a cold shutdown condition, including the effects of the repair on the steam generators and on the remainder of the TMI-1 plant. This interim report was requested by R. F. Wilson, GPU Nuclear, on August 10, 1982 to obtain the Review Group's evaluation of this part of the steam generator program concurrent with decision making on conducting the repair in TMI-1. As GPU Nuclear completes the remainder of the overall repair program, the Review Group will report its evaluation of the remainder of Scope of Review defined in the Charter for this Third Party Review.

CONCLUSION:

Based upon the information developed by the repair program and summarized in the Safety Evaluation, the Review Group concludes that the proposed repair conducted on the TMI-1 steam generators in conformance with the control systems described will not have adverse effects on the nuclear safety related items of the plant (including the steam generators) in the cold shutdown condition. This includes consideration of potential hazards from:

1. Missiles generated by the explosive process.

2. Introduction of chemical residues in the steam generators, reactor coolant system or the reactor plant ambient.

3. Transmission of pressure pulses through air or structures to sensitive items such as previously expanded tubes, previously plugged tubes, other steam generator structures or safety related instruments and controls.

4. Handling of explosives in nuclear safety related equipment or structures (We note that no Review Group member is expert in handling explosives. Acceptance of the response to this potential hazard is based on the procedure controls described in the Safety Evaluation, their compliance with the Laws of the State of Pennsylvania and the exclusive use of blasters licensed in accordance with that Law).

5. Occupational radiation exposures.

This conclusion applies only to the safety of the plant, including the steam generators, of conducting the proposed repair while the plant is in the cold shutdown condition. This conclusion does not apply to the safety of returning the plant, with steam generators repaired by the proposed process, to service.

Although efficacy of the repair is not a consideration in the safety of conducting the repair, it will be important to the safety of returning the plant service. GPU Nuclear may elect to proceed with the proposed repair at substantial economic cost. The Review Group therefore considers it appropriate to render an opinion now about the efficacy of the repair as it may affect future safety considerations.

The Review Group believes that the proposed repair, after completion of the on-going qualification and when conducted in accordance with the control procedures, has a high probability of producing tube-to-tubesheet joints adequate for a safe operation of the plant. However, based upon industrial experience with expanded, unwelded tube-to-tubesheet joints in high pressure heat exchangers, it is expected that greater leak rates will occur during normal operation than typically experienced on new nuclear plant steam generators. The Safety Evaluation covering return of the plant to service should consider this possibility

APPROACH:

On April 12, 1982, R. F. Wilson of GPU Nuclear established a Third Party Review of the TMI-1 steam generator repair program. A Charter was supplied which defined the purpose, scope, membership and operations of the Review Group. The evaluations of the Review Group have been conducted in conformance with the Charter.

The membership of the Review Group, selected by GPU Nuclear for expertise in the following technical specialties is:

Specialty	Name	Affiliation
Steam Generator Design	E. J. Wagner	Burns and Roe, Inc.
Chemistry	D. J. Morgan	Pennsylvania Power & Light
Materials	R. W. Weeks	Argonne National Lab
Stress Analysis	A. Kalnins	Lehigh University
Safety Analysis	W. H. Layman	EPRI - NSAC
Plant Operations	S. A. Holland	Duke Power Co.
Non-Destructive Examinations	S. D. Brown	EPRI - NDE Center

E. G. Wallace of GPU Nuclear is a non-voting member who serves as liaison with GPU Nuclear and was assigned as Secretary. All members have been present and participated in all meetings of the Review Group.

It should be noted that the members act as independent individuals on this Review Group. Neither their individual statements nor their contributions to any reports of this Review Group are intended to represent the opinions or conclusions of the organizations with which they are affiliated.

The evaluation reported in this interim report was conducted concurrently with evaluation of the full Scope of Review defined in the Charter. The evaluation was conducted using reviews of pertinent documents, submittal of written questions to GPU Nuclear, written responses by GPU Nuclear, review of specialty topics by individual members, presentation by cognizant GPU Nuclear or contractor personnel, Review Group meetings and Executive Sessions of the Review Group members only. Full day meetings of the entire Review Group were held on April 23, May 20 and 21, and August 24 and 25, 1982.

The focus of the evaluation of this interim report was the Safety Evaluation of the TMI-1 steam generator repair distributed to the Review Group (E. G. Wallace letter of August 20, 1982 and of its reference documents 1, 2 and 4). The proposed repair described in this Safety Evaluation is the explosive expansion of the top 17 or 22 inches of the tubes within the top tubesheets of both steam generators. The repair will be made on all tubes which will be returned to service. The explosive expansion creates new pressure boundary joints between the reactor coolant and steam-side of the steam generators.

COMMENTS:

During the review of the Safety Evaluation and supporting documents, certain observations were made by the Review Group. These comments and the GPU Nuclear responses could be pertinent to the conclusions of the Review Group in assessing the return of the plant to service. They are therefore documented as follows:

1. The Safety Evaluation states that the repair joints will be leak tight and meet the design bases of the original joints. As the Review Group stated under Conclusion, the repaired joints will probably be adequately leak tight for safe operation. However, the joints should not be expected to be as leak tight in normal operation as those of typical new steam generators.

The Safety Evaluation for the return of the plant to service should consider the potential for higher leak rates from reactor coolant to steam systems and the handling of resultant radioactivity discharges such as from the condenser air ejectors. GPU Nuclear agreed.

2. Although indirect measurements provided some indication, the repair process qualification does not contain a direct metallographic examination to verify that the metallurgical structure of the tube material in the expanded region is not degraded by the expansion.

   GPU Nuclear said that such a metallographic examination would be included in the qualification.

3. Paragrapn 6.1 of the Safety Evaluation discusses residues left on the steam generator surfaces by explosive expansion. The Review Group understands that the testing at Mt. Vernon showed greater amounts of residue than expected based upon mock-up tests. Some cleaning is now expected to be necessary. GPU Nuclear further advised that a material called Immunol is under consideration as a coating to facilitate removal of residues. It would be applied to the tube surfaces before the explosive expanding.

   The Review Group suggested that specific limits and appropriate check methods be included in procedures to preclude existence of detrimental contamination from either the explosive residues or Immunol after completion of the repair. GPU Nuclear agreed.

4. Paragraph 6.5 of the Safety Evaluation indicates that the steam generators will be isolated by temporary plugs from the reactor coolant system during repair. However, a cognizant contractor person stated that, based upon the Mt. Vernon testing, temporary plugs might not be used.

   The Review Group considered it important to assure that contaminants from explosives not be allowed to travel into the reactor coolant system. GPU Nuclear agreed and reiterated that the temporary plugs will be used.

5. Paragraph 8.0 of the Safety Evaluation discusses the quality assurance and quality control for the repair.

   The Review Group asked whether a quality plan existed specifically for the repair. GPU Nuclear advised that the quality actions are an integral part of each procedure

and that all the repair activities would be conducted in accordance with written procedures and the TMI-1 Quality Assurance Plan.

A specific quality check of the adequacy of the overall explosive process (type of explosives, amount of charge, charge condition, correctness of assembly, etc.) was suggested by the Review Group as the type of check that might be identified by a specific quality plan for the repair. The intent of such a check would be to detect any repair process failure early rather than during testing at the completion of repair. This specific check might be conducted by actually explosively expanding a test joint periodically with production explosives and equipment. GPU Nuclear advised they would assure that the integral quality provisions of their procedures constitute an adequate quality plan for the repair and that an overall quality control check such as suggested would be included.