

UPDATE REPORT ON IE BULLETIN 79-17

INSPECTIONS OF STAINLESS STEEL SAFETY RELATED  
PIPING CONTAINING STAGNANT, OXYGENATED,  
BORATED WATER

SAN ONOFRE NUCLEAR GENERATING STATION  
UNIT 1

October 5, 1979

7910150463

## I. INTRODUCTION

The purpose of this report is to present the findings of inspections, to describe short term and long term corrective actions being taken as a result of these findings, to describe and summarize the status of these findings and of IE Bulletin 79-17, and to evaluate the adequacy of corrective actions and NDE with respect to continued safe operation of San Onofre Unit 1.

## II. SUMMARY OF INSPECTIONS AND REPAIRS

In accordance with IE Bulletin 79-17, Item 2(b), liquid penetrant examination of a representative number of circumferential welds in normally accessible portions of safety related, stainless steel piping systems containing stagnant, oxygenated, borated water commenced on September 6, 1979.

During liquid penetrant examination of twenty-three (23) circumferential welds on September 6, 1979, several linear indications were found on two separate welds in the suction piping to the refueling water pumps. These indications were evaluated as cracks and written prompt notification of these findings was given to the NRC Office of Inspection and Enforcement, Region V by SCE letter (J. M. Curran) to the NRC (R. H. Engelken) dated September 7, 1979. The required fourteen day report describing the interim repair modifications and expanded scope of the inspections required by IE Bulletin 79-17 was submitted to Region V by SCE letter (J. T. Head) to NRC (R. H. Engelken) dated September 11, 1979.

The enclosure to the above-referenced fourteen day report indicated that the reinforcing collars designed as the interim repair modification to the two welds on the refueling water pump suction piping would be removed on a weekly basis to allow inspection of the crack areas for increased weepage.

During the first such inspection, on September 14, 1979, after performing verification testing on the suction side piping to determine vibrational characteristics of the piping both with and without the collars, increased weepage was observed in the previously reported through wall cracks and additional through wall cracks were observed. In addition, liquid penetrant examinations of the affected weld areas disclosed additional crack like indications and increases in the sizes of previously reported cracks. Prompt written notification was provided to NRC Region V by SCE letter (J. M. Curran) to NRC (R. H. Engelken) dated September 17, 1979.

Based on these results, it was determined that the reinforcement collars described in the September 11, 1979 report would be removed and the affected portions of the containment spray piping would be repaired by replacement and/or weld repair as appropriate. Accordingly, a plant cold shutdown was initiated at approximately 2000 hours on September 14, 1979 and repairs were commenced on September 15, 1979 with reactor coolant system temperature below 200°F. This repair effort has been completed and is detailed in Section IV, below.

## II. Summary of Inspections and Repairs (Cont'd)

In addition to the above, on September 15, 1979 while conducting ultrasonic examinations of stainless steel piping welds in accordance with IE Bulletin 79-17, Item 2(c), a crack like indication was discovered in the "A" safety injection line (Line No. 6008-6"-1501R) outside containment but inside the sphere enclosure building. The indication appeared to have originated within a weld heat affected zone from the ID surface of the pipe. The section of pipe containing the indication was removed from the line and a replacement piece welded in. Subsequent ultrasonic, radiographic and dye penetrant examinations performed at the station on the removed section have failed to identify the existence of the original indication. However, several previously undetected small indications were found on the inside diameter by the dye penetrant examination. The details of the repair effort on the section of Safety Injection line are described in Section IV.B below.

Portions of the line sections removed from the refueling water pump suction and safety injection piping have been shipped offsite for extensive metallurgical examination to better characterize the nature and extent of the cracking.

The unit remained in cold shutdown until the repairs were completed on September 17, 1979. The reactor remained non-critical through September 24, 1979 to facilitate the inspections inside containment required by Item 2(c) of IE Bulletin 79-17.

During the course of the above-mentioned repairs and inspections, two through-wall pinholes in weld areas of an associated line were observed and weld repaired. This line is a two inch, socket welded stainless steel line which branches off the refueling water pump suction piping to provide suction to the Refueling Water Storage Tank filter pump. The affected areas of this line were repaired as described in Section IV.C below.

The preliminary results of the inspections required by Item 2(c) of IE Bulletin 79-17 are discussed separately in Section III, below. No cracking other than that discussed above was found during the course of these inspections.

