UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION OF THE PRESERVICE INSPECTION, AND FIRST AND SECOND 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN REQUEST FOR RELIEF RCSBCW FOR INDIANA MICHIGAN POWER COMPANY D.C. COOK NUCLEAR PLANT, UNITS 1 AND 2 DOCKET NOS. 50-315 AND 50-316

1.0 INTRODUCTION

The Technical Specifications for D. C. Cook Nuclear Plant, Units 1 and 2, state that the inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the D. C. Cook Nuclear Station, Units 1 and 2, preservice inspection (PSI), and first and second 10-year ISI interval is the 1971 Edition with the Winter 71 Addenda for PSI, the 1974 Edition with the Summer 1975 Addenda for the first 10-year ISI interval, and the 1983 Edition with the Summer 1983 Addenda for the second 10-year ISI interval. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

Enclosure 1

Pursuant to 10 CFR 50.55a(g)(5), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for its facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be authorized by law, will not endanger life, property, or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed. In a letter dated June 5, 1995, Indiana Michigan Power Company, submitted to the NRC its PSI, and First and Second 10-Year Interval Inservice Inspection Program Plan Request for Relief No. RCSBCW [reactor coolant system branch connection welds] for D.C. Cook Nuclear Plant, Units 1 and 2.

2.0 EVALUATION AND CONCLUSIONS

The staff, with technical assistance from its contractor, the Idaho National Engineering Laboratory (INEL), has evaluated the information provided by the licensee in support of its PSI, and First and Second 10-Year Interval Inservice Inspection Program Plan, Request for Relief No. RCSBCW for D.C. Cook Nuclear Plant, Units 1 and 2.

Based on the information submitted, the staff adopts the contractor's conclusions and recommendations presented in the Technical Letter Report attached. The staff has concluded that compliance with the Code examination requirements contained in Request for Relief No. RCSBCW, Part 1 (PSI) would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, Part 1 (PSI) of Request of Relief No. RCSBCW is authorized pursuant to 10CFR50.55a(a)(3)(ii).

The staff has concluded that for Part 1 (first ISI interval) and Part 2 (second ISI interval), the proposed alternatives contained in Request for Relief No. RCSBCW provide an acceptable level of quality and safety. Therefore, Part 1 (first ISI interval) and Part 2 (second ISI interval) of Request for Relief No. RCSBCW are authorized pursuant to 10CFR50.55a(a)(3)(i).

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TECHNICAL LETTER REPORT
PSI AND FIRST AND SECOND 10-YEAR INTERVAL ISI
RELIEF REQUEST RCSBCW
INDIANA MICHIGAN POWER COMPANY
D. C. COOK NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NUMBERS 50-315 AND 50-316

1.0 INTRODUCTION

The licensee, Indiana Michigan Power Company, submitted a relief request regarding reactor coolant system branch connection welds (RCSBCW) for the preservice inspection (PSI), the first 10-year interval inservice inspection (ISI), and examination scheduling for the second 10-year ISI interval at D. C. Cook Nuclear Plant, Units 1 and 2. The original request was contained in a letter dated June 5, 1995. Additional information was provided in a letter dated January 19, 1996. Clarification of alternative examinations proposed were provided during a February 23, 1996 conference call. The Idaho National Engineering Laboratory (INEL) staff has evaluated the subject relief request in the following section.

2.0 EVALUATION

The applicable editions and addenda of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, for the D. C. Cook Nuclear Plant, Units 1 and 2, is the 1971 Edition with the Winter 71 Addenda for PSI, the 1974 Edition with the Summer 1975 Addenda for the first 10-year ISI interval, and the 1983 Edition with the Summer 1983 Addenda for the second 10-year ISI interval. The information provided by the licensee in support of the relief request has been evaluated and the basis for disposition is documented below.

A. Relief Request RCSBCW (Part 1), Examination Category B-J, Items B4.6 and B4.7, Reactor Coolant System Branch Connection Welds

Code Requirement: For PSI (71-W71 Code), Paragraph IS-232 required volumetric examination of essentially 100% of the pressure-retaining branch connection welds larger than 4 inches in diameter. For the first interval ISI (74-S75 Code), Tables IWB-2500 and IWB-2600, Examination Category B-J, Item B4.7 required volumetric examination of 25% of the branch piping welds exceeding 6 inches in diameter. Item B4.6 required surface examination of branch piping welds 6 inches in diameter and smaller. The 1983 Code with Summer 1983 Addenda, now being used by the licensee for the second interval ISI, requires volumetric and surface examinations of 25% of the branch connections equal to or greater than 4 inches NPS.

