U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION V

Report No. 50-206/79-10

Docket No. 50-206 License No. DPR-13 Safeguards Group

Licensee: Southern California Edison Company
2244 Walnut Grove Avenue
Rosemead, California 91770

Facility Name: San Onofre Unit 1

Inspection at: Camp Pendleton, California

Inspection conducted: June 6-20, 1979

Inspectors: D. P. Haist, Reactor Inspector — 7/10/79 Date Signed

P. P. Narbut, Reactor Inspector — 7/10/79 Date Signed

R. J. Pate, Reactor Inspector (Resident) — 7/10/79 Date Signed

Approved By: R. T. Dodds, Chief, Engineering Support Section, Reactor Construction and Engineering Support Branch — 7/10/79 Date Signed

Summary:

Inspection on June 6-20, 1979 (Report No. 50-206/79-10)

Areas Inspected: Nonroutine, announced inspection of steam generator eddy current examination activities, work activities associated with the discovery of crack indications in feedwater line welds at each of three steam generators (LER 79-010), and licensee action on IE Bulletin 79-02.

Results: No items of noncompliance were identified in the areas inspected.

DETAILS

1. Individuals Contacted

a. Southern California Edison Company (SCE)

*J. M. Curran, Site Manager
J. D. Dunn, Project Quality Assurance Supervisor
*G. W. McDonald, Quality Assurance/Quality Control Supervisor
B. L. Curtis, Supervising Engineer
R. Richardson, Metallurgist
M. P. Short, Nuclear Engineer
T. Timmins, Quality Assurance Engineer
W. Malay, Quality Assurance Engineer
G. M. Butler, Consulting Metalurgist

b. Zetec Corporation

E. Hako, Level IIA Data Evaluator, E/C
T. Meyers, Level IIA Data Evaluator, E/C

c. Bechtel Power Corporation (Bechtel)

P. Cady, Senior Construction Welding Engineer

d. Mobile Inspection Corporation

M. Fratt, Level III Examiner, Radiography

e. Westinghouse Electric Corporation

R. Hosley, Westinghouse Outage Coordinator
J. S. Caplan, Westinghouse Nuclear Technology, Principal Engineer
B. Lefebure, Senior Engineer

f. Kemper Insurance

G. Hill, Authorized Inspector

*Denotes attendance at exit interview.

2. Licensee Event Followup

(Open) LER 79-010 - The licensee notified the NRC Regional office via telephone on June 5, 1979, that circumferential crack indications on the "B" feedwater nozzle to pipe reducer weld were detected by radiography performed in accordance with a request from NRC Office of Nuclear Reactor Regulation. The station was undergoing a maintenance outage at the time.

Subsequent radiographs of the "A" and "C" feedwater nozzle to reducer welds disclosed an 8-inch long circumferential crack indication in the "A" line weld and indications in the "C" line weld tentatively interpreted as lack of penetration. An additional radiograph of the "B" line weld confirmed a 20-inch long crack indication. Inspectors were dispatched to the site to review the circumstances and corrective actions planned by the licensee and to witness repairs and nondestructive examinations as described in Paragraph 3 of this report.

The inspector and members of the NRC staff received a presentation by the licensee and Westinghouse Corporation at NRC HQ on June 13, 1979, concerning the circumstances and corrective actions planned by the licensee and an evaluation of the crack indication found. An interim report containing the details of the licensee's presentation to the staff was received on June 15, 1979, as a condition of resumption of power operations. The interim report indicates that the failure mechanism is stress assisted corrosion.

The licensee will submit, within 45 days of June 14, 1979, a final written report of this occurrence including the results of additional metallurgical analyses of the weld defects and a stress analysis of the feedwater piping system. The licensee has supplied a 3-inch square sample of the "A" line nozzle to reducer weld and a set of radiographs of the "A" line weld for independent NRC evaluation. This LER will remain open pending receipt and evaluation of the licensee's final report and an independent evaluation of this occurrence by NRC.

