ENCLOSURE

TEXAS UTILITIES GENERATING COMPANY
COMANCHE PEAK STEAM ELECTRIC STATION
UNIT 1
DOCKET NO. 50-445

SAFETY EVALUATION REPORT SUPPLEMENT

INSERVICE INSPECTION SECTION
MATERIALS ENGINEERING BRANCH

5.2.4 Reactor Coolant Pressure Boundary Inservice Inspection and Testing

This section was prepared with the technical assistance of DOE contractors from the Pacific Northwest Laboratories and Oak Ridge National Laboratory.

This evaluation supplements conclusions in this section of NUREG-0797, which addressed the definition of examination requirements and the evaluation of compliance with 10 CFR 50.55a(g).

5.2.4.1 Evaluation of Unit 1 Compliance with 10 CFR 50.55a(g)

In this section of NUREG-0797, Supplement No. 4, the staff determined that the Preservice Inspection (PSI) Program was acceptable with the exception of the chapter on relief requests that was incomplete. During an inspection conducted at the plant site between September 7-13, 1982 NRC Region IV inspectors observed the PSI of cast stainless steel (CSS) piping welds and reported their conclusions in NRC Inspection Report 50-445/82-19. In a letter dated February 24, 1984, the staff requested that the Applicant address this inspection report and provide additional information pertaining to the ultrasonic testing (UT) of the CSS piping. The Applicant provided a response in report entitled "Demonstration of Ultrasonic Examination Techniques Applied to Welds in Main Coolant Loop Piping" submitted in a letter dated July 6, 1984.

The NRC staff and the nondestructive testing industry are in general agreement that performing ultrasonic testing of cast stainless steel is extremely difficult because of the poor acoustical properties of the materials of construction. This technical issue was discussed with the Applicant at a public meeting held in Bethesda, Maryland on March 3, 1982. Inspection Report 50-445/82-19 discusses observations by NRC inspectors that adequate material penetration could not be verified because only a sporadic back reflection could be identified during the longitudinal wave examinations. During the angle beam examination, the increased gain for the examination saturated the cathode ray screen such that no indications in the first half of the pipe thickness could be identified or evaluated. The examination of weld #13 on Unit 1 isometric drawing TBX-1-4200 was specifically identified by the NRC inspectors.

In the February 24, 1984 letter the staff requested that the Applicant consider a confirmatory examination at Comanche Peak Station on a minimum of three welds with the best available instrumentation. Although the staff was not questioning the PSI of the reactor coolant pressure boundary piping as a whole, the staff believed that the confirmatory examination requested would determine whether (1) the cast stainless steel pipe at Comanche Peak has poor acoustical properties or (2) improvements have been made to the ultrasonic testing instrumentation that resulted in a more effective examination at other nuclear plants. In the event improvements had been achieved in the state-of-the-art of ultrasonic instrumentation since the PSI of Comanche Peak Unit 1, the staff intended to require that future inservice inspections, after the licensing of Comanche Peak Unit 1, be performed as a minimum with the improved ultrasonic testing instrumentation. The Applicant arranged for a confirmatory examination and demonstration by the preservice inspection contractor, Westinghouse, on March 20-21, 1984. Two (2) NRC inspectors from Region IV, including the author of report 50-445/82-19, attended the meeting. DOE contractors from the Pacific Northwest Laboratories and Oak Ridge National Laboratory also observed the confirmatory examination to assist the staff in their review of the issue.

The demonstrations at the plant site on March 20-21, 1984 were conducted on two laboratory pipe weld mock-ups that had been machined flat which contains mechanically induced fatigue cracks, one primary coolant loop weld (#13 on isometric drawing TBX-1-4200) in Unit 1 and four (4) primary coolant loop welds (#5, #6, #7, and #8 on isometric drawing TCX-1-4400) in

