UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

TECHNICAL POSITION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ASME CODE REPAIR REQUIREMENTS

DUKE POWER COMPANY, ET AL.

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

Title 10 of the Code of Federal Regulations (10 CFR) Section 50.55a(g) requires that a nuclear power facility's piping and components meet the applicable requirements of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (hereafter called the Code).

Section XI of the Code specifies Code acceptable repair methods for flaws that exceed Code acceptance limits in piping that is inservice. A Code repair is required to restore the structural integrity of flawed Code piping, independent of the operational mode of the plant when the flaw is detected. Those repairs not in compliance with Section XI of the Code are non-Code repairs. However, the implementation of required Code (weld) repairs to ASME Code Class 1, 2 or 3 systems is often impractical for nuclear licensees since the repairs normally require an isolation of the system requiring the repair, and a shutdown of the nuclear power plant is often required.

Alternatives to Code requirements may be used by nuclear licensees when authorized pursuant to 10 CFR 50.55a. Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2 and 3 Piping," dated June 15, 1990, provides guidance for the staff in evaluating relief requests submitted by licensees for temporary non-Code repairs of Code Class 3 piping.

2.0 BACKGROUND

By letter dated May 11, 1995, Duke Power Company (DPC, the licensee), requested relief from Code repair requirements for pinhole leaks in the moderate energy Class 3 piping at Catawba Nuclear Station, Units 1 and 2. Three pinhole sized leaks were detected in the heat affected zone (HAZ) adjacent to the welds of 4 inch nominal pipe size (NPS), stainless steel piping associated with the service water system. Augmented inspection of the stainless steel service water system yielded a total of 75 pinhole-type leaks at butt-welded and socket-welded connections. To date, 39 of the 75 weld leak sites have been repaired.

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The involved service water system (RN) piping provides cooling for the lube injection simplex strainers, the containment spray heat exchanger cooling water side process radiation monitors (EMFs), and two diesel generator starting air aftercoolers. The pipe size ranged from 3/4 inch to 4 inches.

The licensee stated that repair of the remaining 36 welds, prior to the fall 1995 Unit 2 outage, would result in increased service water unavailability. Delaying the repairs until the fall 1995 Unit 2 outage would allow for scheduling and planning for increased safety system availability and allow for analysis for changes to the welding process to prevent reoccurrence.

In a letter dated November 2, 1995, DPC narrowed the scope of its request for relief to 13 welds and stated that as of November 10, 1995, all 75 of the welds in the initial relief request would have been reconciled by repair or other measures. The staff considers that this represents a withdrawal of the request for relief. The staff is issuing this Technical Position to close the issue and to identify weaknesses in the licensee's submittal that should be addressed should similar circumstances requiring relief be encountered in the future.

3.0 BASIS

3.1 Subject Components

ASME Section III Code Class 3 service water (SW) piping to the lube injection simplex strainers, the containment spray heat exchanger cooling water side process radiation monitors (EMFs), and two diesel generator starting air aftercoolers. The subject components are in the Catawba Units 1 and 2 shared service water (RN) systems.

3.2 Section XI Edition for Catawba, Units 1 and 2

1980 Edition, inclusive of the 1981 Winter Addenda, of the ASME Code.

3.3 Section XI Code Requirement

Section XI, Article IWA-4000 requires that licensees remove unacceptable defects of ASME Code Class components. Section XI, Paragraph IWA-4120 requires that repairs of ASME Code Class components be done in accordance with the repair criteria found in the "Owners Design Specification and original Construction Code of the component or system. . . . . If repair welding cannot be performed in accordance with these requirements, the [provisions of the] following [Section XI Articles] may be used: . . . (3) IWD-4000 for Class 3 components."

3.4 Basis and Content of the Relief Request

Relief was sought from performing a repair of the component in accordance with the requirements of the 1980 Edition of the ASME Code Section XI (inclusive of the 1981 Winter Addenda), Paragraph IWA-4120. DPC stated that immediate removal and repair of the defective service water component would have been impractical based on the following points:

1. Performing a Code repair of the defective service water system components would require DPC to declare the SW systems in Catawba Units 1 and 2 inoperable and to enter a Limiting Condition for Operation (LCO) Action Statement for the systems (Technical Specification 3/4.7.1 Service Water Systems, Standby Service Water System Limit Condition for Operation). During the LCO for the system, standby service water loop "A" and its supported safety-related equipment would not be available to perform their intended safety functions, if called upon by the plant operators.

2. The welding process previously used to join the service water system pipe spools may itself have resulted in the leaks.

3. Delaying the repair would allow DPC to schedule the Code repairs in accordance with pre-planned outage activities, thereby increasing the system availability during the remainder of the operating cycle and allowing for analysis and changes of the welding process to prevent reoccurrence.

