

Official

MAR 17 1987

Docket Nos. 50-259, 50-260, 50-296
License Nos. DPR-33, DPR-52, DPR-68

Tennessee Valley Authority
ATTN: Mr. S. A. White
Manager of Nuclear Power
6N 38A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Gentlemen:

SUBJECT: MEETING SUMMARY - BROWNS FERRY NUCLEAR PLANT, UNIT 2, DOCKET
NO. 50-260

This refers to the management meeting conducted at your request, in the Region II Office on February 9, 1987. This meeting was held to discuss problems encountered with Browns Ferry Unit 2 safe end to reactor pressure vessel (RPV) nozzle welding, problem investigation, and your future course of action. A meeting summary of the topics discussed is provided in Enclosure 1. Enclosure 2 is the attendance list, and the licensee's handout material is provided in Enclosure 3.

It is our opinion that the meeting was beneficial and has provided a better understanding of the actions taken by TVA in resolving welding concerns.

In accordance with Section 2.790 of NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Should you have any questions concerning these matters, we will be pleased to discuss them.

ORIGINAL SIGNED BY
GARY G. ZECH

Gary G. Zech, Assistant Director,
Regional Inspections
Division of TVA Projects
Office of Special Projects

Enclosures:

1. Meeting Summary
2. Attendance List
3. Licensee Handout Material

cc w/encls: (See page 2)

8704030050 870317
PDR ADOCK 05000260
P PDR

11
IE45

MAR 17 1987

cc w/encls:

- ✓ H. P. Pomrehn, Site Director
Browns Ferry Nuclear Plant
- ✓ R. L. Gridley, Director
Nuclear Safety and Licensing
- ✓ R. W. Cantrell, Acting Director
Nuclear Engineering
- ✓ M. J. May, Site Licensing Manager

bcc w/encls:

- ✓ J. G. Keppler, OSP
- ✓ S. D. Ebner, OSP
- ✓ J. A. Zwolinski, OSP
- ✓ B. D. Liaw, OSP
- ✓ S. R. Connelly, OIA
- ✓ K. P. Barr, RII
- ✓ NRC Resident Inspector
- ✓ NRC Document control Desk
- ✓ State of Alabama

RII

Ad
AIgnatonis:er
03/16/87

~~RII~~

~~KBarr
03/17/87~~

ENCLOSURE 1

MEETING SUMMARY

On February 9, 1987, representatives of Tennessee Valley Authority (TVA) met with the NRC, at TVA's request, to discuss Browns Ferry Unit 2 safe end to reactor pressure vessel (RPV) nozzle welding concerns, problem investigation, and the future course of action.

TVA provided an overview of the recirculation piping inlet safe end to RPV weld program starting with a brief information background, commencement of production welding, problems encountered and its identification, problem investigation, future work plans, and lessons learned. The presented material is enclosed. Prior to performing any production welding on replacement system piping, the licensee prepared and performed mockup welds. These mockup welds were inspected by radiographic testing (RT) and no rejectable defects were found. On January 4, 1987, production welding of the safe end to the nozzle commenced. Nozzles "G", "F", and "J" were welded and RT inspections were performed. For the first nozzle "G" no indications were identified by the Level II inspector. Nozzle "F" and "J" were also RT inspected, but by a Level III inspector who came to the site after production welding commenced. The Level III inspector identified indications on "F" and "J" nozzle welds, as well as on the "G" nozzle weld. As a result, TVA stopped production welding on January 7, 1987.

The linear indications always appeared in the upper half of the pipe circumference and on the nozzle side. The dark line exhibited in the radiograph was interpreted to be as an abrupt density change by TVA. TVA initiated on an informal basis a three prong problem investigation effort. The areas being investigated were mockup work, additional NDE analysis, and additional engineering analysis. TVA was able to reproduce the root condition (i.e. indication) on mockup welding by having a large angle on the chamfer and welding being performed in the upper half of the circumference. The additional NDE analysis included radiograph enhancement and UT analysis of the weld. In the engineering analysis area, TVA planned to review the ASME Code requirements and analyze nozzle repair configurations if needed. TVA was reluctant to repair the nozzle welds because of the potential in creating new problems; however, if the UT, RT enhancement, and boroscope results warranted cutting and repair of nozzle welds, then they would do it.

TVA also researched similar work performed at the Peach Bottom and Vermont Yankee facilities. The Vermont Yankee radiographs of the safe end to nozzle welds also exhibited dark lines, but the indications were not attributed by the chamfer angle effect. Their problem was different and the repairs were made as needed.

