VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

April 8, 1998

U.S. Nuclear Regulatory Commission
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Docket Nos.	50-338
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License Nos.	NPF-4
	NPF-7

Dear Sir:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
PROPOSED ALTERNATIVE TO ASME SECTION XI
REPLACEMENT EXAMINATION REQUIREMENTS
PART-LENGTH CONTROL ROD DRIVE MECHANISM HOUSING REPAIR

In response to the flaw identified in a dissimilar metal weld on a part-length CRDM housing at Prairie Island Unit 2, North Anna Unit 2 is planning to replace the part-length control rod drive mechanism (CRDM) housings during the Spring 1998 refueling outage. The refueling outage began on April 5, 1998. The CRDM housing replacement will be performed in accordance with ASME Section XI 1986 Edition (2nd interval Code of reference). The construction Code being used is the 1989 Edition of ASME Section III. Paragraph NB-5271 of ASME Section III requires examination of the final seal weld with a surface (magnetic particle or liquid penetrant) examination method. However, this Code examination requirement creates an unusual difficulty and hardship based on accessibility and personnel exposure. Therefore, pursuant to 10 CFR 50.55a(a)(3), Virginia Electric and Power Company requests the use of an alternate examination method to complete the CRDM part-length housing replacement activity. The alternative proposed examination provides an acceptable level of safety and quality. The alternative examination techniques and supporting documentation are provided in the attachment to this letter.

The next Unit 1 refueling outage is scheduled for fall 1998. Planning for the Unit 1 refueling outage and the corrective action plan for the CRDM part-length housings is ongoing. Although we have not finalized our corrective action plan for the CRDM part-length housings in Unit 1, to facilitate regulatory review, approval of the proposed alternative examination is being requested for both units at this time. The proposed alternative examination requested and the basis are identical, except that the Unit 1 Code of reference is the 1983 Edition with the Summer 1983 Addenda of ASME Section XI. The construction Code would still be the 1989 Edition of ASME Section III.

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In order to complete replacement of the CRDM part-length housing in Unit 2 and not impact the current outage schedule, we request review and approval of the proposed alternative examination by April 15, 1998.

If you have any questions or require additional information concerning this matter, please contact us.

Very truly yours,

R F Saunders

R. F. Saunders
Vice President – Nuclear Engineering and Services

Attachment

cc: U. S. Nuclear Regulatory Commission
Region II
Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, Georgia 30303

Mr. M. J. Morgan
NRC Senior Resident Inspector
North Anna Power Station

ATTACHMENT

10 CFR 50.55a(a)(3) Alternative Examination Technique
Control Rod Drive Mechanism Housing
Replacement Activity

Virginia Electric and Power Company
North Anna Units 1 and 2

ATTACHMENT

I. Component Identification

Code Class:	ASME Class 1
Drawing:	Attached
Examination Category:	NA
Item Number:	NA
Description:	Seal Weld of Reactor Head Adapter to CRDM & Caps

II. Current Code Requirement

The ASME Boiler and Pressure Vessel Code Section III, NB-5271, "Welds of Specially Designed Seals," requires that welds of this type be examined by either the magnetic particle or liquid penetrant method.

III. Alternative Basis

The current Code examination requirement would be an unnecessary hardship to perform. The proposed replacement activity located on top of the reactor vessel head will be located in an approximate 2,000 mr/hr field. The replacement activity itself will be conducted primarily by remote means limiting exposure to personnel. However, remote tooling to perform the code required surface examination is not available. In addition, the accessibility of the new seal welds is limited. The part-lengths are located toward the interior of all the control rod drive housing arrangements (see attached drawing). The poor accessibility is additionally compounded by the close proximity of each of the control rod drive housings to each other. The separation clearance between the outer housings varies from approximately 4 to 8 inches. The distance between the housings is inadequate to gain complete access to the new seal welds for inspection. Performing the current code requirements which includes final surface preparation for examination, the liquid penetrant surface examination, and the subsequent clean-up activities would be extremely difficult as a result. A best effort surface examination would most likely cover only a small percentage of the required surfaces if any, while still requiring high radiation exposure to personnel performing the work.

IV. Proposed Alternative

In accordance with the provisions of 10 CFR 50.55a(a)(3), the following alternative requirements are proposed which provide an acceptable level of quality and safety;

1. Use of a controlled automatic welding process.

2) Observation of the weld puddle/deposit via a camera with an approximately eight-times magnification capability during the welding process.

3) A final visual examination of the weld surface using the same camera with an approximately eight-times magnification capability.