Relief was sought until the next Unit 2 end-of-cycle 7 refueling outage, which began in October of 1995.

4.0 STAFF EVALUATION AND CONCLUSION

The licensee had performed Code repairs on 39 of the 75 degraded areas by the time of submittal of the May 11, 1995, request for relief. In order to justify continued operation, DPC performed a flaw evaluation of the remaining 36 degraded SW areas in accordance with the guidance of GL 90-05. The licensee's assessment used a bounding analysis to determine the structural integrity of the system. Eight socket welds and two butt welds were sectioned for flaw characterization. The maximum flaw size determined in the sectioned specimens was applied as being the bounding flaw size for the remainder of the degraded areas in the SW system. Due to the short time interval to the end-of-cycle 7 refueling outage (from May 11, 1995, to October 1995) DPC did not opt to install engineered temporary clamps around the flawed areas.

The licensee also performed a root-cause evaluation of the SW system and determined that the pitting of the 75 stainless steel SW components had been caused by microbiological induced corrosion (MIC). The MIC induced pitting was limited to the heat affected zone (HAZ) of the degraded welds. Typical

geometry of the flaws was described as initiating as a pinhole defect on the inner diameter (ID) of the pipe segments, enlarging, and then necking back down to a pinhole on the outer diameter of the pipe. The licensee used the largest enlarged flaw cavity as the bounding case for GL 90-05 "through-wall flaw" evaluation calculations. The licensee also determined that the affected components would not result in any significant amount of leakage (flooding concerns) or loss of SW flow to essential equipment. The maximum weepage from any of the pinholes was less than 1 drop per minute. Since DPC had determined that the flaw evaluations had shown compliance with the guidance of the GL 90-05, DPC opted to leave the leaking components in service, without implementing immediate Code repairs of the degraded areas.

The initial relief request had weaknesses in several areas and required the submittal of additional information. The list of affected SW components (number and location) in the May 11, 1995, submittal was incomplete. The manner of presentation of the request suggested that the request was generic with only specific examples cited to support the generic relief request, rather than a specific one. The staff only accepts relief request submittals on a specific, case-by-case basis. Also, the November 2, 1995, letter indicated that, after the May 11, 1995, submittal, 22 of the remaining group of 36 welds were removed from the scope of the relief request by virtue of being reclassified into a category for which ASME Code requirements do not apply and 1 weld was removed by correcting a typographical error. This information should have been provided to the NRC staff at the time of those decisions and not held in abeyance until the November 2, 1995, submittal.

With respect to DPC's method of analyzing the 36 degraded service water (SW) areas, specifically the flawed socket weld fittings, DPC sectioned 8 degraded socket welds and 2 degraded butt welds, and measured the size of the pitted areas to get a general idea of the degree of degradation in the remainder of the degraded SW components (36 total). The licensee assumed, for the degraded socket welds, that the largest measured flaw size, as determined from the eight sectioned socket weld components, was applicable to the remaining degraded socket welds. However, the validity of this assumption cannot be confirmed by ultrasonic or radiographic examinations of the remaining degraded socket welds, as the weld interfaces are known to interfere with the examination results. The staff therefore questioned the applicability of this approach since it would be difficult to confirm that the licensee's assumption was valid. The staff therefore concludes that DPC's bounding flaw size assumption for the socket welds was not necessarily conservative, and that the real flaw sizes in the remaining degraded socket welds were still unknown. Furthermore, the staff concludes that the licensee's structural analysis of the degraded SW components was not acceptable as submitted. In this case, the staff's practice in granting relief for degraded, moderate energy Code Class 3 socket welds is to review proposals for use of fully evaluated, engineered structural clamps as temporary structural replacements of degraded pressure boundary areas. This is also the routine approach for degraded (moderate energy), Code Class 3 threaded connections. Installation of properly evaluated engineering clamps as temporary structural replacements in moderate energy, Code Class 3 systems is in accordance with the guidelines and criteria of GL 90-05.

The licensee indicated that it would complete the dispositioning of the 36 SW system leaks during the end-of-cycle 7 refueling outage for Catawba Unit 2 (by November 10, 1995). Accordingly, relief is no longer required for these components. This Technical Position is provided to close the issue and to address weaknesses that should be addressed should similar circumstances be encountered in the future.

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INSERVICE INSPECTION: GUIDANCE FOR PREPARING REQUESTS FOR RELIEF FROM CERTAIN CODE REQUIREMENTS PURSUANT TO 10 CFR 50.55a

The guidance in this Appendix is intended to illustrate the type and extent of information that is necessary in a "request for relief" submittal for those items that cannot be fully inspected to the requirements of ASME Code Section XI.