(Open) LER 79-08 - The licensee notified the NRC Regional office via telephone and letter on June 4, 1979, that in connection with a maintenance outage which began June 2, 1979, limited eddy-current examination of tubes in steam generator A had identified seven tubes having imperfections sufficient to require plugging. An inspector was dispatched to the site to review the examination activities in conjunction with followup on LER 79-010. The report of this inspection appears in Paragraph 4 of this report. This LER will remain open pending receipt and review of the licensee's followup report of this event.

3. Feedwater Reducer Repair

a. Review of Quality Related Documentation and Implementing Procedures.

The following procedures used for the feedwater line weld repair were reviewed to insure that they were consistent with the applicable codes (ASME Section I-1962 and Section XI-1974) and the San Onofre Unit 1 Quality Assurance Program.

(1) Weld Procedure for weld buildup of new reducers, P1-A-Lh, Revision 1.

(2) Weld Procedure for welding new reducer into feedwater line, P1-AT-Lh, Revision 3.

(3) Procedure Specification for postweld heat treatment of field welds, PHT-501, Revision 6.

(4) Special Engineering procedure SPE-157, Repair of Steam Generator Nozzle Welds, Revision 2.

(5) Special Engineering Procedure SPE-158, Removal of Feedwater Pipe to Steam Generator Nozzle Weld.

(6) Inspection Planning Data Reports for reducer weld buildups, reducer to pipe and nozzle welds and post weld heat treatment.

All of the above procedures appeared to be consistent with the applicable codes and Quality Assurance Program. However, SPE-157, Revision 1, had not included all the safety related activities for weld buildup of the new reducers for the feedwater line. Appropriate action was taken to revise SPE-157 as required by SCE Corrective Action Request (CAR) P-208. However, action to prevent recurrence had not been determined. This is an unresolved item. 50-206/79-10/01

b. Observations of Quality Related Activities

(1) Visual Inspection of reducer sections from feedwater lines to steam generators (S/G) A, B and C was conducted after the reducers were removed from the line.

S/G B reducer to nozzle weld had linear indications in the bottom portion of the weld inside diameter from about 5:00 to 9:00 o'clock. These indications were intermittently enhanced by deposits that were orange-brown to yellow-brown to white. (These were assumed to be corrosion deposits that had bled back from moisture in subsurface openings. There was some ID mismatch in the reducer to nozzle weld. The maximum mismatch was estimated to be 1/8" to 1/16" centered at 9:00 o'clock. This mismatch, plus the root concavity in the bottom portion of the weld, produced a notch effect at the root. Also, in the area from about 5:00 to 7:00 o'clock, 1/2" to 4" back from the center line of weld on the reducer ID, there were multiple linear indications that looked like shrink cracks running approximately parallel to the weld root.

S/G A reducer had indications at the root similar to S/G B reducer but less extensive. There was also some root mismatch. No linear indication (shrink cracks) back from the weld root were observed. Extensive drop-through was observed from approximately the 10:00 o'clock to 3:00 o'clock positions (across the top half of the pipe). Drop-through exceeded 1/4-inch in some places.

S/G C had no linear indications that were visually obvious. Also, there was very little or no mismatch at the root. Some spot corrosion was observed. Drop-through, similar in location but not as extensive as that on the "A" reducer to nozzle weld, was observed.

(2) The inspector visually observed weld build up and machining of the 10-inch end of each replacement reducer and 14-inch ID weld buildup and machining on the "A" and "C" replacement reducer. The inspector could not locate the Field Welding Checklist (WR-5) authorizing the ID buildup and giving the welder and machinist a dimensioned sketch or written instructions on the extent of work. The inspector found that instructions were being given verbally and that a WR-5 did not exist. A WR-5 form was immediately prepared to cover the 14-inch ID buildup operation.

The inspector examined each of the WR-5 forms covering shop work on the replacement reducers and found inconsistencies and omissions in areas such as AI hold requirements, quality verifications, designation of engineering specifications and drawings, NDE requirements and quality control hold requirements. In addition, the WR-5 forms for shop work were not completed and signed off prior to removal of the reducers from the shop and transfer to their final location inside the containment.

