



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D. C. 20555
November 9, 1988

Docket No. 50-316

MEMORANDUM FOR: Wayne E. Scott, Jr., Acting Project Manager
Project Directorate III-1
Division of Reactor Projects -III,
IV, V and Special Projects
Office of Nuclear Reactor Regulation

FROM: C. Y. Cheng, Chief
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Technology

SUBJECT: REQUEST FOR TECHNICAL ASSISTANCE - CRACKING OF
THE REACTOR COOLANT PIPING TO STEAM GENERATOR
NOZZLE WELDS AT D.C. COOK UNIT 2 (AITS 033288,
TAC NO. 68698)

In accordance with a Region III request for technical assistance dated October 4, 1988, the Materials Engineering Branch, NRR, has evaluated the welding problems associated with the steam generator replacements at D.C. Cook Unit 2. Extensive cracking occurred during the welding of the reactor coolant piping to the replacement steam generator nozzles. Our assessment of the issue was derived from the SER related to the licensee's topical report, a meeting with the licensee on September 19, 1988, a site visit between the period September 20-22, 1988 and the licensee's letter dated October 28, 1988. NRR received technical assistance from two consultants from Brookhaven National Laboratory and Parameters Inc. Region III personnel participated in both meetings.

The D.C. Cook replacement project was the first use of the flux cored arc welding (flux core) process to apply a stainless steel butter on a cast carbon steel nozzle. At the September 19, 1988 meeting the licensee concluded that the flux core process is equivalent to other flux processes and no ASME Code or regulatory restrictions exist for this application. The licensee encountered wetting and tie-in difficulties at the nozzle butter deposit. The licensee contended that the cracking problem was resolved with a change in technique, i.e., electrode angle and welding sequence. Before the September 19, 1988 meeting the licensee had removed all known defects and the welding was essentially completed. The licensee concluded that nondestructive testing would demonstrate that the final weld configuration would meet all applicable Codes.

The staff considered the cracking to be a significant event because of the number and depth of repair excavations. The site visit, review of records and interviews determined that factors, in addition to those presented by the licensee, contributed to the problem as described in the attached SER. NRR did not make a specific root cause determination because of the limited scope of the SER, the short amount of time spent at the plant site, and the absence of a cracked specimen for a failure analysis.

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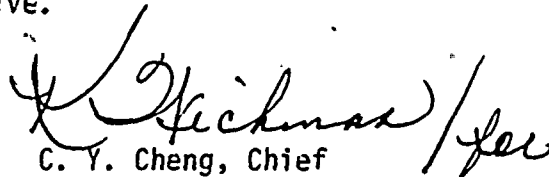
The staff made these findings:

1. The welding was performed based on the requirements of Section III, Section IX and Section XI of the ASME Code. The licensee lost control of the welding process in late August 1988 as a result of the tolerances in the essential variables and the non-essential variables. The degree of cracking is illustrated in the SER.
2. The licensee formed an experienced team to assess the problem and took corrective action. Flaws were excavated and joints rewelded with a modified procedure.
3. The structural integrity of the welds was addressed by the licensee with nondestructive examination methods that exceeded the requirements of the ASME Code.

The SER has the following conclusions:

1. The steam generator nozzle to primary piping welds are acceptable for service based on the nondestructive examinations that were performed.
2. The mechanical properties of the completed welds were not significantly affected by the repair process.
3. The nondestructive testing described in the licensee's October 28, 1988 letter will provide adequate assurance that defects that could cause a loss of structural integrity will be identified.
4. The staff did not find the automatic flux core arc welding process to be a prime contributing factor. The licensee experienced significant difficulties with the control of the welding parameters. The licensee resolved the problems, modified the welding procedure and repaired the welds.

This memorandum completes the requested task to provide technical assistance. A SALP input is not provided for this SER because the Region III activities cover additional functional areas; thus, a regional assessment of the entire replacement program would be more comprehensive.


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