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A Duke Energy Company

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April 2, 2001

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

SUBJECT: Oconee Nuclear Station - Unit 3
Docket No. 50-287
Request to use an Alternative to ASME Boiler and Pressure Vessel Code, Section XI in accordance with 10 CFR 50.55a(a)(3)(ii)

Pursuant to 10 CFR 50.55a(a)(3)(ii), Duke Energy Corporation (Duke) requests the use of an alternative to the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWA-4530, 1992 Edition with no addenda for Oconee Unit 3.

Approval of this request would allow repair of low alloy steel material of the Reactor Vessel head to aid in the repair of leaking CRDM nozzles, using the temper-bead technique per IWA-4500, beyond the depth limitation of IWA-4530. Duke has evaluated and determined that compliance with this requirement of IWA-4530 would result in an unusual difficulty without a compensating increase in the level of quality and safety.

A detailed description of this proposed alternative, including a background discussion and justification, is included as an attachment to this letter.

Questions regarding this request may be directed to Robert Douglas at (864) 885-3073.

Very truly yours,

William R. McCollum

Attachment:
Request for Alternative, Serial Number 01-04

A047

cc w/att:

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DUKE ENERGY CORPORATION
Oconee Nuclear Station, Unit 3

Request for Alternative to the Requirements of the
ASME Boiler and Pressure Vessel Code, Section XI

Applicable Code Edition and Addenda

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) will meet the requirements, except the design and access provisions and the pre-service 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 ISI Code of record for Oconee Nuclear Station, Unit 3, third 10-year interval is the 1989 Edition of the ASME Code. 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 NRC approval. The codes of record for the repairs described within this request are the 1989 Section III and 1992 Section XI codes.

Description of Code Requirement(s) for Which an Alternative is Requested

Section IWA-4530, "Dissimilar Materials," provides requirements for repair of welds joining dissimilar materials that may be made without post-weld heat treatment. This section imposes a 3/8 inch depth limitation beyond the fusion line of the dissimilar metal weld for repair of defects in low alloy steel base material that may be performed in accordance with IWA-4532.

An alternative to the 3/8 inch depth requirement of IWA-4530 is requested.

Description of Proposed Alternative

To gain access for the repair of the Unit 3 Control Rod Drive Mechanism (CRDM) nozzle Nos. 50, 56, 34 and 63 (if needed[1]) in the Reactor Vessel (RV) head and the associated J grove partial penetration welds, it was necessary to excavate up to three inches of the RV head base metal (See Figures 1 & 2)

In lieu of the 3/8 inch base metal repair depth limit requirement of IWA-4530, it is proposed that the repair depth limitation be increased to three inches. This increase in the depth limit, while retaining the other restrictions of IWA-4530, would allow repair of the excavations into the RV head, repairs to the CRDM nozzles, and repairs to the J groove partial penetration welds by the temper bead technique per IWA-4532 in lieu of repairs requiring additional post weld heat treatment.

Background Information and Justification for Using the Proposed Alternative

Normal inspections of the Unit 3 RV head during a forced outage to repair a Pressurizer code safety valve discovered small amounts of boron emanating from the CRDM nozzle interface with the outside radius of the RV head. Boron deposits were discovered at this interface for CRDM nozzles Nos. 3, 7, 11, 23, 28, 34, 50, 56, and 63. This pressure boundary degradation was reported to the NRC on February 19, 2001 in accordance with 10CFR50.72(b)(3)(ii). Subsequent non-destructive examinations utilizing eddy current and ultrasonic methods have been completed for the base metal of the subject CRDM nozzles. Liquid penetrant examinations have also been completed for each J groove partial penetration weld connecting the above CRDM nozzles to the inside radius of the RV head. These examinations revealed the existence of indications in the base metal of the nozzles and in the J groove partial penetration welds. The indications can be grouped into three categories: (1) indications in the J groove partial penetration weld, (2) indications in the nozzle base metal above the J groove partial penetration weld, and (3) indications in the nozzle base metal at or below the J groove

[1] The excavation of the CRDM 63 repairable indications is ongoing. The depth of the excavation cannot be determined until these indications are removed.

partial penetration weld. No indications have been detected in the RV head low alloy steel.