The inspector notified the site manager and Quality Assurance supervisor of his findings and identified two practices that may have contributed to the problems identified, (1) the use of the Bechtel WR-5 Field Welding Checklist form without adoption of the companion Work Plan Procedure/Quality Control Instruction and (2) the use of station Quality Control inspectors unfamiliar with the Bechtel system versus the use of Bechtel or SCE QC inspectors. Appropriate action was taken to correct the WR-5 forms and complete inspections of shop work by SCE Corrective Action Request (CAR) P-208. The licensee stated that prior to further welding activities, the WR-5 forms would be reviewed item-by-item in an onsite review committee meeting so that engineering and QC are thoroughly familar with the quality requirements. As described in Paragraph 3(a), above, action to prevent recurrence on future modifications or repairs had not been determined. This is an unresolved item. (50-206/79-10-01)

(3) Surface Examination and Weld End Preparations.

The inspector visually observed dye penetrant (PT) examinations of each S/G feedwater inlet nozzle. Examinations were restricted to approximately 2-inches axially due to the feedwater ring sleeve.

Initial PT of the "A" feedwater nozzle disclosed heavy pitting and corrosion particularly at the 5:00 o'clock to 7:00 o'clock positions. A weld buildup approximately 1/16-1/8 inch wide originating at the weld preparation was apparent in the nozzle bore.

The inside edge of this buildup created a shallow crevice with a linear indication connecting corrosion pits from the 5:00 o'clock to 7:00 o'clock positions. Numerous linear indications 1/8-1/4 inch in length at corrosion pits were in evidence at other locations. Initial PT of the "B" feedwater nozzle disclosed pitting and corrosion with linear indications 1/8-1/4 inch in evidence at some corrosion pits. As in the "A" nozzle bore, pitting was most severe at the 5:00 o'clock to 7:00 o'clock positions.

Initial PT of the "C" feedwater nozzle disclosed pitting and corrosion similar to the "A" and "B" nozzles with pits of measured depths of 0.030 inch. A weld buildup ranging from 1/8 to 1/2 inch wide by 0.070 inch high was apparent in the nozzle bore. A linear indication connecting corrosion pits at the weld buildup inside edge from the 5:00 o'clock to 7:00 o'clock position was apparent. Small linear indications at corrosion pits were also in evidence.

The licensee received instructions from Westinghouse to remove all linear indications and PT until clear prior to proceeding. Linear indications in the "A" and "B" nozzles were removed by grinding without exceeding the minimum wall of 0.580 inch. Linear indication on the "C" nozzle required grinding below minimum wall and subsequent repair welding, grinding and PT. The inspector questioned the condition of that section of the feedwater nozzle bore obscured by the feedwater ring thermal sleeve. Based upon the slow growth of postulated stress assisted corrosion and increased wall thickness, the licensee and Westinghouse did not feel that an inspection program was warranted.

The inspector observed manual weld preparation on the 10 inch feedwater pipe end. The inspector noted that dams were not installed to prevent tools, dirt, grinding chips, etc. from falling into pipes. The licensee immediately took appropriate action by installing dams and initiating a dam control log. A procedure was developed later that day for control of work on open nuclear piping and will be reviewed and approved for station use by the onsite review committee.

The inspector observed several E308 welding rod stubs near the "A" feedwater nozzle work station and approximately 25 E7018 rods (without portable rod oven) and 10 E308 rods in a open Bechtel tool box immediately outside of the containment equipment hatch. No weld rod issue slips were in the area and no welding was being done. The licensee stated that weld rod issue slips should be present although only convenience welding is being performed. The licensee stated that all uncontrolled rod and stubs will be removed prior to commencement of safety related welding. The control of weld filler material is considered unresolved pending a review of the licensee's weld filler material control procedures. (50-206/79-10-02)

(4) The inspector checked the final fitup of S/G A, B and C reducer 14 inch ends and measured the ID mismatch. Maximum mismatch on S/G A and B was less than 1/16 inch. Maximum mismatch on S/G C was 5/64 ± 1/64 (smallest division on measuring device was 1/16 inch. The root openings on all three fitups were approximately 1/8 inch. All three fitups were within the code allowable limits.

