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SUBJECT: Modifies relief request submitted in 960628 ltr which requested approval to defer exam of two of four outlet & all four inlet reactor pressure vessel nozzle to shell welds on Unit 2 from second 10-yr interval.

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September 10, 1996

AEP:NRC:0969AX

Docket No: 50-316

U. S. Nuclear Regulatory Commission
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Reference: Letter AEP:NRC:0969AQ, "Donald C. Cook Nuclear Plant Unit 2, REQUEST FOR ASME CODE RELIEF--REACTOR VESSEL NOZZLE WELDS", dated June 28, 1996

Donald C. Cook Nuclear Plant Unit 2
REQUEST FOR ASME CODE RELIEF--REACTOR VESSEL NOZZLE WELDS

Gentlemen:

The purpose of this letter is to modify our relief request submitted in the referenced letter. That letter requested approval to defer examination of two of the four outlet and all four inlet reactor pressure vessel nozzle to shell welds on unit 2 from the second ten year interval to the first period of the third ten year interval. The relief was requested because it had been discovered that an incorrect gain setting had been used during examinations performed during the previous unit 2 refueling outage. Since the previous submittal, our contractor, Southwest Research Institute (SwRI), has reviewed and enhanced the data obtained during the reactor vessel nozzle weld examination conducted during the last unit 2 refueling outage. SwRI demonstrated the ability to identify those indications that exceeded the ASME Code and Regulatory Guide 1.150 equivalent evaluation thresholds.

The data obtained during the examination, however, does not allow a complete sizing evaluation using ASME Code or Regulatory Guide criteria. Comparison of the data from the indications with the data from a previously characterized code-acceptable flaw has allowed SwRI to conclude that the measured dimensions of these indications were less than the measured dimensions for the known flaw. The SwRI report is included as attachment 2 to this letter.

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Because of the latest information provided by SwRI, we are amending our relief request, submitted under the provisions of 10 CFR 50.55a(3)(i) as an alternative test that provides an acceptable level of quality and safety. Previously, we had requested that we be granted relief until the examinations could be repeated during the first period of the third ten-year interval. We are now requesting that the examinations performed on unit 2 in 1996, and reported in our referenced letter, be considered an acceptable alternative test for meeting the requirements of 10 CFR 50.55a for the second ten-year interval. Justification for this request is contained in attachment 1.

We are requesting your approval by December 31, 1996.

Sincerely,

E E Fitzpatrick

E. E. Fitzpatrick
Vice President

jmb

Attachments

cc: A. A. Blind
A. B. Beach
NFEM Section Chief
NRC Resident Inspector
J. R. Padgett

ATTACHMENT 1 TO AEP:NRC:0969AX

BACKGROUND INFORMATION AND JUSTIFICATION CODE RELIEF REQUEST FOR THE REACTOR PRESSURE VESSEL TO NOZZLE WELD EXAMINATIONS FOR COOK NUCLEAR PLANT UNIT 2 SECOND TEN-YEAR INTERVAL ISI EXAMINATION

I. System/Component for which Relief is Requested.

Code relief is requested for the second ten year inservice inspection (ISI) interval from the scanning sensitivity and flaw indication sizing requirements of ASME Section V for the examination of two of the four outlet and four inlet unit 2 reactor pressure vessel (RPV) nozzle-to-shell welds. This relief applies for the scans performed from the nozzle bore surface for reflectors oriented parallel to the weld axis. The affected welds are listed below.

Cat.	Item	Description
B-D	B3.90	outlet nozzle to shell weld (2-N4-O @ 22°)
B-D	B3.90	inlet nozzle to shell weld (2-N4-I @ 67°)
B-D	B3.90	inlet nozzle to shell weld (2-N3-I @ 113°)
B-D	B3.90	outlet nozzle to shell weld (2-N3-O @ 158°)
B-D	B3.90	inlet nozzle to shell weld (2-N2-I @ 247°)
B-D	B3.90	inlet nozzle to shell weld (2-N1-I @ 293°)