A. Description of Requests for Relief

The inservice inspection program should contain requests for relief that identify the inspection and pressure testing requirements of the applicable portion of Section XI that are deemed impractical because of the limitations of design, geometry, radiation considerations, or materials of construction of the components. Each request for relief should provide the information identified in the following sections of this Appendix for the inspections and pressure tests considered impractical.

B. Request for Relief From Certain Inspection and Testing Requirements

Many requests for relief from inservice inspection requirements submitted by licensees have not been supported by adequate descriptive and detailed technical information. This detailed information is necessary to: (1) document the impracticality of the ASME Code requirements because of the limitations of design, geometry, and materials of construction of components; and (2) determine whether the use of alternatives will provide an acceptable level of quality and safety.

Relief requests submitted with a justification such as "impractical", "inaccessible", or any other categorical basis, require additional information to permit an evaluation of that relief request. The objective of the guidance provided in this section is to illustrate the extent of the information required to make a proper evaluation and to adequately document the basis for the granting of relief in the Safety Evaluation Report. Requests for additional information and delays in completing the review can be considerably reduced if this information is provided in the licensee's initial submittal.

Each relief request should contain adequate information to act as a *"stand alone"* document and should include the following:

1. The ASME Code Class, Examination Category, and Item Number(s) or the specific Code paragraph number from which relief is being requested.

2. ASME Code Section XI examination or test requirements for the weld(s) and/or component(s) for which relief is being requested.

3. The number of items associated with the requested relief.

4. Identification of the specific ASME Code requirement that has been determined to be impractical.

5. An itemized list of the specific welds(s) and/or component(s) for which relief is requested.

6. An estimate of the percentage of the Code-required examination that can be completed for each of the individual welds(s) and/or component(s) requiring relief.

7. Information to support the determination that the requirement is impractical; i.e., state and explain the basis for requesting relief. If the Code-required examination cannot be performed because of a limitation or obstruction, describe or provide drawings showing the specific limitation or obstruction.

8. Identification of the alternative examinations that are proposed: (a) in lieu of the requirements of Section XI; or (b) to supplement partial Section XI examinations performed.

9. A discussion of the failure consequences of the weld(s) and/or component(s) that would not receive the Code required examination. Discuss any changes expected in the overall level of plant safety by performing the proposed alternative examination in lieu of the examination required by Section XI. If it is not possible to perform alternative examinations, discuss the impact on the overall level of plant quality and safety.

10. State when the proposed alternative examinations will be implemented and performed.

11. State when the request for relief would apply during the inspection period or interval (i.e., whether the request is to defer an examination).

12. State the time period for which the requested relief is needed.

Technical justification or data must be submitted to support the relief request. Stating without substantiation that a change will not affect the quality level is unsatisfactory (i.e., because a licensee does not agree with a Code requirement is not considered justification for the granting of relief). If the relief is requested for inaccessibility, a detailed description or drawing that depicts the inaccessibility must accompany the request.

C. Request for Relief for Radiation Considerations

Radiation exposures of test personnel to accomplish the examinations prescribed in ASME Code Section XI can be an important factor in determining whether, or under what conditions, an examination must be performed. A request for relief must be submitted by the licensee in the manner described above for inaccessibility and must be subsequently approved by the NRC staff.

Some of the radiation considerations will only be known at the time of the test. However, from experience at operating facilities, the licensee generally is aware of those areas where relief will be necessary and should submit as a minimum (in addition to the previous general requirements in Section B) the following additional information regarding the request for relief:

1. The total estimated man-rem exposure involved in the examination.

2. The radiation levels at the test area.

3. Flushing or shielding capabilities that might reduce radiation levels.

4. A discussion of the considerations involved in remote inspections.

5. The results of any previous inservice inspections regarding ALARA for the welds for which the relief is being requested.

Suggested Format For Relief Requests

LICENSEE/UTILITY NAME
PLANT NAME, UNIT _
_____ 10-YEAR INTERVAL
REQUEST FOR RELIEF NO. ___

I. *Provide an itemized list of the specific weld(s) and/or component(s) for which relief is requested. Include the ASME Code Class, Examination Category, and Item Number(s). Relief cannot be granted for generic Requests for Relief.*

NOTE: Each Relief Request should contain only one Examination Category.

