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Jim McGinley
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March 27, 2001
RMG-01-015

U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTN: Document Control Desk

Subject: TNW CAR 00-069
NRC Inspection Report No. 72-1004/00-201

Dear Sir,

This letter provides the information requested by the Nuclear Regulatory Commission (NRC) during the subject inspection. At that time TNW Corrective Action Report (CAR) No 00-069 had been issued to document a failure to detect rejectable indications by the UT examination. The investigation of root causes and corrective actions was in process. The results of the investigation are summarized in the attachment to this letter.

Please contact me at (510) 744-6020 or Tony Chen at (510) 744-6048 with any questions.

Sincerely,

Robert Grenier
President and Chief Operating Officer

Attachment

cc:  Deputy Director
Licensing and Inspection Directorate,
Spent Fuel Project Office,
Nuclear Material Safety and Safeguards

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TNW CAR 00-069
REJECTABLE UT INDICATIONS NOT DETECTED DURING INITIAL INSPECTION

Description of the Condition

The final acceptance ultrasonic examinations (UT) of cask confinement welds did not disclose unacceptable inclusions. The unacceptable weld conditions were instead identified as a result of a weld reexamination prompted by an inadvertent dropping of a canister during fabrication. The weld involved was the bottom-plate-to-shell weld. TNW wrote CAR 00-069 on the problem and was in the process of determining cause and corrective actions. The NRC inspection team noted that one of the corrective actions was to reexamine the bottom-plate-to-shell welds on all the canisters that had been fabricated or were in process of fabrication. TNW subsequently determined that the canister delivered to SMUD was acceptable and did not have any unacceptable inclusion. However, three canisters at PCC that had been welded, inspected by UT, and accepted were found to have unacceptable inclusions when re-inspected by UT. As an interim corrective action, PCC disqualified the UT examiners involved and subsequently had them re-qualified. PCC also required that each subsequent UT weld examination be done by the re-qualified UT technician (Level II Examiner) and his supervisor (Level III Examiner). The NRC team considered the interim actions taken by TNW and PCC to be adequate for continued fabrication.

Determination of Cause

PCC conducted an extensive root cause investigation that analyzed two (2) possible failure mechanisms. The first mechanism evaluated the possibility that the indications were not present during the initial UT inspection, and thus focused on the post-inspection manufacturing effects on the weld and their influence on the inspection results. The second mechanism investigated the possibility that the indications were present during the initial inspection but not detected by the UT Level II technician, and thus focused on the equipment and inspection personnel effects.

The results of the PCC investigation indicate that the first possible failure mechanism could not be substantiated. This conclusion is based on the comparison of sample UT indications between manufacturing processes. This conclusion is confirmed by analytical results where low stress levels introduced by subsequent manufacturing operations do not support the indication growth theory. The investigation of the second possible failure mechanism yields no evidence of equipment malfunction. PCC Level III examiners also witnessed each Level II technician's performance. No operator errors were observed. The Level II inspectors involved have over 14 years of UT experience. Based on this investigation PCC concluded that the only probable and reasonable cause is human or operator error. PCC's investigation has also determined that the extent of the error was isolated to three (3) individuals on this specific weld joint configuration and NDE method. Other contributing causes may include the weld joint design and welding process utilized.

In addition, PCC engaged an independent consultant to validate the investigation results. The consultant interviewed all personnel involved, reviewed training and certification procedures, qualification records, UT procedure utilized and equipment used. The consultant also observed the technician's testing methods and scanning technique. The consultant's analysis supports PCC's conclusion.

TNW also evaluated the adequacy of its fabrication oversight activities at PCC. Our review concluded that the qualification of the oversight personnel meets or exceeds the requirements of our program. Our oversight personnel have appropriate experience in the fabrication activities to perform effective oversight activities. The oversight plan and checklists used by the oversight personnel have the appropriate attributes for the level of oversight activities planned. TNW has committed adequate oversight resources at PCC.

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Remedial Actions Taken

PCC issued manufacturing holds to control the performance of additional UT inspection and the inner-bottom-plate-to-shell welding, and documented the identified issues in Corrective Action Reports in accordance with its QA program.

PCC Level III examiner re-inspected the delivered DSC at SMUD, and confirmed its acceptability. This conclusion was supported by TNW independent Level III over-inspection.

PCC Level III examiners also re-inspected this weld joint on three (3) additional canisters which were welded, but not UT inspected by Level II technician prior to the initial discovery of this deficiency. TNW also engaged an independent Level III examiner to perform a 100% over inspection of this weld joint on all canisters fabricated. All rejectable indications identified have been documented in non-conformance reports in accordance with the applicable QA program requirements.

PCC has removed all rejectable indications discovered during the re-inspection by machining or grinding the weld from the shield plug side. The removed areas were re-inspected by the appropriate NDE method prior to weld repair. The repaired areas were re-inspected in accordance with the established fabrication procedures. TNW's independent Level III examiner has performed a 100% over inspection of all repaired weld joints.

Action to Prevent Recurrence

PCC has counseled each individual involved on this deficiency including training in each of the possible failure modes used in the cause investigation and re-qualified the Level II technicians. An unannounced Level III over inspection program has been implemented by PCC where the next UT inspection by each Level II was 100% over inspected. The following UT inspection and every 5th thereafter by each Level II are 25% over inspected.

PCC has also taken actions to minimize the indications during welding of the inner bottom plate to shell. An extensive analysis and forensic investigation of the nature of the indications was performed to evaluate all aspects of this weld joint. To this end, PCC selected two canisters that were welded prior to the initial discovery of this deficiency. The study also evaluated the weld joint design, weld process, welder technique, back-grinding technique, use of gages and in-process PT inspection technique. Experienced weld engineering and NDE personnel performed 100% surveillance during the welding of the inner bottom plate to shell. The forensic investigation involved a controlled probe grinding of the UT detected weld indications to expose but preserve the indications. Exploratory excavation to expose suspect areas revealed predominant slag defects. As a result, the following actions have been implemented:

1. The joint preparation for the inner bottom plate weld was modified to increase the root opening for better welding accessibility.
2. The shell diameter in the area of the inner bottom plate was expanded prior to welding in order to compensate for weld distortion.
3. The weld process was modified to utilize SMAW until split bead FCAW can be welded. GTAW has been eliminated.

The above preventive actions have been implemented with a satisfactory result on one canister.

TNW will continue over inspection by an independent Level III examiner until there is sufficient confidence that the preventive actions are effective. TNW also made available additional oversight resources, discussed with our oversight personnel this deficiency and the need for a broad, intrusive oversight attitude.