II. Code Requirements

ASME Section XI, 1983 Edition Summer Addendum, Table IWB-2500-1, Category B-D, Item B3.90, requires volumetric examination of all RPV nozzle-to-shell welds in each ten year interval. The ASME Section XI code requires that ultrasonic (UT) examination of these welds be performed in accordance with ASME Section V, Article 4, for reflectors oriented parallel and transverse to the weld. Paragraph T-425.3 states that scanning shall be performed at a gain setting at least two times the reference level, except that the reference level shall be used when electronic distance amplitude correction is used with automated scanning. Paragraphs T-441.8.2 (b) and (c) describe data collection requirements in the through-wall and length dimension for reflectors exceeding 50% distance amplitude correction (DAC). Additionally, the supplemental requirements specified in Regulatory Guide 1.150, Revision 1, are applicable to the UT examination of RPV shell welds.

III. Basis for Code Relief

The second ten year RPV ISI examination of the nozzle-to-shell welds from the nozzle bore surface for reflectors oriented parallel to the weld is not in compliance with ASME Section V, Article 4, T-425.3 and T-441.8.2 (b) and (c), and the supplemental requirements of Regulatory Guide 1.150 for scanning gain setting and data collection for recordable indications. During post-examination data review, it was determined that these examinations were conducted at gain settings less then ASME Code and that as a result, the detection and sizing requirements of ASME Section XI and

Regulatory Guide 1.150 were not met. These welds were not reexamined upon discovery of this error due to the undue hardship and burden of removing the core barrel and the equipment hatch flange and unpacking and reassembly of the automated inspection equipment. We estimate that seven additional outage days would have been required to reexamine these nozzle welds, with an estimated radiation dose of 500-700 mr without any commensurate benefits in quality and safety.

IV. Alternate Examinations

As an alternative to the requirements of the ASME Code and Regulatory Guide 1.150, the examinations performed from the nozzle bore surface in April 1996 (second ten year ISI RPV examination) are proposed. We cannot demonstrate full compliance with ASME Section V and Regulatory Guide 1.150 for the examinations conducted in 1996. However, we were able to detect, at the lower gain setting, the same code acceptable indication that was found during the first interval examination, and our review of the nozzle data taken at the lower gain setting revealed no other indications of greater amplitude or extent (length) than the previously characterized indication. Additionally we were able to demonstrate the detectibility of indications that would be in excess of 50% DAC for the outer 75% of the wall and 20% DAC for the inner 25% of the wall. We therefore have reasonable assurance that the nozzle-to-shell weld bore examination conducted at the lower gain setting during the 1996 outage was capable of detecting flaws of equivalent amplitude or extent as the code acceptable indication found during the first interval examination.

V. Justification for Granting of Code Relief

During the unit 2 second ten year ISI RPV examination, an incorrect scanning gain setting was used on the eight nozzle-to-shell weld examinations conducted from the nozzle bore surface. This examination was performed in April 1996 during the last refueling outage of the second ten year interval. Code relief is requested for six of the eight nozzles, since two nozzles were properly examined during the first period of the second interval. The second ten year interval ended on June 30, 1996.

The incorrect gain setting was discovered while investigating a discrepancy in the data between the first and second ten year ISI examinations for an indication on one of the inlet nozzles. This indication was originally found during the first ten year ISI RPV examination and was further investigated by removing a small piece of insulation from the RPV outside diameter and scanning manually. The indication

was characterized as a code acceptable slag inclusion. During the second ten year ISI examination, this indication was also detected with the automated RPV UT equipment at the lower gain setting, but at a significantly lower amplitude than recorded during the first interval. Prior to the discovery of the incorrect gain setting, we performed the manual examination from the outside surface of the RPV to compare with the results of the first interval examination. The results of this manual examination correlated well with the results of the prior examination and demonstrated that the indication was approximately the same size as characterized during the first interval examination. It is important to note that the core barrel was reinstalled in the vessel prior to the discovery of the incorrect gain setting on the automated UT examination. We estimate that the reexamination would have resulted in an additional seven outage days and radiation exposure of 500-700 mr.

Attachment 2 is the vendor's final report that details the evaluation of the Enhanced Data Acquisition System (EDAS) data gathered at the incorrect pulser gain setting during the unit 2 examinations. The EDAS data from the 1996 unit 2 examinations was compared with the data obtained from previous examinations of these nozzles (preservice and the first ten year interval inservice examinations). It was established through these evaluations that there are no indications greater in length than the one code acceptable indication detected at the lower gain setting and characterized manually from the outside surface of the vessel during the 1996 unit 2 examinations and the first interval examinations.