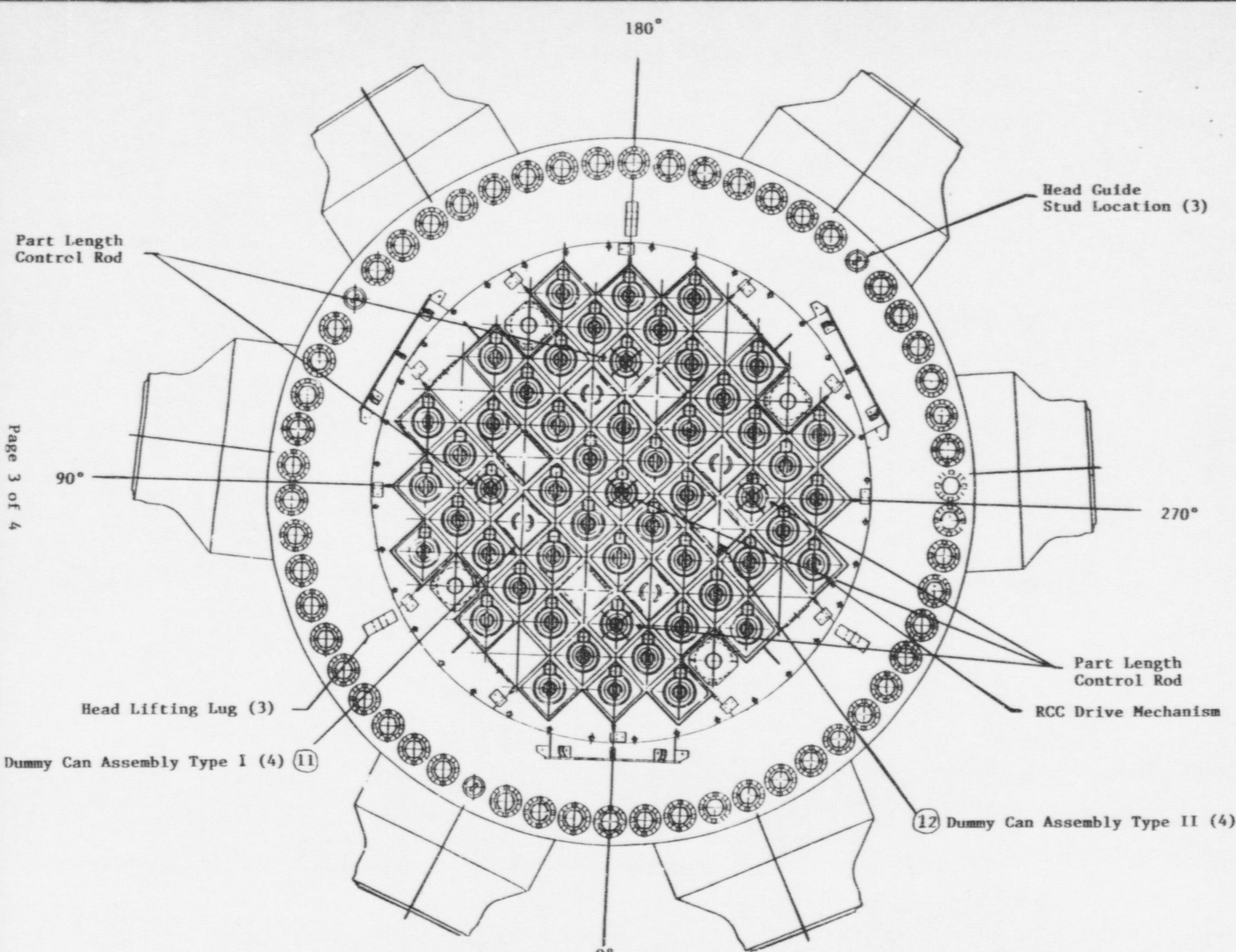
4) Performance of a VT-2 inspection of the reactor head area in accordance with IWA-5241 during the start-up leakage test.

Westinghouse performed an analysis to calculate the size of the critical flaw associated with the Cap Seal Welds. A summary of this analysis is attached. The result showed that the critical flaw length exceeded 70% of the circumference of the weld.

The proposed visual examination will be performed using a camera with an approximately eight-times magnification capability. This is an enhanced examination over the normal VT-1 type examination as defined by the Code.

The proposed alternative is very similar to the alternative requirements proposed by Northern States Power for their Prairie Island Unit 2 plant in their letter of February 13, 1998 and found acceptable by the NRC in a letter dated February 20, 1998.

The replacement activity will be reviewed by the Authorized Nuclear Inservice Inspector (ANII) and will be documented as required with a NIS-2 form.



PLAN VIEW WITH HEAD ASSEMBLED

Critical Flaw Size Calculation: Cap Seal Welds

A structural evaluation was conducted to determine the amount of weld material which is necessary to ensure the integrity of the seal weld applied to the caps installed on the part length CRDM housings. Although the majority of the axial forces from the operating pressure are taken by the threads, there are some stresses which result from differences in thermal expansion for the materials at steady state operation.

A detailed finite element analysis has been carried out to determine these stresses, and the results show that the maximum stress in the seal weld region is 10.02 ksi. This stress was applied to the weld in an evaluation of the critical flaw size , to determine how much weld would be required to take the stress. The evaluation was a ductile limit load calculation, and used the same approach used by the ASME Code Section XI.

The result showed that the critical flaw length exceeded 70 percent of the circumference of the weld. This means that 70 percent of the circumference of the weld could be completely missing, and it would still take the required loads. The stress at failure for the remaining cross section would still be 22 ksi, providing a factor of safety of more than two over the maximum stress of 10.02 ksi present there. This assessment has used all the applied stresses in the region of interest, regardless of whether they would actually contribute to a potential failure here. The thermal expansion stresses would be relieved as the flaw extended, and therefore would have no effect on the failure, so their inclusion adds further margin to the calculation.

Since there is a need to maintain a leak-tight seal with the weld, another way of looking at the integrity of the joint may be in order. A series of analyses were completed to determine how much of the weld thickness is necessary to carry the stresses at this location. The results showed that less than 15 percent of the weld thickness is needed to carry the stress, while still maintaining a margin of more than two on the stresses. This means that a continuous region of lack of fusion or some other form of degradation could be present around the entire circumference of the weld, to a depth of more than 85 percent of the weld thickness, and the weld would still take the loads.

Therefore there is no need for a surface examination of the seal weld, since only a very small part of it is needed to take the loads.

W. Bamford

Warren Bamford
Structural Mechanics Technology
Westinghouse
6 April 1998