Licensee's Code Relief Request: The licensee requested relief from the volumetric examinations required for PSI and first interval ISI for the reactor coolant system branch connection welds listed in Table 1.

Licensee's Basis for Requesting Relief (as stated):

"BACKGROUND

"During review of in-service inspection volumetric examinations (ultrasonic) to prepare for the third interval ISI long term plan, it was discovered that the potential existed that the ultrasonic technique was not properly directed to examine the RCS branch connection welds during the pre-service and first interval in-service examinations. American Electric Power Service Corporation, Indiana Michigan Power, and Southwest Research Institute personnel confirmed that, based on review of design drawings, the weld examination coverage was not adequate to meet ASME Section XI requirements.

"Table 1 'Cook Nuclear Plant - Units 1 and 2 RCS pipe branch connection welds' identifies the ten RCS branch connection welds per unit that are affected for the pre-service volumetric examination, and the two per unit for the first interval inspection. It should be noted, however, that volumetric

examinations were performed by the radiographic method, and determined to be acceptable, along with the surface examinations and hydrostatic tests, per the construction code.
"Six welds (three per unit) were selected for in-service examinations during the second ten-year inspection interval (unit one and unit two 1986-1996). Five of the six branch connection welds from both units have had a surface examination performed with no recordable indications. The sixth branch connection had been scheduled for surface examination during the upcoming unit two refueling outage currently scheduled for March 1996.

"JUSTIFICATION

"1. *Original Construction Welding and Examination*

"Cook Nuclear Plant units 1 and 2 RCS piping is manufactured from centrifugally cast, ASTM A-351, grade CF8M piping which is similar to an AISI Type 316 stainless steel. Branch connection forged nozzles, composed of ASTM A-182, grade F316 stainless steel, are welded to the main RCS header by setting the nozzles on top of the header and making a multipass weldment in an orientation normal to the branch pipe axis.

"The manufacturer, Southwest Fabricating and Welding (SWF&W), made the branch connection weld by using a multi-process welding procedure which specified GTAW (TIG) root passes to ensure uniformity of the inside surface of the weldment and SMAW (Stick) welding for the fill passes. The welds were made in accordance with a qualified welding procedure by welders qualified in accordance with ASME Boiler and Pressure Vessel Code Section IX. Liquid penetrant examinations were conducted at SWF&W on the root and intermediate weld passes and all completed weld surfaces. Radiography of the shop welds was accomplished in accordance with the construction code for these welds. Finally, a shop hydrostatic test at 3,730 pig was performed. These in-process fabrication controls ensure that a high quality weld was made.

"On May 23, 1995, a review of the construction radiographs of the branch connection shop welds indicated high quality welds with very few manufacturing discontinuities. Minor slag inclusions and randomly dispersed porosity, within code limits, were observed in five of the twenty welds.

"2. *Material Properties*

"A leak-before-break (LBB) analysis of the subject RCS piping was approved as the design basis for Cook Nuclear Plant in an NRC safety evaluation report (SER) dated November 22, 1985. The mechanistic fracture evaluation of the primary piping material performed by Westinghouse Electric Corporation is documented in WCAP-9558, Rev. 2, and the tensile and impact properties of the

Table 2 Cook Nuclear Plant - Units 1 & 2 RCS Pipe Branch Connection Welds

RC Loop	Branch Connection Description	Size	1974 Item No.*	PSI RR**	1st Ival ISI RR***
1	From RHR Loop	6"	B4.7	Yes	No
1	From Accum. Tanks	10"	B4.6	Yes	Y-Unit 2
2	To RHR Loop	14"	B4.6	Yes	Y-Unit 1
2	From RHR Loop	6"	B4.7	Yes	No
2	From RHR Loop and Accum.	10"	B4.6	Yes	No
3	Pressurizer Surge Line	14"	B4.6	Yes	No
3	From RHR Loop and SI	6"	B4.7	Yes	No
3	From RHR Loop and Accum.	10"	B4.6	Yes	Y-Unit 1 Y-Unit 2
4	From RHR Loop and SI	6"	B4.7	Yes	No
4	From Accum. Tanks	10"	B4.6	Yes	No

Notes:
* Item No. in the 1971 Edition is 4.2 for all these branch connections.
** ASME Section XI 1971 Edition through Winter 71 Addenda.
***ASME Section XI 1974 Edition through Summer 75 Addenda.

weld metal is documented in WCAP 9787. Both reports were reviewed and approved by the NRC.

"The forged nozzle material, ASTM A-182, has similar properties as other primary piping materials analyzed in WCAP-9558, Rev. 2. Fracture toughness and tensile properties of the primary piping material and weld metal were evaluated as part of the development of the LBB methodology. Based on the results noted in the above reports, it is reasonable to conclude that the conclusions made in WCAP-9558, Rev. 2, envelope the behavior of the nozzle material and the subject weld joints will undergo LBB behavior.