For the lessons learned, TVA concluded that they should have had Level III inspector involvement early in the project and should have had better project control. However, once the problems surfaced TVA has stated that they quickly responded to them, although no formal (written) plans were made for the recovery effort. The Site Director was fully involved in the problem investigation. TVA committed to document their work and inform the NRC prior to restart of production welding.

On February 27, 1987, TVA informed the NRC of their intent to resume production welding. Production welding on the "B" nozzle was completed and radiographed as satisfactory. The large angle on the chamfer was verified to be the principle contributor of the safe end to nozzle welding problem.

ENCLOSURE 2

MEETING ATTENDEES

U.S. Nuclear Regulatory Commission

G. G. Zech, Assistant Director, Regional Inspection, DTVA, OSP
K. P. Barr, Deputy, Assistant Director, Regional Inspections, DTVA, OSP
A. J. Ignatonis, Chief, Projects Section 2, DTVAP, OSP
A. R. Herdt, Chief, Engineering Branch, Division of Reactor Safety (DRS)
J. J. Blake, Chief, Materials and Processes Section, DRS
J. L. Coley, Reactor Inspector, DRS
E. H. Girard, Reactor Inspector, DRS
R. W. Newsome, Reactor Inspector, DRS

Tennessee Valley Authority

H. P. Pomrehn, Site Director, Browns Ferry
M. J. May, Manager of Licensing, Browns Ferry
E. Hartwig, Project Manager, Browns Ferry Project Management
S. P. Stagnolia, Section Manager, Nozzle Replacement Group
A. J. Everitt, Welding Engineer, Nozzle Replacement Group
R. McKenna, Project Management, Browns Ferry
N. R. Bentley, BDE Engineer
M. Turnbow, ISI/QA Engineer
J. H. Fox, Senior Metallurgical Engineer

Electric Power Research Institute (EPRI) NDE Center

J. A. Disney

ENCLOSURE 3

LICENSEE HANDOUT MATERIAL

T V A

BROWNS FERRY — UNIT II

SAFE END TO RPV NOZZLE WELD PROGRAM

FEBRUARY 9, 1987

MEETING IN NRC OFFICES ATLANTA, GA.

- OUTLINE OF DISCUSSION
- PREFIELD WELDING
- WELDING ON RPV COMMENCES
- PROBLEM IDENTIFICATION
- PROBLEM INVESTIGATION
- ADDITIONAL MOCK UP PROGRAM INITIATED
- ADDITIONAL NDE ANALYSIS INITIATED
- ADDITIONAL ENGINEERING ANALYSIS INITIATED
- CONSULTATION WITH EXPERTS
- CURRENT STATUS
- FINAL VERIFICATION ON MOCKUP WITH REVISED WELDING PARAMETERS
- FUTURE WORK PLANS
- LESSONS LEARNED

SAFE END TO RPV NOZZLE WELD PROGRAM

PRE FIELD WELDING

- KICK OFF MEETING WITH NRC NOVEMBER 4, 1986

- EQUIPMENT AVAILABLE AND OPERATIONAL

- WELDING PROCEDURES QUALIFIED

- MOCK UPS OF WELD MADE
 - RT INSPECTION OF WELDS PERFORMED

- TESTING OF WELDERS

SAFE END TO RPV NOZZLE WELD PROGRAM

WELDING ON RPV COMMENCES

- STARTING DATE JANUARY 4, 1987 ON SAFE END TO NOZZLE

- FIRST NOZZLE (G) INSPECTED BY RT
 - IN PROCESS ROOT CONSUMED PLUS FOUR HOT PASSES
 - INDICATION NOT IDENTIFIED BY LEVEL II INSPECTOR

- SECOND AND THIRD NOZZLES (F AND J) INSPECTED BY RT
 - IN PROCESS (ROOT CONSUMED PLUS FOUR HOT PASSES)
 - LACK OF FUSION IDENTIFIED IN NOZZLE (F).
 - LACK OF FUSION REMOVED BY EXCAVATION
 - (F) AND (J) REVIEWED AND INDICATION IDENTIFIED BY LEVEL III
 - (G) NOZZLE REVIEWED AND INDICATION IDENTIFIED BY LEVEL III

- TVA STOPPED PRODUCTION WORK ON JANUARY 7, 1987

SAFE END TO RPV NOZZLE WELD PROGRAM

PROBLEM IDENTIFICATION

- ABRUPT DENSITY CHANGE

- LINEAR INDICATION CHARACTERISTICS
 - ALWAYS ON NOZZLE SIDE
 - PARALLEL TO ROOT PASS
 - OUTSIDE OF ROOT AREA
 - ALWAYS IN THE UPPER HALF OF THE PIPE CIRCUMFERENCE

- LACK OF FUSION
 - ONE TWO INCH LACK OF FUSION FOUND AND REMOVED SUCCESSFULLY ON NOZZLE (F)

