Duke Energy

W. R. McCollum, Jr.
Vice President

Duke Energy
Oconee Nuclear Station
7800 Rochester Highway
Seneca, SC 29672
(864) 885-3107 OFFICE
(864) 885-3564 FAX

May 13, 2001

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

SUBJECT: Oconee Nuclear Station - Unit 2
Docket No. 50-270
Request to use an Alternative to ASME Boiler and Pressure Vessel Code, Section XI in accordance with 10 CFR 50.55a(a)(3)(ii) (RR 01-08)

Pursuant to 10 CFR 50.55a(a)(3)(ii), Duke Energy Corporation (DEC) requests the use of alternatives to portions of the ASME Boiler and Pressure Vessel Code, Section XI, Subsections IWA-4170(d) and IWA-4310, 1992 Edition with no addenda for Oconee Unit 2.

Approval of this request would allow the use of alternates to the post-weld repair non-destructive examination requirements, flaw removal, and implicit crack characterization requirements of the above ASME code section for the repair of Class A Reactor Vessel head components. It has been evaluated and determined that the alternatives described herein provide an acceptable level of quality and safety. Entry into Mode 2 operation following completion of repairs is currently scheduled for May 26, 2001.

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

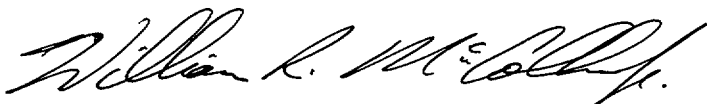
Attachments A, B, and C to this request contain information proprietary to Framatome ANP (FRA-ANP). Brackets enclose the proprietary information "[]" provided in Attachment A. Attachments B and C are proprietary in their entirety. An affidavit from FRA-ANP is included as Attachment D. This affidavit establishes the basis on which the NRC, pursuant to

A047

10 CFR 2.790 may withhold the information from public disclosure. Attachment E provides a non-proprietary version of this request.

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

Very truly yours,



William R. McCollum,
Oconee Site Vice President

Attachments:

A - Request for Alternative, Serial Number 01-08 (Proprietary)
B - Framatome-ANP Document No. 32-5012625-00 (Proprietary)
C - Framatome-ANP Document No. 32-5012649-00 (Proprietary)
D - Affidavit of R.W. Ganthner
E - Request for Alternative, Serial Number 01-08 (Non-Proprietary)

cc w/att:

L. A. Reyes, Regional Administrator
U.S. Nuclear Regulatory Commission, Region II
Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, GA 30303

D. E. Labarge, Senior Project Manager (ONS)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-8 H12
Washington, D.C. 20555-0001

cc (w/o att):

M. E. Shannon,
NRC Senior Resident Inspector
Oconee Nuclear Station

Mr. Virgil Autrey
Division of Radioactive Waste Management
Bureau of Land and Waste Management
SC Dept. of Health & Environmental Control
2600 Bull St.
Columbia, SC 29201

ATTACHMENT D

DUKE ENERGY CORPORATION
RELIEF REQUEST 01-08

AFFIDAVIT OF

R. W. Ganthner

AFFIDAVIT OF RAYMOND W. GANTHNER

A. My name is Raymond W. Ganthner. I am Vice-President of Engineering & Licensing for Framatome ANP, Inc. (FRA-ANP), and as such, I am authorized to execute this Affidavit.

B. I am familiar with the criteria applied by FRA-ANP to determine whether certain information of FRA-ANP is proprietary and I am familiar with the procedures established within FRA-ANP to ensure the proper application of these criteria.

C. In determining whether an FRA-ANP document is to be classified as proprietary information, an initial determination is made by the Unit Manager, who is responsible for originating the document, as to whether it falls within the criteria set forth in Paragraph D hereof. If the information falls within any one of these criteria, it is classified as proprietary by the originating Unit Manager. This initial determination is reviewed by the cognizant Section Manager. If the document is designated as proprietary, it is reviewed again by me to assure that the regulatory requirements of 10 CFR Section 2.790 are met.