In order to remove the indications in both the CRDM nozzles and J groove partial penetration welds, manual grinding and arc air thermal cutting were utilized. The depth of the excavation necessary to remove the indications and provide access for weld repair in the nozzle walls and welds resulted in the removal of portions of the RV head low alloy steel beyond the 3/8 inch depth limitation imposed by IWA-4530.

The 3/8 inch limitation imposed by IWA-4530 presents an unusual difficulty in the ensuing repairs of the RV head low alloy steel. Excavation to the 3/8 inch limitation requires precise and exacting removal of material by grinding. Grinding is a slow and time-consuming process that would have resulted in large radiation doses to a large number of repair personnel. Less precise, but still controlled, air thermal cutting of the material allows for the operations to proceed quickly and with less radiation exposure to repair personnel. This excavation technique has resulted in removal of low alloy steel of the RV head beyond the 3/8 inch cavity depth limitation in the base material imposed by IWA-4530 for temper bead repair.

Repairs of the low alloy steel cavities with similar metal weld material and then restoring the dissimilar weld by the temper bead process would also present an unusual difficulty. This process would require two separate welding operations. The first welding operation would replace the low alloy steel with a similar metal weld to beyond the fusion line with the dissimilar metal weld butter, grinding to restore the fusion line to its original configuration, and then applying post weld heat treatment. The second operation would then replace the dissimilar metal weld by the temper bead process and grind to restore the configuration of the dissimilar metal weld. Such operations would substantially increase the radiation exposure to repair personnel without any compensating increase in the level of quality and safety over replacement of both the low alloy steel and the dissimilar metal weld with a dissimilar metal weld.

The original Code restriction on the depth of the dissimilar metal temper bead repair was written for the case where base metal excavation became extensive. For such extensive

excavations, the similar metal procedure would be used to repair the base metal. For the repairs described herein, the as-repaired geometry (See Figure 3) and the choice of filler metal will satisfy the Section III design rules without fully restoring the base metal to its original geometry. In lieu of restoring the RV head base metal to its original geometry with a similar metal temper bead repair and then completing the attachment weld to the CRDM nozzle with a dissimilar filler material, it is proposed that the dissimilar metal temper bead weld procedure be used to repair the base metal as well as the dissimilar metal weld. The temper bead procedure has been fully qualified for the type repairs described herein. The dissimilar metal temper bead weld procedure will produce an acceptable tempering in the heat affected zone (HAZ) of the base metal. The extent of the HAZ is independent of the excavation limit. However, the HAZ could be a function of the overall depth of repair and therefore, the current IWA-4530 and Procedure Qualification Report (PQR) joint depth limits will be retained. The PQR qualified a similar P43 material (Alloy 600) to that being used in the repair (Alloy 690).

Section III contains a similar limitation on the 3/8 inch excavation into the low alloy steel for temper bead repairs (NB-4622.11(b)). This limitation is not weld related, but is related to geometry control as noted above. The HAZ of the subsequent repair is not affected if more material from the sidewall is excavated. The structural characteristics of the modified geometry will be included in a code stress analysis of the RV Head in accordance with ASME Section III, Subsection NB.

Repairs to the RV head, CRDM nozzles, and J groove partial penetration welds will be completed in accordance with the other limitations of IWA-4530 and ASME Section III, subsection NB. Excavations to three inches and the subsequent repairs will not exceed the lesser of one-half the thickness of the RV head or the PQR qualified depth of repairs of four inches in accordance with IWA-4531. A limit of one half the thickness of the head is a more appropriate limit than one half the thickness of the J groove weld joint. This is because of the uniqueness of the partial penetration J groove weld versus the repair full penetration weld shown in Figure IWA-4532.1-1. The surface of the completed repair will not exceed 100 inches square. NDE inspections of the weld repairs will be in

accordance with Section III NB-5245 and Section XI IWA-4523 subject to the limitations described in (2) below.

Other relief requests related to the repair of the Unit 3 CRDM nozzles and RV head low alloy steel are as follows:

1. The Alloy 690 filler material (Alloy 52 and 152) to be used in the repairs has not been incorporated into Section II and Section IX of the 1992 code. The Code Cases 2142-1 and 2143-1 that establish welding classification and other requirements for both bare wire filler material and coated electrode filler materials have not been incorporated by reference into the regulations. Therefore, the use of this alternative material requires NRC approval. Duke previously submitted a relief request for the use of Alloy 690 material in the repairs of the Unit 3 CRDM nozzles and welds on March 6, 2001.

