

TENNESSEE VALLEY AUTHORITY  
CHATTANOOGA, TENNESSEE 37401  
400 Chestnut Street Tower II

SNRC REGION II  
ATLANTA, GEORGIA

February 2, 1982  
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U.S. Nuclear Regulatory Commission  
Region II  
Attn: Mr. James P. O'Reilly, Regional Administrator  
101 Marietta Street, Suite 3100  
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

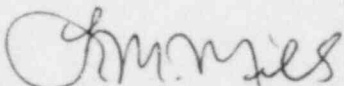
BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2 - LACK OF INTERNAL PURGE ON TWO WELDS IN CHEMICAL ADDITION AND BORON RECOVERY SYSTEM - NCR 1171 - FINAL REPORT

The subject nonconformance was initially reported to NRC-OIE Inspector J. D. Wilcox on April 17, 1980 in accordance with 10 CFR 50.55(e). Interim reports were submitted on May 16, June 3, July 23, and December 1, 1980 and June 24, September 15, and November 23, 1981. Enclosed is our final report.

If you have any questions concerning this matter, please get in touch with R. H. Shell at FTS 858-2688.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



L. M. Mills, Manager  
Nuclear Regulation and Safety

Enclosure

cc: Mr. Richard C. DeYoung, Director (Enclosure)  
Office of Inspection and Enforcement  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555



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ENCLOSURE

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2  
LACK OF INTERNAL PURGE ON TWO WELDS IN CHEMICAL ADDITION  
AND BORON RECOVERY SYSTEM

NCR 1171  
10 CFR 50.55(e)  
FINAL REPORT

Description of Deficiency

During routine rework operations of the Chemical Addition and Boron Recovery System, it was discovered that two welds (ONB-00367 and ONB-00368) had evidence of lack of internal purge or 'sugaring.' The original investigation revealed a training program had been initiated by the pipefitter welder's foreman where an inexperienced welder made the root passes and an experienced welder completed the remainder of the weld. Nonconformance report (NCR) 1171 was written to document and disposition the discrepant condition.

A spot radiography program was established to determine the extent of sugaring present in all of the welds made by these two welders. During the course of radiographing the suspect work of the originally identified two welders, it was discovered that other welders had made welds exhibiting this same condition in other systems.

After trying unsuccessfully to identify a common factor attributable to the sugaring in various plant systems, TVA decided to identify and statistically sample, utilizing the techniques of Mil-STD 105D, all stainless steel butt welds requiring internal root purge made before January 15, 1980, the date of inception of Bellefonte's spot radiography program.

Safety Implications

The Waste Disposal System (WDS) and Chemical Addition and Boron Recovery System (CA&BRS) piping involved is small diameter (2 to 3 inch) piping, and though it is classified ASME III-3, it serves no safety-related function. Both are low pressure systems, and the probability of a failure in the piping systems is low even considering the improper welding. Should a failure of the system piping occur, the released radioactive water would be collected in the Auxiliary Building sump and any gaseous releases would be processed by the charcoal adsorbers and HEPA filters in the ventilation system before release to the environment.

The Spent Fuel Cooling System (SFCS) units 1 and 2, piping involved ranges from 1 to 12 inches in diameter. A failure of this piping would release radioactive water which would be collected in the Auxiliary Building sump. Any gaseous releases would be processed by the charcoal adsorbers and HEPA filters in the ventilation system before release to the environment.

A failure of unembedded welds on the Spent Fuel Cooling System, unit 1 or 2, would mean that the system piping could not drain the respective spent fuel pool level lower than 16 feet 6 inches above the top of the stored spent fuel elements. Such a failure could interrupt normal spent fuel cooling in the affected spent fuel pool. However, the spent fuel can be adequately cooled by boiling of the water in the spent fuel pool. Though this is not a design basis mode of spent fuel cooling, the spent fuel pool is capable of withstanding the elevated temperature. Makeup to the spent fuel pool to replace water inventory boiled off would be provided by a fire hose connected to a permanently installed connection to the Essential Raw Cooling Water System (ERCW). A conservative analysis has shown that the event of pool cooling releases at the site boundary are approximately 11 percent of 10 CFR Part 100 allowables. Thus, the spent fuel would remain adequately cooled and radioactive releases would be within limits.