D. The following information is provided to demonstrate that the provisions of 10 CFR Section 2.790 of the Commission's regulations have been considered:

(i) The information has been held in confidence by FRA-ANP. Copies of the document are clearly identified as proprietary. In addition, whenever FRA-ANP transmits the information to a customer, customer's agent, potential customer or regulatory agency, the transmittal requests the recipient to hold the information as proprietary. Also, in order to strictly limit any potential or actual customer's use of proprietary information, the substance of the following provision is included in all agreements entered into by FRA-ANP, and an equivalent version of the proprietary provision is included in all of FRA-ANP's proposals:

"Any proprietary information concerning Company's or its Supplier's products or manufacturing processes which is so designated by Company or its Suppliers and disclosed to Purchaser incident to the performance of such contract shall remain the property of Company or its Suppliers and is disclosed in confidence, and Purchaser shall not publish or otherwise disclose it to others without the written approval of Company, and no rights, implied or otherwise, are granted to produce or have produced any products or to practice or cause to be practiced any manufacturing processes covered thereby.

Notwithstanding the above, Purchaser may provide the NRC or any other regulatory agency with any such proprietary information as the NRC or such other agency may require; provided, however, that Purchaser shall first give Company written notice of such proposed disclosure and Company shall have the right to amend such proprietary information so as to make it non-proprietary. In the event that Company cannot amend such proprietary information, Purchaser shall prior to disclosing such information, use its best efforts to obtain a commitment from NRC or such other agency to have such information withheld from public inspection.

Company shall be given the right to participate in pursuit of such confidential treatment."

(ii) The following criteria are customarily applied by FRA-ANP in a rational decision process to determine whether the information should be classified as proprietary. Information may be classified as proprietary if one or more of the following criteria are met:

a. Information reveals cost or price information, commercial strategies, production capabilities, or budget levels of FRA-ANP, its customers or suppliers.

b. The information reveals data or material concerning FRA-ANP research or development plans or programs of present or potential competitive advantage to FRA-ANP.

c. The use of the information by a competitor would decrease his expenditures, in time or resources, in designing, producing or marketing a similar product.

d. The information consists of test data or other similar data concerning a process, method or component, the application of which results in a competitive advantage to FRA-ANP.

e. The information reveals special aspects of a process, method, component or the like, the exclusive use of which results in a competitive advantage to FRA-ANP.

f. The information contains ideas for which patent protection may be sought.

The document(s) listed on Exhibit "A", which is attached hereto and made a part hereof, has been evaluated in accordance with normal FRA-ANP procedures with respect to classification and has been found to contain information which falls within one or more of the criteria enumerated above. Exhibit "B", which is attached hereto and made a part hereof, specifically identifies the criteria applicable to the document(s) listed in Exhibit "A".

(iii) The document(s) listed in Exhibit "A", which has been made available to the United States Nuclear Regulatory Commission was made available in confidence with a request that the document(s) and the information contained therein be withheld from public disclosure.

(iv) The information is not available in the open literature and to the best of our knowledge is not known by General Electric, Westinghouse-CE, or other current or potential domestic or foreign competitors of FRA-ANP.

(v) Specific information with regard to whether public disclosure of the information is likely to cause harm to the competitive position of FRA-ANP, taking into account the value of the information to FRA-ANP; the amount of effort or money expended by FRA-ANP developing the information; and the ease or difficulty with which the information could be properly duplicated by others is given in Exhibit "B".

E. I have personally reviewed the document(s) listed on Exhibit "A" and have found that it is considered proprietary by FRA-ANP because it contains information which falls within one or more of the criteria enumerated in Paragraph D, and it is information which is customarily held in confidence and protected as proprietary information by FRA-ANP. This report

comprises information utilized by FRA-ANP in its business which affords FRA-ANP an opportunity to obtain a competitive advantage over those who may wish to know or use the information contained in the document(s).

RAYMOND W. GANTHNER

State of Virginia)
) SS. Lynchburg
City of Lynchburg)

Raymond W. Ganthner, being duly sworn, on his oath deposes and says that he is the person who subscribed his name to the foregoing statement, and that the matters and facts set forth in the statement are true.

RAYMOND W. GANTHNER

Subscribed and sworn before me
this 13 day of May 2001.

