UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE REQUEST FOR RELIEF UNDER 10 CFR 50.55a(g)(6)(i)

TOLEDO EDISON COMPANY

DAVIS-BESSE NUCLEAR POWER STATION UNIT 1

DOCKET NO. 50-346

1.0 INTRODUCTION

The Technical Specifications for the Davis-Besse Nuclear Power Station, Unit 1, state that the surveillance requirements for inservice inspection and testing of ASME Code Class 1, 2 and 3 components shall be applicable as follows:

1. From issuance of the Facility Operating License to the start of facility commercial operation, inservice testing of ASME Code Class 1, 2 and 3 pumps and valves shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code 1974 Edition, and Addenda through Summer 1975, except where specific written relief has been granted by the Commission.

2. Following start of facility commercial operation, inservice inspection of ASME Code Class 1, 2 and 3 components and inservice testing of ASME Code Class 1, 2 and 3 pumps and valves shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR Part 50, Section 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR Part 50, Section 50.55a(g)(6)(i).

The first 10-year inspection interval started on November 21, 1977, and is scheduled to end on September 21, 1990.

In a letter dated May 15, 1980, the Toledo Edison Company (the licensee) requested that the Inservice Inspection Program for Davis-Besse, Unit 1, be updated to the requirements of Section XI of the ASME Code, 1977 Edition, Summer 1978 Addenda. The request was approved by the Commission.

On August 8, 1989, an inspection was conducted by J. L. Coley, Region II, at the Office of Special Products and Integrated Field Services, Babcock and Wilcox (B&W), Lynchburg, Virginia, to observe a demonstration of the ultrasonic flaw detection capability on a mock-up of the core flood nozzle-to-safe end weld. Details of the inspection are provided in Inspection Report No. 50-302/89-21.

The examination was conducted with the B&W Automated Reactor Inspection System (ARIS-II) utilizing immersion examination methods. Section XI, 1977 Edition, Summer 1978 Addenda, of the ASME Code requires that the reactor vessel nozzles receive both a volumetric and surface examination. For the demonstration, the volumetric examination was conducted from the inside surface of the pipe using the shear wave mode of transmission. The examination was required to penetrate the full thickness of the wall, which consisted of the Inconel weld, Type 304 stainless steel pipe, and the ferritic steel nozzle forging. The effectiveness of the examination of the dissimilar materials in the weld zone was questioned. Of particular concern was the capability of the ultrasonic examination to detect flaws originating at the outside surface of the pipe.

The results of the volumetric examination demonstrated that 1) opposite surface reflectors down to 2.3% (34 mils) through-wall were detectable in two axial directions in the ferritic steel nozzle material, 2) opposite surface reflectors down to 2.3% (34 mils) through-wall were detectable in the Inconel butter material scanned in the safe end direction, 3) opposite surface reflectors down to 2.3% (34 mils) through-wall were detectable in the stainless steel safe end when scanned in the nozzle direction, and down to 5.6 (84 mils) through-wall when scanned in the safe end direction, and 4) none of the opposite surface reflectors, regardless of size or direction scanned, could be detected in the Inconel weld material.

Region II concluded, after the demonstration on August 8, 1989, that there were severe limitations to the capability of detecting flaws in the Inconel weld material. The licensee and its contractor (Babcock & Wilcox Nuclear Service Company) attributed the inability to detect opposite surface reflectors in the Inconel weld metal to the use of an ultrasonic shear wave transmitter. The limitations identified in the report by Region II were corrected through the use of an ultrasonic longitudinal wave transmitter. The latter transmitter will be used in the subject examinations.

In a letter dated December 7, 1989, the Toledo Edison Company requested relief for the Core Flood Nozzle, Outlet Reactor Vessel Nozzle-to-Pipe and Inlet Reactor Vessel Nozzle-to-Pipe Welds from the Section XI, ASME Code examination requirement for the surface for the first inspection interval scheduled to end on September 21, 1990. The purpose of this Safety Evaluation is to evaluate the information submitted in support of the determination.

2.0 EVALUATION

RELIEF REQUEST

Components: Reactor Vessel Inlet, Outlet, and Core Flood Nozzle to Pipe Welds

36" Outlet Reactor Vessel Nozzle (X)-to-Pipe Weld (FW111A)
36" Outlet Reactor Vessel Nozzle (Z)-to-Pipe Weld (FW111B)
28" Inlet Reactor Vessel Nozzle (Z/W)-to-Pipe Weld (FW56B)

28" Inlet Reactor Vessel Nozzle (X/Z)-to-Pipe Weld (FW113B)
28" Inlet Reactor Vessel Nozzle (X/Y)-to-Pipe Weld (FW56A)
28" Inlet Reactor Vessel Nozzle (W/X)-to-Pipe Weld (FW113A)
Core Flood Nozzle Pipe-to-Nozzle Weld W-axis
Core Flood Nozzle Pipe-to-Nozzle Weld Y-axis

Code Requirement: Section XI, ASME Code, 1977 Edition, Summer 1978 Addenda, requires volumetric and surface examination of pressure retaining dissimilar metal welds.