"3. *In-service Inspection and Testing*.

"Pre-Service, first and second interval in-service inspection surface examinations (liquid penetrant) of these branch connections have been performed and all have yielded acceptable results, confirming good weld quality.

"System leakage and hydrostatic test have been conducted several times since construction on the RCS boundary with no leaks reported. Inspections of the RCS at operating temperature and pressure following unit outages have also verified that pressure boundary leakage did not exist. Additionally, leakage monitoring requirements pursuant to technical specifications ensure that no pressure boundary leakage exists during plant operation.

"4.

"Our review of nuclear utility experience with Southwest Research Institute has not detected weld failures of these branch connections. This reinforces the belief that the stainless steel materials used in the fabrication of this piping have a high tolerance to resist the development and progression of service induced flaws.

"REASON WHY APPLICATION OF CODE REQUIREMENTS IS IMPRACTICAL

"It would be necessary to remove the units from power operation to perform the weld examinations, which would unnecessarily challenge and thermally cycle the unit, reduce the system capacity, and provide minimal safety benefit. For this reason, we consider immediate code-type examination to be impractical.

"We believe no safety benefit would be realized from performing the pre-service and first interval volumetric examinations now based on the years of plant operating experience, the results of construction and inservice non-destructive examinations and hydrostatic tests, and the lack of compelling industry failure data. Volumetric examination of ten RCS branch connection welds for one unit would require approximately 4800 man-hours for scaffolding construction, insulation removal, and examination at a cost of 30 person-rem of exposure. The impact of this work does not include interruptions to other scheduled work during the outage while insulation is being removed from containment. If both units are to be examined, this estimate is doubled. For these reasons we consider the performance of a pre-service and first inspection interval volumetric examination of all the branch connection welds to be impractical.

"COMPENSATORY MEASURES

"Three branch welds for each unit will be selected and examined,

using ultrasonic and liquid penetrant techniques, during the next refueling outages to satisfy Section XI requirements for the second inspection interval. These welds will be selected to represent a range of piping sizes, high ratios of calculated stress to code allowable, frequency of system usage, and accessibility. The selection of welds based on stress levels is consistent with the philosophy adopted in late code editions and will target the examinations to a more significant weld population. Additional examinations will be performed based on the outcome of these volumetric examinations in accordance with ASME Section XI criteria.

"Our review of this design configuration, a forged nozzle to centrifugally cast stainless steel pipe, indicates it is unique to the RCS. These welds represent the only pipe-to-nozzle branch connections in the ISI program requiring volumetric examination. No further compensatory measures are required for welds outside of this population.

"The existing surveillance program includes technical specification required RCS leak rate monitoring on a daily basis during steady state operations. This will provide early indication of potential weld degradation. The LBB phenomenon would allow sufficient time for a safe and orderly shut down of the plant."

Licensee's Alternative: The licensee's proposed alternatives to the PSI examination are the fabrication surface examinations, radiography (volumetric examination), and hydrostatic testing. The alternatives to first interval ISI are the surface examinations and pressure tests performed during the first interval.

Evaluation: The licensee's failure to perform PSI and first interval ISI volumetric examinations are treated as unique issues (PSI and ISI) in this evaluation.

(Both Issues) The licensee discovered the need for this relief request during preparation for the third interval ISI. It was found that the PSI and first interval ISI volumetric (ultrasonic) examinations had not been performed as required by the applicable Section XI Codes and Addenda (71-W71 for PSI and 74-S75 for first interval ISI). The subject relief request is for all 20 of the

reactor coolant system branch connection welds (10 welds per unit) for PSI, and 4 of the 20 welds (2 welds per unit) for the first interval ISI.

(PSI Issue) The Code requires that PSI be performed prior to initial plant operation. PSI can enhance safety by providing for additional examinations that can complement the fabrication examinations. The fabrication volumetric examination is usually done with radiography while the inservice and preservice examinations use the ultrasonic method. At the D. C. Cook plants, the effectiveness of the fabrication examinations has been verified by the successful operating history of the subject welds.

(PSI Issue) Another reason for performing PSI is to obtain baseline data to aid in the subsequent evaluation of ISI results. ISI examination technology has progressed, and there are now capabilities to independently evaluate ISI results without PSI baseline data.

(PSI Issue) The licensee's proposed alternative to the PSI examination is to use the acceptable results of fabrication surface examinations, radiography (volumetric examination), and hydrostatic testing. Also, the licensee has committed to perform the second interval ISI ultrasonic examinations on 6 of the 20 subject RCS branch connection welds.