Notary Public in and for the City
of Lynchburg, State of Virginia.

My Commission Expires 2/29/04

EXHIBITS A & B

EXHIBIT A

Request for Alternate No. 01-08, Duke Energy Corporation, Oconee Nuclear Station, Unit 2.

EXHIBIT B

The above listed document contains information which is considered Proprietary in accordance with Criteria b, c, d, e and f of the attached affidavit.

DUKE ENERGY CORPORATION
Oconee Nuclear Station, Unit 2

Request for Alternate 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 2, 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 Requirements for Which an Alternative is Requested

An alternative is requested to the following portion of IWA-4170(d):

IWA-4170(d) requires that "... An item to be used for replacement may meet all or portions of the requirements of later Editions and Addenda of the Construction Code or Section III ...." The Unit 2 RV closure head original code of construction is the ASME Section III 1965 edition with Summer 1967 addenda. The 1989 ASME Section III code has been adopted for the repairs described herein. Section III, subsection NB-5330(b) requires that "Indications characterized as cracks, lack of fusion, or incomplete penetration are unacceptable regardless of length."

An alternative is requested to the following portions of subsection IWA-4310:

IWA-4310 requires in part that "Defects shall be removed or reduced in size in accordance with this Paragraph." Furthermore, IWA-4310 allows that "...the defect removal and any remaining portion of the flaw may be evaluated and the component accepted in accordance with the appropriate flaw evaluation rules of Section XI."

An alternative is requested to the requirement that the repair meet all the rules of the referenced Section III code as noted in IWA-4170(d). Specifically, the acceptance rules for weld lack of fusion in NB-5330(b), and the implicit requirement for evaluation of the actual flaw characteristics as defined in the rules of IWB-3500 as referenced in IWA-4310.

Description of Proposed Alternatives

In lieu of the requirements of IWA-4170(d) and the referenced weld lack of fusion requirements of NB-5330(b), the following alternative is proposed:

[

] Experience has shown that during solidification of the Alloy 690 weld filler material, a lack of fusion (otherwise known as a welding solidification anomaly) area may occur at the root of the partial penetration welds. Subsection NB-5330(b) mandates that no lack of fusion is acceptable. Calculations have been completed which justifies this welding solidification anomaly.

In lieu of the requirements to the noted portions of IWA-4310 and the referenced flaw evaluation rules defined in IWB-3500, the following alternative is proposed:

The planned repair for the subject CRD nozzles does not include [ ], therefore, per the requirements of IWA-4310, the cracks must be evaluated using the appropriate flaw evaluation rules of Section XI. These cracks were discovered by liquid penetration examinations. No additional inspections are planned to characterize the cracks. Thus, the actual dimensions of the flaw will not be fully determined. In lieu of fully characterizing the existing cracks, it is planned to utilize worst case assumptions to conservatively estimate the crack extent and orientation. The postulated crack extent and orientation will then be evaluated versus the rules of IWB-3500.

Background Information

Normal inspections of the Unit 2 RV closure head during a refueling outage discovered small amounts of boron emanating from the CRDM nozzle interface with the outside radius of the closure RV head. Boron deposits were discovered at this interface for CRDM nozzles Nos. 4, 6, 18, and 30[1]. This pressure boundary degradation was reported to the NRC on April 28, 2001 in accordance with 10CFR50.72(b)(3)(ii).

Liquid penetrant examinations have confirmed the existence of cracks in the original J-groove partial penetration welds and in the CRDM nozzle base material.

Experience gained from the repairs to the Unit 1 and Unit 3 CRDM nozzles indicated that removal and repair of the defective portions of the original J-groove partial penetration welds were time consuming and radiation dose intensive. The previous repairs indicated that more remote automated repair methods were needed to reduce radiation dose to repair personnel. So for the Unit 2 repairs, [ ]

[1] Should the relief requested herein be needed for other CRDM nozzles, a letter supplementing this request will identify these nozzles.