2. One hundred percent (100%) examination of the band area defined by IWA-4500(e)(2) cannot be completed due to interference of the CRDM nozzle which penetrates the band area.

   Radiographic examination required by IWA-4533 of the repaired region cannot be completed because of the complexity of the geometry of the RV head in the area of the repairs.

   A relief request addressing the above two issues was submitted March 29, 2001.

In summary, compliance with the limitation of the 3/8 inch excavation imposed by IWA-4530 would result in an unusual difficulty without a compensating increase in the level of quality and safety regarding the repairs to the Oconee Unit 3 CRDM nozzles, J groove welds, and adjacent RV Head low alloy steel. Exceeding the excavation limitation has been fully evaluated and the repair methodologies presented herein provide an acceptable level of quality and safety.

Due to the previous repairs to the Oconee Unit 1 thermocouple nozzles and CRDM nozzle 21, the Unit 3 CRDM repairs described herein, and Primary Water Stress Corrosion Cracking concerns throughout the nuclear industry, Duke is planning to replace

the Oconee Units 1, 2 and 3 RV heads. The plans are focusing on replacement of the RV heads between 2003 and 2006.

Duration of Proposed Alternative

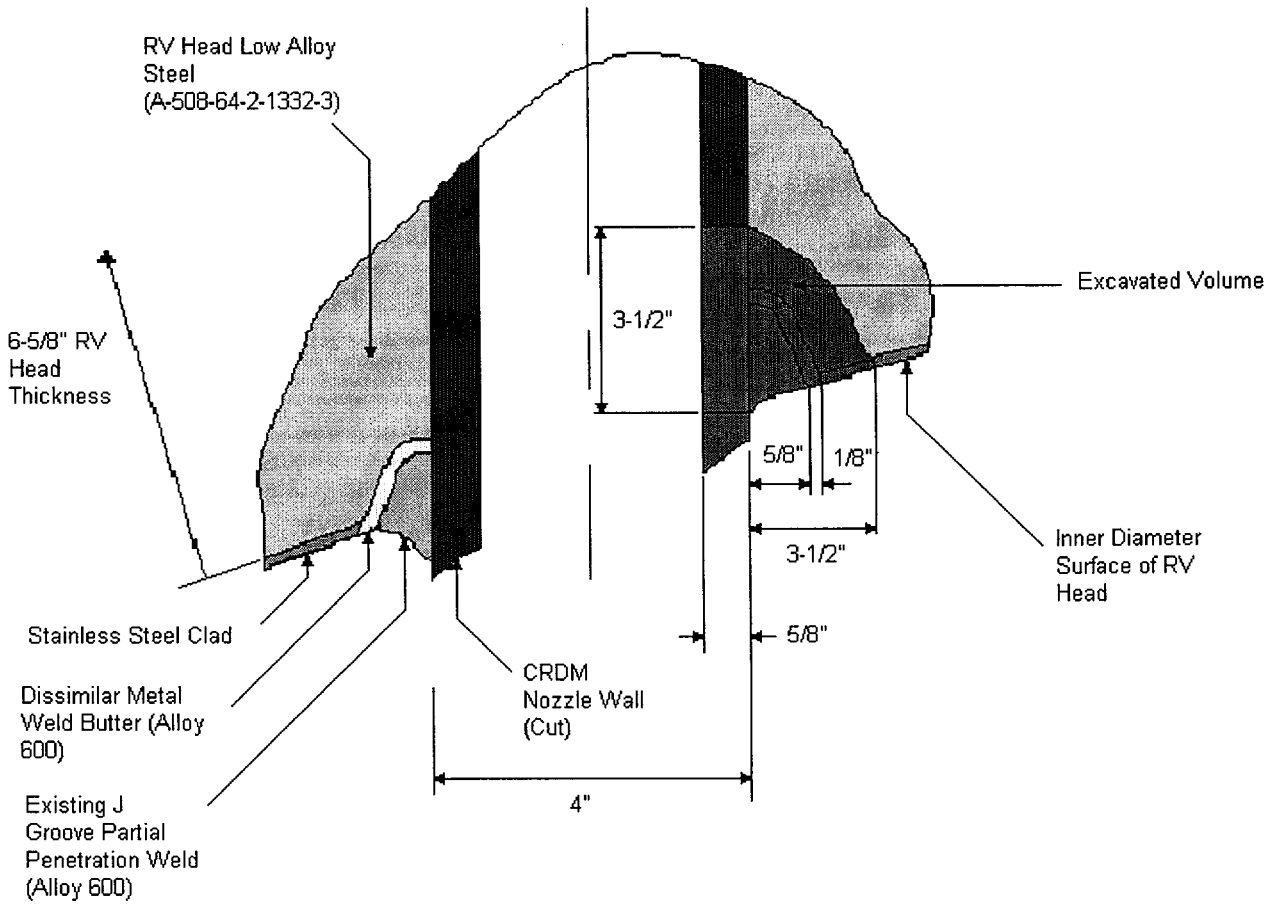
This request for alternative applies only to the repairs to the Oconee Unit 3 RV head CRDM nozzles described herein.