Unit 2. The test instrument was a Sonic Mark I. The search unit was a nominal 1-MHz Gamma 1-inch-diameter transducer unit examining through a standoff (filled with water) that, in turn, made contact with the pipe entry surface and produces a nominally 40° refracted longitudinal wave. Ultrasound is transmitted through the couplant path that consists of (1) the water column, (2) the Neoprene rubber boot, and (3) a commercial surface contact couplant. The basic calibration block is ASTM A-351, Grade CF8M centrifugally cast stainless steel approximately 2.2 inches thick and contains three 3/16-inch diameter side-drilled holes at depths from the entry surface of 1/4, 1/2, and 3/4 of the block thickness. This block was identified as TBX-2, HTC 1438, and had been used for the Unit 1 preservice inspection performed during September 7-13, 1982. Distance amplitude correction curves were established on the side-drilled holes at reference and scan gain settings. Scanning of the two laboratory pipe weld specimens, approximetely 1-15/16 inch thick, that contains fatigue cracks of nominal depths of 10% and 15% of the thickness, did detect the cracks at some repeatable positions along the crack length. The specimens used were identified as Westinghouse pipe weld fatigue crack samples DGRP 40605, weld 7 DW1, and DGRP 40605 weld 6 OV1.

Pertinent information about the location, configuration and origin of the materials of the five (5) welds selected for the field demonstration are as follows:

Item	Material / Heat	Manufacturer /Date
Unit 1, Weld #13 27 1/2" x 22° Elbow (Loop 2)	SA351, CF8A/ Ht. 3-3249-1620, Ser. #4	Breda Fucine Meridionali, Bari, Italy/1976
Unit 2, Weld #5 31" I.D. x 40° Elbow (Loop 4)	SA351, CF8A/ Ht. 3-3612-0762, Ser. #12	Breda Fucine Meridionali, Bari, Italy/1977
Unit 2, Weld #6 31" I.D. x 4'6-7/8" Pipe (Loop 4)	SA351, CF8A/ Ht. 156375, Pc. 2	Sandusky Foundry, Sandusky, Ohio/1978
Unit 2, Weld #7 31" I.D. x 90° Elbow (Loop 4)	SA351, CF8A/ Ht. 3-3729-1939, Ser. #18	Breda Fucine Meridionali, Bari, Italy/1976
Unit 2, Weld #8 31" I.D. 3'5-3/4" Pipe (Loop 4)	SA351, CF8A/ Ht. 156375, Pc. 2	Sandusky Foundry, Sandusky, Ohio/1978

Observations by the staff of the field demonstration are summarized as follows. The surface preparation of Unit 1 weld #13 was not adequate for ultrasonic inspection. The surface condition of the elbow adjacent to the weld was, for the most part, as-cast. The weld crown area had been ground to the extent that a depression of approximately .250 inches occurred around the circumference of the weld. During an examination with a 0 degree longitudinal wave, a continous back reflection could not be maintained from the pipe (CSS) side of the weld. This apparent lack of penetration was the result of a combination of surface roughness and material acoustic properties. A continous back reflection was maintained from the nozzle side of the weld. During an examination with the 40 degree angle longitudinal transducer weld counterbore was obtained from the nozzle side of the weld. The ambient acoustic noise level present during the demonstration appeared to be between 40-50% full screen height. The staff reached the conclusion that for Unit 1 weld #13, the findings in NRC Report 50-445/82-19 were confirmed and the lack of surface preparation for ultrasonic examination of the elbow base material appeared to be the major factor contributing to the examination difficulties.

The field demonstrations continued at Unit 2 because the primary piping system welds were not yet insulated, as were the majority of welds in Unit 1, and a sufficient population of welds was available to reach a definitive conclusion about the ability to perform ultrasonic examinations. In contrast to Unit 1, the surface condition adjacent to the four welds in Unit 2 selected for the demonstration was much better than that noted for weld #13 in Unit 1. In particular, the elbow outside diameter surfaces were machined by the supplier for a greater distance from the edge of the weld preparation. During the examination of the four (4) welds, a continuous backwall reflection was maintained during the 0 degree longitudinal wave examination of the pipe. The backwall signal was strong (not sporadic and attenuated as the signal was for weld #13 in Unit 1) and the counterbore was located in all four field welds by the straight beam test. However, the angle beam search unit required a longer metal path than was possible on three of the field welds. The fourth weld (field weld 29) had an adequate surface preparation to allow the angle beam detection of the counterbore. The counterbore signal was evident at intervals around the weld and gave a large near-constant amplitude response in the areas scanned. The fact that three of the four welds examined limited the angle beam demonstation of the counterbore step will not affect the flaw detection scanning of the weld areas. Since the staff was satisfied that ultrasonic penetration of Unit 2 cast pipe was possible, no further demonstrations were requested.