[

]

Justification for Alternate to Welding Solidification Anomaly Acceptance Requirements for New Pressure Boundary Weld

[Welding solidification is an inherent problem when [

] IWA-4170 mandates that the repair design meets the original construction code or the adopted Section III code. As noted the 1989 ASME Section III code has been adopted for qualification of the described repairs. Subsection NB-5330(b) stipulates that no lack of fusion area be present in the weld. To account for this problem, a flaw evaluation was performed to justify flaws up to [

] This Framatome-ANP calculation, document number 32-5012625-00, "[

]" (See Attachment B), evaluated the postulated [ ] flaw based on the 1992 Section XI subsection IWB-3612 acceptance criteria based on applied stress intensity factor, and the IWB-3642 limit load acceptance criteria based on applied stress. The evaluation demonstrates that a [ ] weld anomaly is acceptable for an eight-year design life. A fracture toughness margin of 10.6 was shown compared to the required margin of $10^{1/2}$ per IWB-3612, and a limit load margin of 6.99 was shown compared

to the required margin of 3.0 per IWB-3642. The eight-year design life exceeds the time planned for replacement of the Unit 2 RV closure head.

Justification for Alternate to Flaw Removal and Characterization Requirements for J-groove Partial Penetration Weld

A flaw tolerance evaluation was completed to determine the extent to which an assumed radial crack, [

], would grow into the RV closure head low alloy steel. This Framatome-ANP calculation, document number 32-5012649-00, "CRDM Nozzle J-Groove Weld Flaw." (See Attachment C), used the normal and upset loads applicable to the RV head to determine the stress intensity factor that would drive the crack. The yield strength of the SA-533 Grade B, Class 1 Mn-Mo low alloy steel plate was established as 43.8 ksi at 600 degrees F for this evaluation. The RT_{NDT} was conservatively taken as 60 degrees F and a fracture toughness of 250 ksi-$in^{1/2}$ was used as a conservative upper shelf value for evaluation of loads at temperatures above 500 degrees F. At temperatures below 250 degrees F, the fracture toughness of the material was established in accordance with Appendix A, Article A-4000 of Section XI.

Based on fatigue crack growth calculations for the RV closure head low alloy steel, a postulated radial crack [ ] in the J-groove partial penetration weld would be acceptable for 70 heat-up and cool-down cycles. The resultant number of heat-up/cool-down cycles bounds the expected number of such cycles during the period of time until the RV closure head is replaced.

The Quality and Safety Provided by the Proposed Alternative

IWA-4170 mandates that the repair meet the provisions of the original design code of record or an adopted Section III code, subject to regulatory acceptance of the adopted Section III code. An analysis of the new pressure boundary weld indicates that the welds meet the stress and fatigue requirements of Section III. The flaw evaluation, assuming a [ ] flaw

at the root of the weld, has shown an acceptable service life of the new weld, until the new RV closure head can be replaced. Acceptable material fracture toughness margins were shown to exceed the requirements of Section XI IWA-3612 and the limit load margins in IWA-3642. The root of the new weld will be examined in accordance with Section III NB-5330 acceptance criteria. The qualified procedure is capable of detecting flaws at the [ ] postulated size. The alternative, along with the cited analyses and examinations will provide an acceptable level of quality and safety when compared to the referenced code requirements.

The requirements of IWA-4310 allow two options for determining the disposition of discovered cracks. The subject cracks are either removed as part of the repair process or left as-is and evaluated per the rules of IWB-3500. The assumptions of IWB-3500 are that the cracks are fully characterized to be able to compare the calculated crack parameters to the acceptable parameters addressed in IWB-3500.

In the alternative being proposed, the postulated crack extent is calculated based on the two inputs of expected crack orientation and the geometry of the weld. Typically, an expected crack orientation is evaluated based on prevalent stresses at the location of interest. In these welds, operating stresses were obtained using finite element analysis of the RV closure head. Since hoop stresses were calculated to be the dominant stress, it is expected that radial type cracks (with respect to the penetration) will occur. Using worst case (maximum) assumptions with the geometry of the as left weld, the postulated crack was assumed to begin at the intersection of the RV closure head inner diameter surface [ ] and propagate into the RV closure head low alloy steel. Based on this weld geometry and the expected orientation, the crack was assumed in the radial direction [ ]. The depth and orientation are worst case assumptions for cracks that may occur in the remaining J-groove partial penetration weld configuration. [

]

A flaw tolerance evaluation for fatigue crack growth was then completed to evaluate the depth to which this postulated worst case radial crack would grow into the RV closure head low alloy steel. The evaluation showed the crack growth into the RV closure head low alloy steel was insignificant, and further, that the RV closure head was acceptable, given that these postulated cracks would remain for 70 heat-up/cool-down cycles. Assuming a conservative number of 10 heat-up/cool-down cycles in a given year, the RV closure head, with the postulated cracks, is acceptable for seven years.