(5) The inspector observed a magnetic particle (MT) examination of S/G B feedwater nozzle to reducer (14 inch end) root weld. This was an in-process check not required by code. No unacceptable indications were observed.

(6) The inspector observed the liquid penetrant (PT) examination of the lower half for S/G C feedwater nozzle ID. The examiner found three small (1/4 inch) linear indications. Two of these were within 1/8 inch of the end of the feedwater ring sleeve. These indications were ground out and the repeat PT was clear.

(7) The inspector visually examined the completed welds for S/G A reducer before the reinforcement was prepared for nondestructive testing. A small spot of cluster porosity was observed on the bottom of both the 10 inch and 14 inch weld. This was removed during the surface preparation.

(8) The repair of the 10 inch end weld on the reducer for S/G B was observed. The requirements of the weld procedure P1-AT-Lh, Revision 3 were followed.

(9) Portions of the preheat and post weld heat treatment (PWHT) for S/G A, B and C reducer welds were observed. No deviations from the applicable procedures were noted.

(10) The inspector visually examined the completed feedwater pipe reducer welds for leaks while the S/G's A, B and C were at 900 psig and 530° F. No leaks were observed.

c. Review of Safety Related Records

The following records were reviewed during the inspection. Review comments are noted below.

(1) Radiographs of S/G feedwater line reducer to nozzle welds (14-inch end). The double wall radiographs taken prior to reducer removal and the single wall radiographs taken after removal were reviewed for each line:

"A" Line

Linear indications were observed in the root of the weld in the bottom half of the pipe. Drop-through was observed at the top half of the pipe. Root concavity was observed concurrent with the linear indications. Corrosion pits were observed in weld and base material.

"B" Line

Linear indications were observed in the root of weld in the bottom half of the pipe. Multiple smaller linear indications were observed in the area extending from the weld root into the reducer approximately 4-inches at 15-18 inches around the circumference from the top of the reducer.

"C" Line

Linear indications approximately 1/4-1/2 inch were observed at 17 and 22 inches around the circumference from the top of the reducer. Drop-through was observed in approximately the top third of the weld.

(2) Radiographs of feedwater line to reducer welds (10-inch end). The double wall radiographs taken prior to destruction of the welds were reviewed for each line:

"A" Line

Some drop-through and corrosion pits were observed. No linear indications were apparent. This was a shop weld.

"B" Line

Excessive drop-through and some slag were observed in the top half of the weld. Intermittent linear indications were observed in the bottom half of the pipe in the weld root area. This was a field weld.

"C" Line

Some porosity or corrosion pitting was observed. This was a generally good weld.

(3) Radiograph of the 90^{o} elbow on feedwater line to S/G A that had a UT indication (weld 393-7). The radiograph was clear.

(4) Radiographs of weld buildup on new reducers. Reducers for S/Gs A, B and C (10 inch end) and reducer for S/G A (14 inch end). All radiographs were clear except for limited porosity.

(5) Radiograph of new reducer to nozzle weld for S/G A (14 inch end, weld no. 393-10). Linear indication in root 9 inch to 13 inch from the top of the reducer. Judged to be mismatch in reducer to nozzle fitup.

(6) Radiograph of new reducer to pipe weld for S/G A (10 inch end, weld no. 939-9). Slag inclusions in area 15 inch to 18 inch from top that are acceptable by code.

(7) Radiograph of new reducer to nozzle weld for S/G B (14 inch end, weld no. 392-14). Unacceptable slag inclusion at 24 inch from top. Radiograph of grind-out shows slag removed.