SAFE END TO RPV NOZZLE WELD PROGRAM

PROBLEM INVESTIGATION

- GRINDING ON (F) AND (J) NOZZLES IN AREAS OF INDICATION – JANUARY 9, 1987
 - HOT PASSES REMOVED (ROOT PASS REMAINS)
 - NO IRREGULARITIES FOUND
 - INDICATION REMAINS

- (G) NOZZLE WELDED OUT AND RT TAKEN. INDICATION REMAINS – JANUARY 14, 1987

SAFE END TO RPV NOZZLE WELD PROGRAM

ADDITIONAL MOCK UP PROGRAM INITIATED

- PHIPPS BEND RPV NOZZLE
 - USE SAME PARAMETERS AS PRODUCTION WELDS
 - RT TAKEN IN PROCESS
 - SET UP BEFORE WELDING
 - AFTER INSERT CONSUMED
 - FIRST HOT LAYER – TWO PASSES
 - SECOND HOT LAYER – TWO PASSES
 - THIRD HOT LAYER –
 - FULL WELD OUT
 - NONE OF THE RT EXAMINATIONS SHOWS THE SUBJECT INDICATION

- CONSTRUCT ADDITIONAL PIPE TO PIPE MOCK UPS
 - MATRIX DETAILING MOCK UPS

- ROOT CONDITION REPRODUCED ON PIPE TO PIPE MOCKUP ONLY WHEN:
 - LARGE ANGLE ON CHAMFER
 - CHAMFER SIDE ONLY
 - UPPER HALF OF THE WELD

SAFE END TO RPV NOZZLE WELD PROGRAM

ADDITIONAL NDE ANALYSIS INITIATED

- PARALLAX RT ON NOZZLE G
 - RADIOGRAPHS SENT TO APTECH FOR STUDY
 - RESULTS OF STUDY

- DIGITAL ENHANCEMENT OF RADIOGRAPHS
 - BY APTECH
 - RESULTS OF STUDY

- UT ANALYSIS OF WELD.
 - QUALIFY PROGRAM
 - APPLICATION OF I-98 PROGRAM
 - EXAMINATION OF PHIPPS BEND MOCKUP AND NOZZLE G
 - RESULTS OF EXAMINATION

SAFE END TO RPV NOZZLE WELD PROGRAM

LESSONS LEARNED

- USE UT TO COMPLEMENT RT
- BETTER SIMULATION OF PLANT CONDITIONS
- EARLY LEVEL III INVOLVEMENT

SAFE END TO RPV NOZZLE WELD PROGRAM

ADDITIONAL ENGINEERING ANALYSIS INITIATED

- REVIEW OF CODE INTERPRETATION
 - INTERPRETATION FOUND CONCERNING DRESDEN PLANT
 - CONCERNS CENTER ON ROOT CONDITION — DOES NOT APPLY TO BF

- DESIGN ANALYSIS OF WELD JOINT CONFIGURATION
 - NOZZLE DESIGN REPORT REVIEW
 - STUDY OF HEAT INPUT VS SHRINKAGE

- ANALYSE NOZZLE REPAIR CONFIGURATIONS.

SAFE END TO RPV NOZZLE WELD PROGRAM

CONSULTATION WITH EXPERTS

- TVA
- OTHER BWR PLANTS
- DESIGN ENGINEERING FIRMS
- EPRI
- CONTRACTORS

SAFE END TO RPV NOZZLE WELD PROGRAM

CURRENT STATUS

- EVALUATING UT REPORT ON PHIPPS BEND NOZZLE
- EVALUATING UT REPORT ON G NOZZLE
- DIGITAL ENHANCEMENT OF RT
- VERIFICATION MOCKUPS IN FABRICATION

SAFE END TO RPV NOZZLE WELD PROGRAM

FINAL VERIFICATION ON MOCK UP WITH REVISED WELDING PARAMETERS

- RETAIN CONFIGURATION OF FIELD WELD
- ADD CHAMFER DETAIL TO DUPLICATE FIELD AS BUILT.
- INSERT PLACEMENT NO CHANGE
- CONSUME INSERT USING EXISTING PARAMETERS
- HOT PASSES (ONE LAYER OVER ROOT) USING EXISTING PARAMETERS
- FILL PASSES TO RECEIVE LESS HEAT INPUT

SAFE END TO RPV NOZZLE WELD PROGRAM

FUTURE WORK PLAN:

- RESUME PRODUCTION WELDING USING:
 - MODIFIED IN PROCESS INSPECTION PROGRAM
 - REVISED WELDING PARAMETERS

- NOZZLE G

- NOZZLES F & J
 - PROGRAM FOR WELD DISPOSITION