Relief Requested: Relief is requested from performing the surface examination requirement determined to be redundant by the licensee.

Basis for Relief: Pursuant to ASME Code requirements, nozzles to reactor vessel and core flood pipe welds require both a volumetric examination and surface examination of the weld. The volumetric examination is to be performed from the ID of the nozzle using the B&W ARIS tool, while the surface examination will be done using a manual magnetic particle examination technique. Due to the high radiation levels at the nozzle locations, it is proposed that an ultrasonic examination of the weld surface be performed from the nozzle ID using the ARIS tool in lieu of the required surface examination from the OD using the magnetic particle technique. To justify this proposed alternative, a demonstration of the opposite surface flaw detection capabilities utilizing state-of-the-art examination techniques and equipment was performed at the B&W Lynchburg, Virginia, facility on August 8, 1989.

The purpose of the demonstration was to define the capabilities of detecting the minimum size (through-wall dimension) reflector originating at the opposite (OD) surface which could be detected during an actual ARIS examination from the ID of the nozzle. Data were acquired and analyzed using the B&W state-of-the-art data acquisition and imaging system (ACCUSONEX). The ultrasonic system was calibrated using side drilled holes to establish a calibrated sweep range with a Distance Amplitude Correction (DAC) curve. The gain level for the DAC curve was used as a reference for the gain adjustment during this benchmark demonstration. To lower the recording threshold, the DAC curve was adjusted to a 20% full screen height (FSH) flat recording threshold. The test block was then scanned several times at increased gain levels until all of the notches were detectable. The result was that all the notches were detectable at a gain level of 24 dB above reference with a recording threshold of 20% FSH. Due to the low material noise of the carbon steel test block, excessive noise signals were not encountered allowing the use of high gain levels.

The surface examination has been estimated to require approximately 40 man-hours for preparation of each of the reactor vessel inlet, outlet and core flood nozzles-to-pipe welds and an additional 10 man-hours of inspection time. Because of the location of the nozzles, radiation levels are anticipated to result in a total exposure of 60 to 90 man-rem. Since the installation of shielding in the nozzle area is impractical, these inspection requirements are not considered practical by the licensee.

Assessment: The staff concurs with the licensee that conducting both the surface and volumetric examination are redundant in that they should provide equivalent information on the detection and distribution of surface flaws. There has been an extensive effort by B&W and the licensee to provide ultrasonic technology to detect and characterize flaws in the HPI/Makeup Nozzle. The ultrasonic techniques and technology using a longitudal wave form provide essentially complete effective volumetric examination of welds and adjacent material so that the ASME Code required surface examination is not important in the characterization of surface defects. The surface examination is redundant and requires approximately 40 man-hours for surface preparation and an additional 10 man-hours of inspection time. Because of the location of the nozzles, radiation levels are expected to result in a total exposure of 60 to 90 man-rem which is an unnecessary hardship without a compensating increase in the level of quality and safety. Thus, the code examination is impractical and would result in a burden on the licensee if imposed on the facility.

3.0 CONCLUSION:

The staff has reviewed and evaluated the information submitted by the licensee in support of this relief request from the Section XI ASME Code requirement for the surface examination of the Reactor Vessel Inlet Nozzle, Reactor Vessel Outlet Nozzle and Core Flood Nozzle-to-Pipe Welds at the Davis-Besse Nuclear Power Station, Unit 1. The ultrasonic procedures developed for the Toledo Edison Company, including using a longitudinal wave form, have demonstrated the capability to identify flaws in welds originating at the outside surface, thus negating the importance of the surface examination requirement. The proposed ultrasonic examination is capable of detecting opposite surface flaws and would provide an acceptable level of quality and safety. Based on the staff's review, it has been determined that the testing for which this relief has been requested is impractical to perform and that the alternative requirement for enhanced UT is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest. In making this determination, due consideration has been given to the burden that would result if the surface examinations were imposed on the facility. The relief is granted as requested pursuant to 10 CFR Part 50.55a(g)(6)(i) and 50.55a(a)(3)(ii).

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