Therefore, a failure of the Waste Disposal System, Chemical Addition and Boron Recovery System, or the Spent Fuel Cooling System, unit 1 or unit 2, piping would not adversely affect the safe operation of the plant or result in an unacceptable release of radiation to the environment.

A failure of the affected welds in the ERCW System could precipitate a failure of the ERCW System and therefore could adversely affect the safety of operations of the plant.

#### Corrective Action

Previously, TVA reported that the work of 221 welders, responsible for making in excess of 5100 welds, comprising the total sample space of all plant safety-related systems affected, would be sampled by spot radiography for evidence of lack of internal purge or sugaring. Actually, welds made by a total of 182 welders were radiographed in a total sampling space of 4,206 welds. The reason for the difference is that 39 welders made socket welds (requiring no internal purge) or made butt welds that were embedded and inaccessible for spot radiography. Therefore, these welders and their corresponding welds could not be counted in the total sampling space. Of the 39 welders involved, one welder made only socket welds. The remaining 38 welders made a combination of socket and embedded butt welds. Those embedded and inaccessible butt welds, where uncertainty exists with respect to the weld's internal root condition, have been dispositioned by NCR 1555, a nonreportable NCR that was evaluated based on the findings and disposition of NCRs 1001, 1053, and 1054. These NCRs document the nonconformance of unembedded and embedded welds in safety-related systems because of inadequate argon gas purge resulting in a 'sugared' condition. The embedded welds were dispositioned 'use-as-is.' This determination was based on the following reasons: the affected piping systems conformed to the applicable ASME code; the surrounding concrete effectively eliminates pipe deflection and bending stress; conservative calculations indicated the minimum wall thickness requirement was met; and thermal cycling effects were considered negligible because of an effectively constant temperature.

There were 1591 spot radiographs taken representing the total 4,206 weld sample spaces. Based upon a 99-percent confidence level of acceptance as defined by Mil-STD 105D, twelve (12) welders out of the 182 sampled failed the statistical hypothesis and consequently, all welds made by these welders were spot radiographed or visually examined where accessible. There were four (4) welders out of the twelve who had some welds that were embedded and inaccessible for spot radiography. These welds are also being dispositioned by NCR 1555.

The results of the NCR 1171 investigation revealed that a total of 178 plant system welds had some degree of sugaring. Where internal weld roots could be checked visually, owing to routine plant system rework operations, this method was used in lieu of spot radiography for verification of acceptable root condition. A breakdown of rejectable welds for each affected plant system is as follows.

<u>System</u>	<u>No. of Welds Rejected</u>		
	<u>Spot RT</u>	<u>Visual Exam</u>	<u>Total</u>
1KE (ERCW Unit 1)	4	1	5
2KE (ERCW Unit 2)	0	1	1
0NB (CA&BRS Common)	20	45	65
1NB (CA&BRS Unit 1)	12	58	70
2NB (CA&BRS Unit 2)	4	27	31
2NM (SFCS Unit 2)	3	2	5
OWD (WDS Common)	<u>1</u>	<u>0</u>	<u>1</u>
	44	134	178

Statistics confirm that Bellefonte's sugaring problems were confined primarily to the Chemical Addition and Boron Recovery System since 93.26 percent of the total welds found rejectable were located in these systems. All of the 178 rejectable sugared welds have been cut out and rewelded.

During the course of Bellefonte's NCR 1171 investigation, it was determined that socket welds on thin wall (less than 0.100" wall thickness) pipe/tubing were also a concern with respect to internal purge adequacy. QCIR 5727 was written to document and disposition the concern. A total of seven (7) socket welds in this category were found not to have been purged internally during welding. These welds were all located in the CA&BRS and are included in the above totals for rejectable system welds found sugared.

Bellefonte's spot radiography program (BNP-SOP-711), instituted in January of 1980, has established an additional check on the overall welding program to help preclude the possibility of this type of QA violation from going undetected.

All craft foremen involved with welding operations have been instructed through the site QA program of their responsibility in complying with QA requirements.

Those welders that exhibited poor performance records with regard to lack of internal purge have had their certifications revoked.