Several tests were developed by our ISI contractor to validate both qualitatively and quantitatively the results of the 1996 unit 2 examinations. An empirical approach was used to determine the equivalent 50% DAC and 20% DAC thresholds for each channel used during the 1996 examinations after the examination system was fully calibrated, normalized to the configuration used at Cook Nuclear Plant and verified. The EDAS used in the examination of these nozzles records ten bits of data, but only the upper seven bits are normally used for data analysis. In this evaluation the lower three bits were used for the evaluation of the 1996 nozzle bore examinations. Effectively, the ISI contractor was able to review the detection data as if it were only two decibels less than ASME code required sensitivity. This review identified eleven signals that exceeded 50% DAC, all detected in the outer 75% of the wall. No signals greater than 20% DAC were detected in the inner 25% of the wall. Amplitude based sizing was done at code scanning increments (0.60 inch) larger than code sizing increments (0.25 inch), which increases the conservatism of indication sizing in the length

direction. The sizing data is presented in attachment 2, and the results show that the size of any indications associated with these signals would be expected to be significantly less than that of the known flaw. It therefore can be concluded from this analysis that acceptable detectibility was achieved during the unit 2 examinations at the required 50% DAC and 20% DAC sensitivities. It also can be concluded that it is unlikely a defect exists in these welds that exceeds the length of the known flaw that is code acceptable.

Construction records were reviewed for all unit 2 RPV nozzles in an attempt to verify the nature and geometry of the indications detected during the 1996 unit 2 examinations. Twelve indications were identified and characterized both by radiographic and ultrasonic techniques. Two boat samples were removed at that time and were determined by metallurgical analysis to be slag inclusions. All twelve slag inclusions were weld repaired followed by nondestructive testing confirming their removal. There was little, if any, correlation with the 1996 examination data, which further supports the conclusion that the signals produced during the 1996 examination were either not relevant (i.e. geometry, beam redirection, surface lift-off, etc.), or were produced by reflectors within code acceptable limits.

The six nozzle-to-shell welds for which code relief is requested were examined in 1988 for reflectors parallel and transverse to the weld with an ASME Section V/Regulatory Guide 1.150 compliant technique. The only relevant indication found in these nozzles during the 1988 examinations was the code-acceptable slag indication mentioned previously. The ASME Code/Regulatory Guide 1.150 compliant examinations of the nozzle-to-vessel welds from the shell side for reflectors transverse to the weld were conducted in April 1996 at the proper gain setting and no indications were found. In-service, ASME Code/Regulatory Guide 1.150 acceptable examinations of outlet nozzles 2-N1-O and 2-N2-O, which are not part of this request, were conducted in the first period of the second ten year interval, with no recordable indications. Additionally, neither we nor our ISI vendor are aware of any past industry experience with service-induced flaws on the nozzle-to-shell welds in PWRs.

There is significant data which supports the conclusions that the most common type of indication in the nozzle-to-shell welds of reactor pressure vessels is slag inclusion defects. Our ISI vendor has over 20 years experience examining RPV nozzle welds, and has confirmed that the indications found are typically slag inclusions due to construction practices

and processes used at that time. It is reasonable to conclude from the construction records and industry history that the only relevant indications in the nozzle-to-shell welds are slag inclusions which are within code acceptable size limits.

We therefore believe that there are no safety or structural integrity concerns based on past examination results, industry experience on service-induced flaws in nozzle-to-shell welds, and the close review of data on the recent second ten year interval ISI RPV exams. We also believe that the use of the 1996 unit 2 examination as an alternate examination provides an acceptable level of quality and safety.

ATTACHMENT 2 TO AEP:NRC:0969AX

SOUTHWEST RESEARCH INSTITUTE REPORT
FINAL REPORT
THE DONALD C. COOK NUCLEAR PLANT, UNIT 2
REACTOR PRESSURE VESSEL NOZZLE BORE
DATA EVALUATION
AUGUST 1996