An additional evaluation was made to determine the potential for debris from a cracking J-groove partial penetration weld. As noted above, radial cracks were postulated to occur in the weld due to the dominance of the hoop stress at this location. The occurrence of transverse cracks that could intersect the radial cracks is considered remote. There are no forces that would drive a transverse crack. Only thermal and welding residual stresses could cause a transverse crack to grow. However, the presence of radial cracks limits the growth potential of the transverse cracks. The radial cracks would relieve the potential transverse crack driving forces. Hence it is unlikely that a series of transverse cracks could intersect a series of radial cracks resulting in any fragments becoming dislodged.

The cited evaluations provide an acceptable level of safety and quality in insuring that the RV closure head remains capable of performing its design function until the head is replaced between 2003 and 2006.

Justification for Granting Relief

DEC believes that compliance with the portions of Section XI IWA-4170(d) and Section III NB-5330(b) (by reference) constitutes a hardship per 10 CFR 50.55 (a), (a)(3)(ii). It is physically impossible, using the techniques described, to install the new pressure boundary welds without the possibility of a solidification anomaly. The new and innovative approach for repair of the subject CRDM nozzles will significantly reduce radiation dose to repair personnel. The total radiation dose for the remote semi-automated repair

method is currently projected to be 25 to 30 REM[2]. In contrast, it is projected, using the Unit 1 and 3 manual repair methods for Unit 2 would result in a total radiation dose of 125 REM. It has been shown that the new pressure boundary welds, with the cited analyses, and the alternate examinations, are acceptable and thus demonstrate the repairs provide an acceptable level of quality and safety.

DEC believes that compliance with the portions of IWA-4310 described constitutes a hardship per 10 CFR 50.55 (a), (a)(3)(ii). Removal of the cracks in the existing J-groove partial penetration welds would incur excessive radiation dose for repair personnel. [

] It is well understood that the cause of the cracks in the subject J-groove welds is Primary Water Stress Corrosion Cracking (PWSCC). As shown by industry experience, the low alloy steel of the RV head impedes crack growth by PWSCC. DEC believes the alternatives described will provide an acceptable level of quality and safety when compared to the code requirements in IWB-3500 to characterize the cracks left in service. Using flaw tolerance techniques, it has been determined that the assumed worst case crack size would not grow to an unacceptable depth into the RV head low alloy steel. Thus, the RV head can be accepted per the requirements of IWA-4310.

Due to the previous repairs to the Oconee Unit 1 thermocouple nozzles and CRDM nozzle 21, the Unit 3 CRDM nozzles, the Unit 2 CRDM repairs described herein, and Primary Water Stress Corrosion Cracking concerns throughout the nuclear industry, DEC is planning to replace the Oconee Units 1, 2 and 3 RV heads. Orders for the new RV heads have been placed. The RV heads are to be replaced between 2003 and 2006.

Duration of the Proposed Alternative

The proposed alternative is only applicable to the repairs of the subject Oconee Unit 2 RV head CRDM nozzles.

[2] The initial dose estimate of 21 REM provided in Request for Alternate 01-07 is increased due to unanticipated tooling repairs and process changes.

Implementation Schedule

This Request for Alternate is associated with the ongoing repair of the Unit 2 RV head CRDM nozzles. Entry into Mode 2 operation is currently scheduled for May 26, 2001.