EXAMPLE:

System/Component(s) for Which Relief is Requested: Six RPV Nozzle-to-Pipe Welds

Examination Category B-J, Item B9.10

36" Outlet Reactor Nozzel (A)-to-Pipe Weld (WELD-1)
36" Outlet Reactor Nozzel (B)-to-Pipe Weld (WELD-2)
28" Inlet Reactor Nozzel (C)-to-Pipe Weld (WELD-3)
28" Inlet Reactor Nozzel (D)-to-Pipe Weld (WELD-4)
28" Inlet Reactor Nozzel (E)-to-Pipe Weld (WELD-5)
28" Inlet Reactor Nozzel (F)-to-Pipe Weld (WELD-6)

II. *Report the Code-requirement(s) for the specific weld(s) and/or component(s) for which relief is being requested.*

EXAMPLE:

Code Requirement: Section XI, Table IWB-2500-1, Examination Category B-J, Item B9.11 requires an OD surface examination of the weld and adjacent base metal and a volumetric examination of the weld and adjacent base metal (interior one-third volume) on all dissimilar metal piping welds and terminal end piping welds at vessels as defined by Figure IWB-2500-8.

III. *Identify the specific Section XI examination or test requirements for the weld(s) and/or component(s) for which relief is being requested.*

EXAMPLE

Code Requirement from Which Relief is Requested: Relief is requested from performing the Code-required surface examination on above identified Reactor Pressure Vessel inlet and outlet nozzle-to-pipe welds.

IV. *Provide technical justification to support the determination that the Code requirement is impractical: i.e., state and explain the basis for requesting relief. If the Code-required examination cannot be performed because of a limitation or obstruction, describe or provide drawings showing the specific limitation or obstruction.*

-If a partial Code-required examination can be performed, provide an estimate of the percentage of the Code-required examination that can be completed for each of the individual weld(s) and/or component(s) covered by the Request for Relief.

-If justification for the request for relief is based on radiation considerations (ALARA), address the following:

a. *The total estimated man-rem exposure involved in the examination;*

b. *the radiation levels at the test area;*

c. *flushing or shielding capabilities that might reduce radiation levels;*

d. *proposed alternative inspection techniques;*

e. *the considerations involved in remote inspections;*

f. *similar components in redundant systems or similar welds in the same systems that can be inspected;*

g. *the results of previous inservice inspections that may help provide technical justification for the granting of relief; and*

h. *the failure consequences of the component(s) that would not receive the Code required examination(s).*

EXAMPLE

Basis for Relief: The subject welds are located inside the reactor vessel primary shield wall (see attached Drawing No. NLU-RPV-XX.xx) and the Code-required examination would necessitate removal of sand plugs and insulation to gain access into the high radiation environment. NLU (Name

Licensee/Utility) extimates the radiation level would be in excess of 10 R/hr at the examination area and that a cumulative exposure of 87 Person-Rem would be necessary to complete the Code-required surface examination of these welds.

V. *Identify proposed alternative examinations:*

(a) in lieu of the requirements of Section XI; or

(b) to supplement partial examinations performed per ASME Code Section XI requirements.

NOTE: Code required examinations are not considered alternatives.

EXAMPLE

Alternate Examinations: NLU proposes that, in lieu of the Code-required OD surface examination, the subject reactor vessel nozzle-to-pipe butt weld OD surfaces will receive an ultrasonic examination from the nozzle bore using the automated reactor vessel tool. This volumetric examination will include the entire weld volume and heat affected zone instead of only the inner one-third of the weld.

VI. *Address the following regarding why the Licensee feels relief should be granted:*

(a) How the proposed alternatives or partial examination provide a reasonable assurance of the continued structural integrity;

(b) the burden upon the Licensee should the Request for Relief be denied; and

(c) why public health and safety will not be jeopardized by the granting of relief.

EXAMPLE

Justification for the Granting of Relief: NLU has contracted with NIA (Name Inspection Agency) to perform the alternative volumetric examinations. The remote volumetric examinations will include the entire weld volume and the heat affected zone instead of only the inner one-third of the weld as required by the Code. NIA will be utilizing state-of-the-art techniques and equipment that has been demonstrated to NLU and the NRC to be capable of detecting OD surface connected defects in the circumferential orientation in a laboratory test block. The laboratory test block contained cracks and not machined

notches.

The proposed alternative volumetric examination will provide reasonable assurance that unallowable inservice flaws have not developed in the subject welds or that they will be detected and repaired prior to return of the reactor vessel to service. Thus an acceptable level of quality and safety will have been achieved and public health and safety will not be endangered by allowing the proposed alternative examination in lieu of the Code requirement.

VII. *Discuss the period of time for which relief is required.*

NOTE: Requests for relief are only applicable for the 10-year inspection interval during which relief was requested and approv[illegible]oes not apply for subsequent inspection intervals.

EXAMPLE

Implementation Schedule: Four of the subject examinations will be performed during the first period, and the remaining examinations will be performed during the third period of the _____ 10-year interval.