(PSI Issue) Examining all 20 of the subject welds to establish a new baseline would be a considerable burden (approximately 4800 man-hours and 30 person-rem of exposure total for the 2 units). Based on the alternative fabrication surface examinations, radiography (volumetric examination), and hydrostatic testing; the qualification of the welding procedure and personnel; the fracture toughness and tensile properties of the material; the successful operating history; the inservice

surface examinations and pressure testing; and the proposed ultrasonic examination of 6 of the 20 welds, it is concluded that reasonable assurance of operational readiness will be provided. Since performing the baseline ultrasonic examinations on all 20 of the subject welds at this time would result in a hardship (4800 person-hours and 30 person-rem of exposure) without a compensating increase in safety, it is recommended that the proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the PSI ultrasonic examinations of the RCS branch connections.

(ISI Issue) Since the first interval is over, it is not possible to perform the Code-required first interval volumetric examinations to the Code-required schedule. Also the second interval volumetric examinations that are now in process include the welds that would have been volumetrically examined if the first interval ISI requirements were fully met. The licensee's alternative, surface examinations and pressure tests combined with the ongoing second interval volumetric examinations, will provide an acceptable level of quality and safety. This is based on the successful performance of the branch connections during operation and the examinations scheduled to be performed, which will provide reasonable assurance of operational readiness. Thus, it is recommended that the proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the first interval ISI examinations of the RCS branch connections.

B. Relief Request RCSBCW (Part 2), Examination Category B-J, Item B9.31, Reactor Coolant System Branch Connection Welds

Code Requirement: The 1983 Edition with Summer 1983 Addenda, now being used by the licensee for the second interval ISI, requires volumetric and surface examinations of 25% of the branch connections equal to or greater than 4 inches NPS. For

examination scheduling, Table IWB-2412-1 provides percentage completion requirements for the inspection periods during each interval. Paragraph IWB-2420(a) states that the distribution of component examinations established during the first interval shall be repeated each inspection interval to the extent practical.

Licensee's Code Relief Request: The licensee requested relief from the examination scheduling requirements for the second interval ISI for six of the reactor coolant system branch connection welds (3 welds per unit).

Licensee's Basis for Requesting Relief (as stated):

"Based on the time of discovery (i.e., late in the second inspection interval), the NRC and INEL reviewers interpretation indicated that the distribution of branch connection weld inspections for the second inspection interval was not in accordance with ASME Section XI paragraph IWB-2420(a) which states that the distribution of component examinations established during the first interval shall be repeated each inspection interval to the extent practical. As a result, by copy of this letter, relief is requested for a permanent exemption from the requirements of paragraph IWB-2420(a) for three in-service volumetric examinations per unit (Table IWB-2500, Category B-J, item 9.31) for the second inspection interval for both unit one and unit two (July 1, 1986 through June 30,1996)."

Licensee's Alternative (as stated):

"As an alternative, volumetric examinations will be performed during the last inspection period of the second interval for both units. Furthermore, for the third and fourth inspection intervals, we plan to evenly distribute these branch connection weld examinations over the inspection periods."

Evaluation: This part of the relief request covers the examination scheduling requirements for the second interval. The licensee's basis references Paragraph IWB-2420(a), but the scheduling requirements are also contained in Table IWB-2412-1.

In the case of the subject welds (10 per unit), three welds are required to be examined per interval, one weld in each of the

three periods. It is not possible to perform examinations according to the Code-required schedule for the second interval because the problem was not discovered until the third period of this interval. The licensee's alternative, to perform all of the examinations in the third period of the second interval and to then perform the subsequent interval examinations per the Code-required schedule, will provide an acceptable level of quality and safety. This is based on the successful performance of the branch connections during operation and the examinations scheduled to be performed. Thus, it is recommended that the proposed alternative, a *one-time* modification to the schedule for examinations, be authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the second interval ISI examinations of the RCS branch connections.

3.0 CONCLUSION

The INEL staff has reviewed the licensee's Relief Request RCSBCW and determined that the proposed alternatives to the Code examination requirements are acceptable for the D. C. Cook Nuclear Plant, Units 1 and 2. Therefore, as explained in the evaluation above, it is recommended that the proposed alternatives for PSI be authorized pursuant to 10 CFR 50.55a(a)(3)(ii) based on the hardships, alternative examinations, and reasonable assurance of operational readiness. It is also recommended that the alternative surface examinations and pressure tests for the first interval ISI volumetric examinations and the alternative examination schedule for the second interval ISI examinations be authorized pursuant to 10 CFR 50.55a(a)(3)(i) based on the acceptable level of quality and safety.

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