Based on a review of the above information the staff has reached the following conclusions regarding the ability to perform preservice and inservice inspections of the cast stainless steel pipe welds at the Comanche Peak plant:

1. The examination procedures used during the preservice inspection of Unit 1 meet the methodology requirements of Section XI of the ASME Code.

2. One of the objectives of the preservice examination is to identify limitations to future inservice examinations. NRC Inspection Report 50-445/82-19 indicated that the ultrasonic results from other cast stainless steel welds in Unit 1 were similar to the observations on weld #13. Although Section XI of the ASME Code does not have

quantitative requirements for the surface preparation of welds to allow ultrasonic examination, the staff assumes that the plant Owner or his inspection agency will assure that practical measures have been completed to adequately prepare components for valid future examinations. The surface condition was good and sufficient for the examination of the four pipe welds in Unit 2. Therefore, the Applicant recognizes the measures needed to be taken to prepare the Unit 1 welds for the required examinations

3. For the Unit 2 welds the ultrasound was penetrating the region of the weld subject to examination and produced reflections from inherent geometrical conditions in the pipe that could be interpreted.

4. For the Unit 2 welds the detection of significant construction-type defects, if present, would be possible with the ultrasonic signal to noise ratios observed.

5. For the Unit 1 welds the radiography performed during construction provides adequate assurance of the preservice structural integrity.

The staff has determined that the CSS pipe and elbow welds at the Comanche Peak plant have sufficiently good acoustical properties to permit a valid ultrasonic examination with state-of-the-art instrumentation provided that the surface of the weld and adjacent base material are adequately prepared for examination. Therefore, the staff considers the issue of the preservice ultrasonic examination of welds in the CSS piping system to be resolved. However, the staff will require that the Applicant consider the existing surface condition during the selection of welds subject to examination in the initial Inservice Inspection (ISI) Program for Unit 1. The basic objective of inservice inspections of the piping welds in the reactor coolant pressure boundary is to perform a repetitive examination of a representative sample of welds in order to detect generic service-induced degradation. To assure that this objective is accomplished the staff will require that the welds with the most favorable acoustical properties be included, to the extent practical, in the ISI Program and that effective inservice examinations be performed on these welds.

In letters dated October 7, 1982, March 10, 1983, May 6, 1983, November 8, 1983 and August 29, 1984, the Applicant requested relief from ASME Section XI Code requirements which have been determined to be not practical to perform. These relief requests were supported by information pursuant to 10 CFR 50.55a(a)(2)(i). Therefore, the staff evaluation consisted of reviewing these submittals and determining if relief from the Code requirements were justified. Pursuant to 10 CFR Part 50, Paragraph 50.55a(a)(2), the staff has allowed relief from the impractical requirements that, if implemented, would result in hardships or unusual difficulties without a compensating increase in the level of quality and safety. The detailed evaluation of relief requests is included as Appendix to this report. Based on review of the Applicant's submittals the staff has determined that the Comanche Peak Unit 1 Preservice Inspection Program is acceptable and that the review is considered to be completed.

The initial inservice inspection program has not been submitted by the Applicant. The program will be evaluated after the applicable ASME Code Edition and Addenda can be determined based on Paragraph 50.55a(b) of 10 CFR Part 50, but before the first refueling outage when inservice inspection commences.

6.6 Inservice Inspection of Class 2 and 3 Components

This section was prepared with the technical assistance of DOE contractors from the Pacific Northwest Laboratories.

This evaluation supplements conclusions in this section of NUREG-0797, which addressed the definition of examination requirements and the evaulation of compliance with 10 CFR 50.55a(g).

6.6.1 Evaluation of Unit 1 Compliance with 10 CFR 50.55a(g)

In this section of NUREG-0797, Supplement No. 4, the staff determined that the Preservice Inspection (PSI) Program was acceptable with the exception of the chapter on relief requests that was incomplete.

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