(8) Radiograph of new reducer to pipe weld for S/G B (10 inch end, weld no. 392-13). Unacceptable linear indication at root in area near top of reducer. Appeared to be an inclusion. Unacceptable linear indication of root about 9 inches from the top. Both areas were repaired. Reviewed radiograph of reducer weld 392-13 after repair and outside surface had been prepared for UT examination. Slag inclusion at top of weld was reduced to an acceptable size and the area at 9 inch from the top had an acceptable cluster of small inclusions.

(9) Radiograph of new reducer to nozzle weld for S/G A (14 inch end, weld no. 393-10). Radiograph is clear, except for acceptable root mismatch.

(10) Radiograph of new reducer to pipe weld for S/G C (10 inch end, weld no. 391-9). Acceptable slag inclusion at 18 inches from top.

(11) Radiograph of new reducer to nozzle weld for S/G C (14 inch end, weld no. 391-10). Radiograph appears to have insufficient density. However, there was no density measuring instrument available when the radiographs were reviewed. This will be done in a future inspection. (50-206/79-10-03)

(12) UT results records for the reducer to nozzle weld on S/Gs A, B and C (14 inch end). No unacceptable indications were recorded. These examinations were made only from the reducer side with a 60° angle. No UT examination of the 10 inch end welds were attempted. A letter from the UT inspection contractor will be made available at a future inspection to explain why only a limited inspection was performed. (50-206/79-10-04)

4. Steam Generator (S/G) Tube Inspection

The inspector examined the licensee's actions relating to the steam generator tube inspection conducted in June 1979. Prior to the maintenance outage starting June 2, 1979, the licensee had detected steam generator leakage in S/G A well under the technical specification limit of Specification 3.1.4.c. The licensee performed a limited eddy current examination to determine the source of the leakage. S/G A and C were inspected. The licensee stated S/G B was not inspected because it had no leak indications and because of its good performance history from previous inspections. Although S/G C had no indications of leakage, it was inspected by eddy current examination because its performance history was not as good as the history of S/G B.

Prior to eddy current testing, one tube in S/G A was determined to be leaking by visual examination of the primary side of the steam generator tube sheet during secondary side hydrostatic test. S/G A and C were eddy current inspected from the inlet side and through the U-bend area. The outlet side was not inspected because of good performance history. S/G A and C were inspected in a pattern of every fourth row and column. In areas where increased wall thinning was noted, the inspection was increased to 100% of the tubes in the area. In S/G A, 642 tubes were inspected (approximately 17%). In S/G B, 216 tubes were inspected (approximately 6%). Seventeen additional tubes in S/G A were determined to have greater wall degradation than the plugging limit of 50% wall degradation. The eighteen tubes in S/G A were subsquently plugged. No tubes exceeded the plugging limit in S/G C. A review of the data was performed by Westinghouse resulting in identification of three additional tubes in S/G A with questionable indications. These three additional tubes were plugged. Of the 21 tubes plugged in S/G A, two tubes had wall degradation indications 2-3 inches below the top of the tube sheet, eight tubes had wall degradation indications at the top of the tube sheet, eight tubes had wall degradation indications about 2 inches above the top of the tube sheet, and 3 tubes had questionable indications identified by Westinghouse review.

The inspector reviewed a sampling of the eddy current magnetic tape recordings. Through discussions with the eddy current personnel, it was determined that the methods used do not differentiate between overall wall thinning and localized cracking.

The inspector had no further questions on this item.

5. Concrete Expansion Anchor Bolts

The inspector discussed the licensee's planned actions in response to IE Bulletin 79-02, Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts. The licensee stated that they did not plan to perform anchor bolt testing prior to their response to the bulletin. The inspector informed the licensee that their planned response did not meet the intent of the bulletin.

6. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance or deviations. Two unresolved items were identified during this inspection and are discussed in Paragraphs 3.b.(2) and 3.b.(3).

7. Exit Interview

The inspectors met with licensee representatives denoted in Paragraph 1 on June 11, 1979. The activities covered and observations and findings at that point in the inspection were discussed. The inspectors expressed their concern over the unresolved items and the need for complete action to prevent recurrence during future repairs.