San Onofre Unit 1 was returned to service at 1602 hours on September 24, 1979, following completion of all required inspections and repairs.

## III. FINDINGS OF INSPECTIONS TO DATE

In accordance with IE Bulletin 79-17, Item 2(c), the required weld examinations begun on September 6, 1979 were expanded to encompass all safety-related, stainless steel piping systems of 2-1/2 inches and larger in diameter identified as containing stagnant, oxygenated borated water. The inspections were conducted outside containment during the period of September 7-25, 1979, and those inside containment during September 14-24, 1979.

### III. Findings of Inspections to Date (Cont'd)

Since the examinations were of two types: dye penetrant and volumetric (U.T.), discussion of the preliminary results will be divided into two categories.

#### A. Dye Penetrant Examinations

Approximately 325 welds in safety related, stainless steel piping systems of 2-1/2 inches and larger in diameter containing stagnant, oxygenated borated water were liquid penetrant examined. The piping in this category was primarily ASTM A-312, type 304 stainless steel schedule 10 located outside containment in areas which are fully exposed, partially exposed or unexposed to the environment.

Systems examined included Safety Injection, Chemical and Volume Control, Containment Spray and Recirculation.

Other than the aforementioned indications of cracking in the re-fueling water pump suction, no additional cracking was identified during this phase of the inspections.

#### B. Volumetric (Ultrasonic) Examinations

In accordance with IE Bulletin 79-17, Item 2(c), all safety-related, stainless steel piping systems of 2-1/2 inches and larger in diameter containing stagnant, oxygenated borated water were volumetrically examined. Ultrasonics was chosen as the method of volumetric examination. Methods and procedures utilized in the ultrasonic examinations will be discussed in the final report required by IE Bulletin 79-17.

Approximately 220 welds inside containment and 475 welds outside containment were examined ultrasonically. The systems examined included Safety Injection, Residual Heat Removal, Containment Spray, Chemical and Volume Control, Recirculation, and Spent Fuel Pool Cooling.

All welds examined were clear of problems, with one exception. The one indication of potential cracking was in Safety Injection Weld No. 6008-16a. Subsequent radiographic examination proved inconclusive, and the section containing the weld was removed from the line and replaced (reference Section IV.B for details). Follow-up radiographic, ultrasonic and dye penetrant examination failed to confirm the existence of the original ultrasonic indication. However, during the dye penetrant examination of the removed section, several previously undetected small linear indications were found on the inside diameter. The maximum length noted was 1/8", with one exception at 5/8". The indications are longitudinal in direction and randomly spaced around the inside circumference. The indications are undergoing continuing evaluation to determine their significance. A representative portion

### III. Findings of Inspections to Date (Cont'd)

of the line containing the weld in question (approximately 3" on each side of the weld) has been shipped offsite for extensive metallurgical analysis.

Result of the metallurgical analyses on the removed piping sections will be submitted as part of the final response to IE Bulletin 79-17.

### IV. DESCRIPTION OF REPAIRS

Three separate replacement/repair efforts were accomplished during the period of September 14-24, 1979. The following sub-sections detail each effort.

#### A. Refueling Water Pump Suction (Line No. 729-8"-HP)

Cracks previously discovered in the heat affected zones of weld Nos. 729-6 and 729-16 in line No. 729-8"-HP on September 7, 1979 were re-examined on September 14, 1979 and found to have increased in number and/or size.

Additional crack indications in Weld No. 729-6, beyond those originally reported, were apparent upon re-examination and one of the previously reported cracks was showing evidence of liquid weepage. Weld No. 729-16, originally reported to have two 1/4" through wall cracks with barely perceptible weepage, was noted to have an additional crack and a through wall pinhole on top.

Based on these results, a cold shutdown was initiated on September 14, 1979 in order to replace the affected sections of Line 729. Two sections of pipe, one between Weld Nos. 729-5 and 729-7, and one between Weld Nos. 729-11a and 729-16, were removed from the line following securing and draining of the system. (Reference attached Dwg. No. 334734 for weld locations.) A procedural requirement for dye penetrant examination of all weld prep areas prior to welding led to the discovery of cracking in the weld prepared ends of the north refueling water pump suction block valve and the check valve installed in line No. 729. The cracks, none of which were identified as through wall, were apparently the result of chloride stress corrosion cracking on the weld prep area of the valve bodies. Crack indications in the weld prep areas of both valves were completely removed prior to the commencement of welding. The hot pass of each new weld was dye penetrant examined before proceeding with successive passes.