References

3. Framatome-ANP document 32-5012625-00, "[ ]" dated 4/30/01 (See Attachment B)

4. Framatome-ANP document 32-5012649-00, "CRDM Nozzle J-Groove Weld Flaw", dated 4/26/01 (See Attachment C).

Originated By: Timothy D. Brown for 5/13/01
Melvin L. Arey, Jr. Date

Reviewed By: [signature] for 5/13/01
Leonard J. Azzarello Date

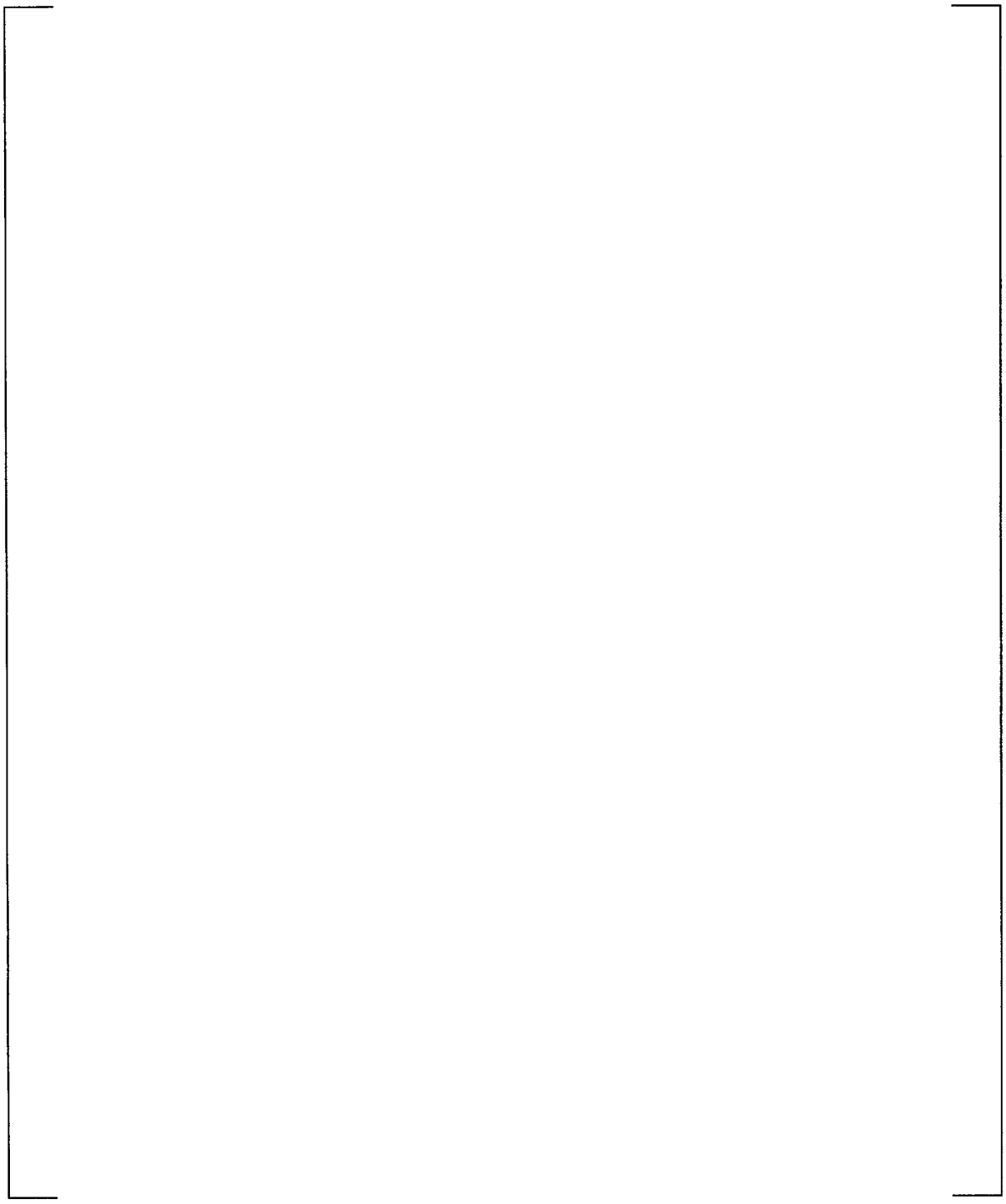


Figure 1: Oconee Unit 2 CRDM Machining

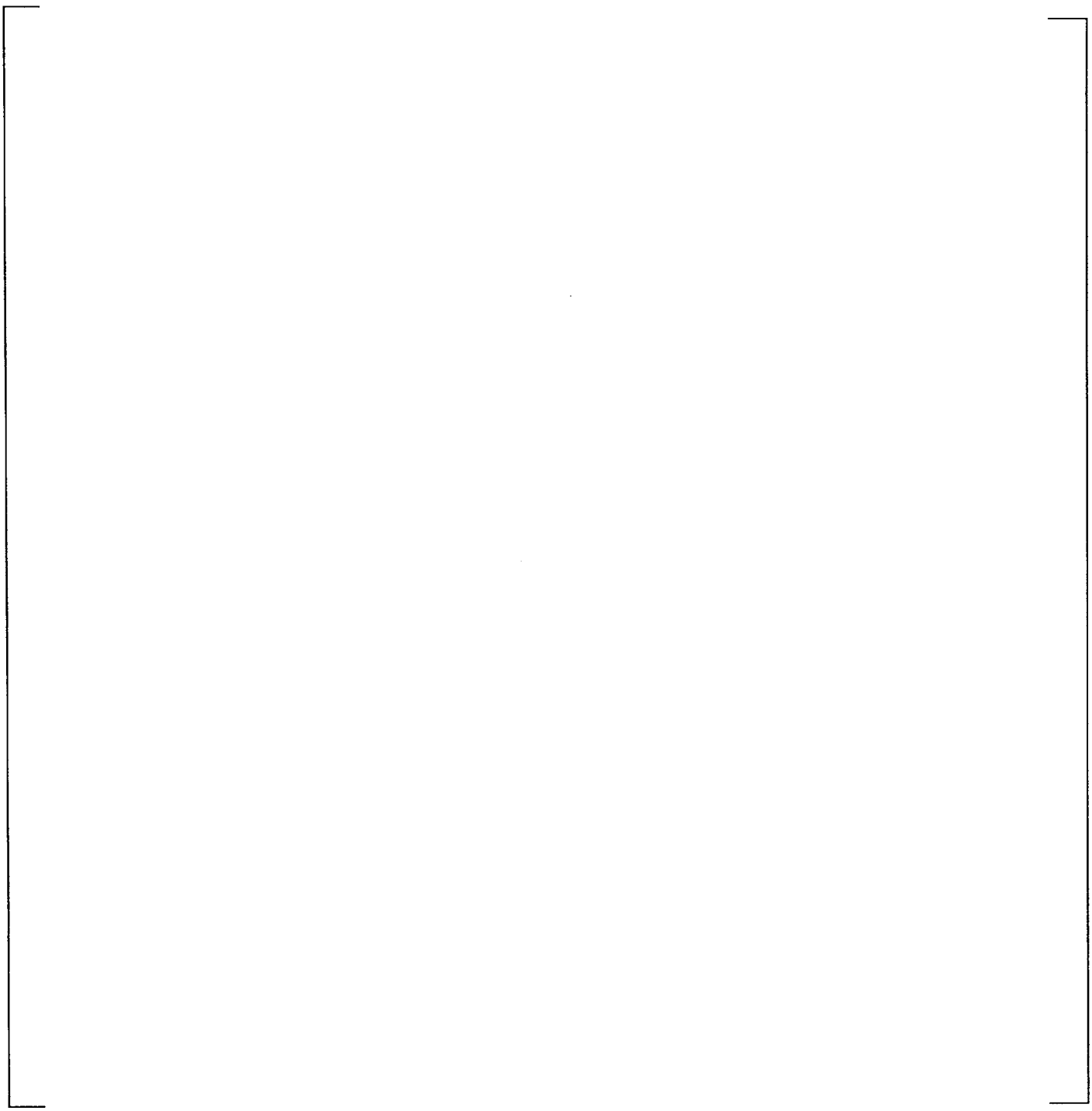


Figure 2: Oconee Unit 2 New CRDM Pressure Boundary Welds