Implementation Schedule

Completion of the Oconee Unit 3 RV head CRDM nozzle repair activities is currently scheduled for April 12, 2001. Entry into Mode 2 operation is currently scheduled for April 16, 2001.

Originated By: Timothy D. Brown 4/2/01
Timothy D. Brown Date

Reviewed By: Leonard J. Azzarello 4/2/01
Leonard J. Azzarello Date

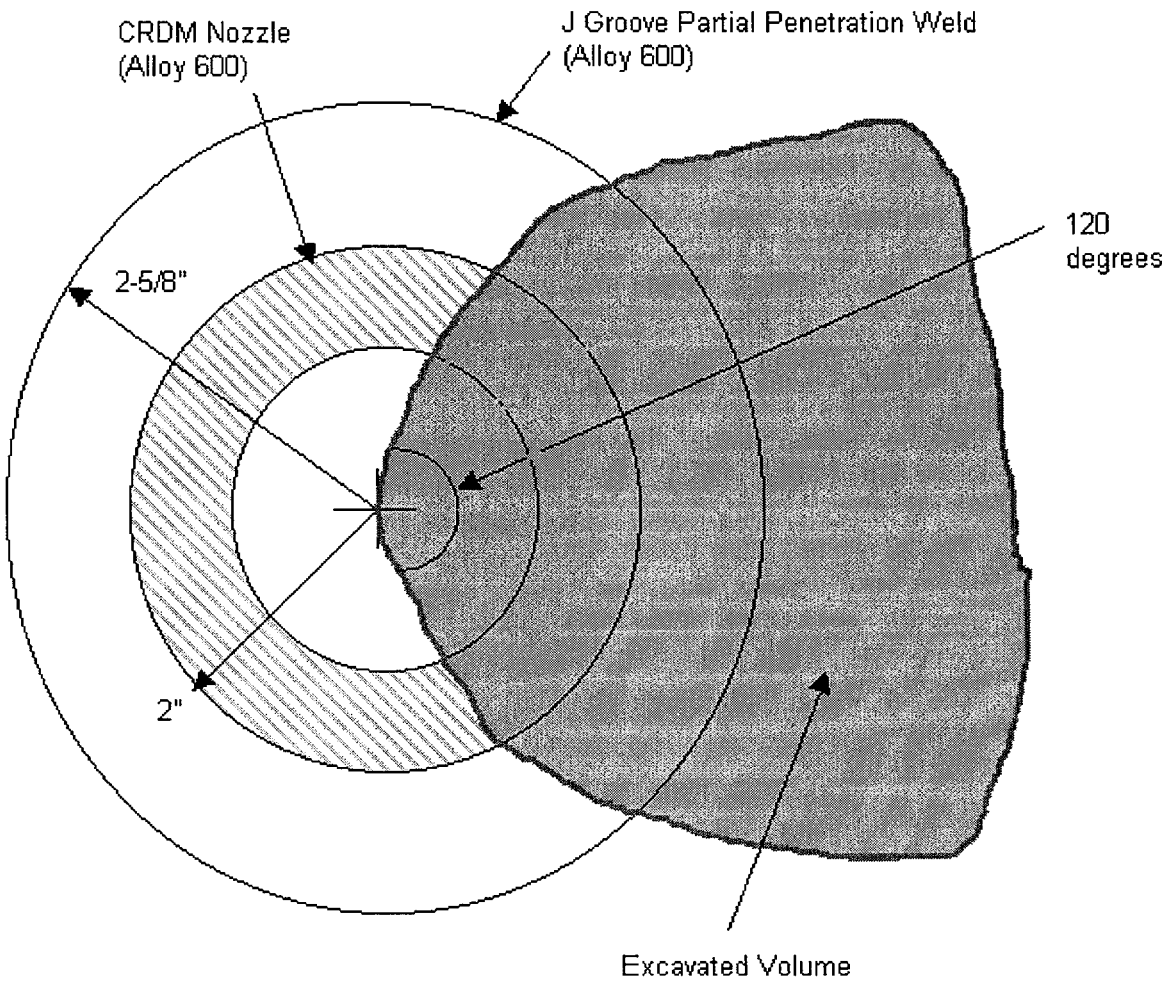


NOTE:

Dimension values are typical except for CRDM OD, CRDM wall thickness, and RV head thickness.

Figure 1
Oconee Nuclear Station

CRDM Nozzle Excavation Detail

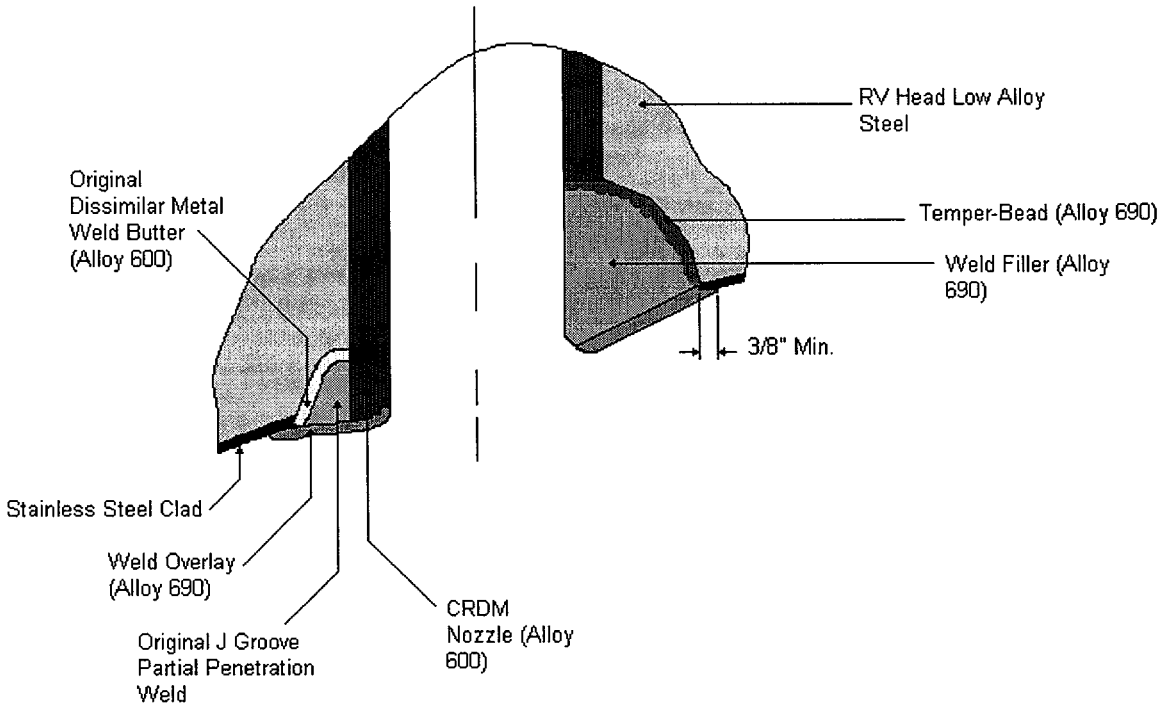


NOTE:

Dimension values are typical except for CRDM OD.

Figure 2
Oconee Nuclear Station

Plan View (Looking Up) of CRDM Excavation



NOTE:

Dimension values are typical.

Figure 3
Oconee Nuclear Station

Detail of CRDM Nozzle Repaired Configuration