IV. Description of Repairs (Cont'd)

Replacement materials used included one 8", schedule 10, SA-403 type 304, 90° elbow and two lengths of 8", SA-312, Type 304 stainless steel schedule 10 pipe.

Repairs in this area were completed by September 17, 1979. Repairs, subsequent visual and liquid penetrant inspection and in-service leak testing were performed to the requirements of ANSI-B.31.1-1977.

B. Safety Injection to "A" Loop (Line No. 6008-6"-1501R)

An indication in Weld No. 6008-16a of Line No. 6008-6"-1501R was detected by ultrasonic methods on September 15, 1979. When radiographic examination produced inconclusive results, the decision was made to remove and replace the section in question.

An 18" section containing Weld No. 6008-16a was cut from the line and a replacement piece welded in. (Reference attached Dwg No. 334583 for weld locations.) The replacement piece was SA-312, type 316, schedule 80 pipe.

Repair, visual inspection and in-service leak testing was in accordance with the requirements of ANSI-B.31.1-1977. The hot pass of each new weld was dye penetrant inspected and the completed welds were radiographed.

C. Refueling Water Storage Tank Filter Pump Suction (Line No. 8021-2"-HP)

As noted in Section II, above, Weld Nos. 8021-9 and 8021-11 in Line No. 8021-2"-HP were each observed to have a through wall pinhole with barely perceptible weepage in the heat affected zones. (Reference Dwg. No. 334799 for weld locations.) Weld No. 8021-11 was weld repaired, and the repair dye penetrant examined and in-service leak tested in accordance with the requirements of ANSI-B.31.1-1977.

During the repair of the pinhole leak in Weld No. 8021-9, grinding caused an increase in the size of the through wall leak, and the weld in question was sleeved over on September 23, 1979. Materials used for the sleeving included: one schedule 40, SA-182WP, type 304L, 3000#, 2-1/2" x 3" socket weld coupling; one schedule 40, A-403, type 304L, 3000#, 3/4" x 1/2" swage fitting, and one SA182, type 304L, 1/2" cap. The repairs and visual inspections were made in accordance with the requirements of ANSI-B-31.1-1977.

#### IV. Description of Repairs (Cont'd)

In evaluating the installation of the sleeve, the following aspects were considered:

1. The weight addition represented by the sleeve is less than 1-1/2% of the total weight of the pipe.
2. Weight and other sustained loads are unaffected by the addition of the sleeve.
3. Occasional loads (e.g. seismic) applied to the piping system are unaffected by the addition of the sleeve.
4. The pressure boundary is maintained by the sleeve.

Accordingly, the piping systems, with the addition of the sleeve, will perform its intended function. In addition, the affected portion of pipe will be replaced during the next refueling outage scheduled to commence in March-April, 1980.

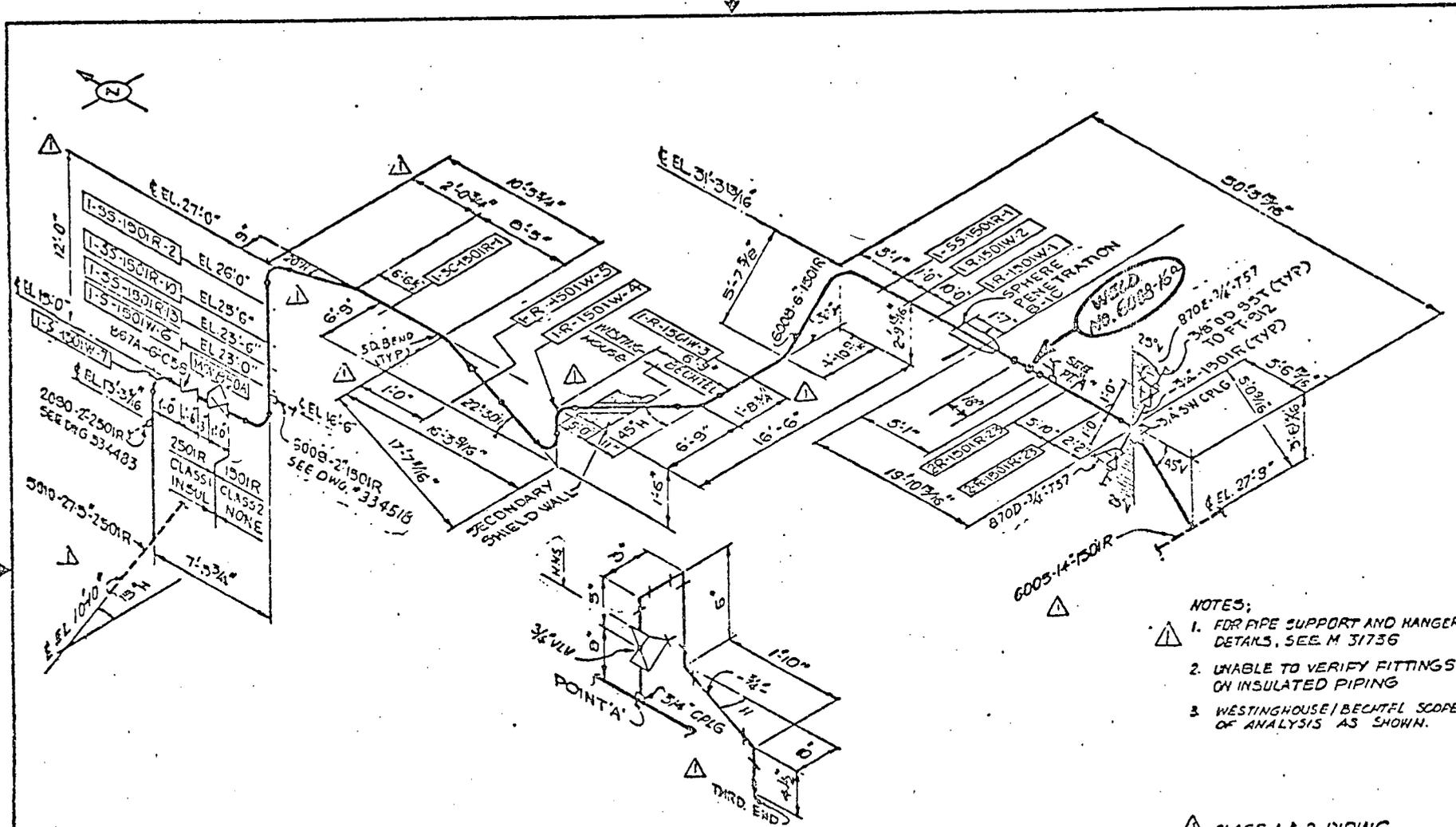
#### V. CORRECTIVE ACTION AND CONCLUSION

The above-described repairs have returned the refueling water pump suction and safety injection lines to the original configuration. Metallurgical evaluations are in progress to determine the nature and extent of the observed cracking as well as the probable cause.

Details of the complete inspection program and any additional corrective actions deemed necessary will be included in the 120 day final response to IE Bulletin 79-17.

Based on the above completed and planned actions, there is reasonable assurance that San Onofre Unit 1 may continue in operation without undue risk to the health and safety of the general public.





- NOTES:
1. FOR PIPE SUPPORT AND HANGER DETAILS, SEE M 31736
  2. UNABLE TO VERIFY FITTINGS ON INSULATED PIPING
  3. WESTINGHOUSE/BECHTEL SCOPE OF ANALYSIS AS SHOWN.

▲ CLASS 1 & 2 PIPING

SAFETY RELATED

▲ CERTIFIED AS BUILT

BOP-SEISMIC REEVALUATION  
ANALYSIS BOUNDARY-ISOMETRIC  
UNIT 1

INFORMATION ONLY  
NOT FOR CONSTRUCTION

NO.	SCHEM.	DATE

BECHTEL CORPORATION ENGINEERS & CONSTRUCTORS LOS ANGELES, CALIF.			J.D. NO. SAN ONOFRE NUCLEAR GENERATING STATION		
JOB NO. 7186-001	DATE	APPROVED	FILE	ISOMETRIC-LINE NOS: 6008-6-1501R. 6008-6-2501R FROM: 6005-14 TO LOOP A COLD LEG	
2 INCORPORATED CCM#1 (6008-6-1501R) (23rd) 6-26-51 J.C.T. P.D. N/A			SOUTHERN CALIFORNIA Edison COMPANY LOS ANGELES CALIF		
1 INCORPORATED DCN #1 AND #2 3-11-51 S.M.P. N/A			SCALE NONE		
0 AS BUILT 9-2-51 S.A. Z.B. N/A					
NO. REVISIONS			DATE DR CHK EGS. CH.F. P.E. O.A.E.		

▲ 334583-2

