

VIRGINIA ELECTRIC AND POWER COMPANY  
RICHMOND, VIRGINIA 23261

June 15, 2007

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

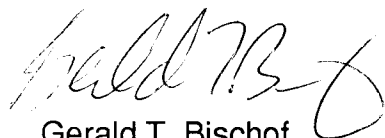
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**VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)**  
**NORTH ANNA POWER STATION UNIT 2**  
**ORDER - EA 03-009 SIXTY-DAY REPORT**  
**REACTOR PRESSURE VESSEL (RPV) HEAD INSPECTION RESULTS**

On February 20, 2004 the NRC issued the first revised Order (EA-03-009) establishing interim inspection requirements for reactor pressure vessel heads. In order to meet the Order inspection requirements, both a bare-metal visual exam of the RPV head surface and volumetric examinations of each penetration from under the RPV head were performed during the North Anna Unit 2 spring refueling outage. In accordance with the Order's inspection and reporting requirements, this letter provides the results of: 1) the visual inspections performed to identify potential boric acid leaks above the RPV head and 2) the volumetric examination results completed on all penetrations, including a leak path assessment of the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel. No crack indications or indications of leakage or material wastage were identified. A summary of the inspections and the results are provided in the attachment to this letter.

If you have any questions or require additional information, please contact Mr. Thomas Shaub at (804) 273-2763.

Very truly yours,



Gerald T. Bischof  
Vice President – Nuclear Engineering

Commitments made in this letter: None

Attachment: Sixty-Day Report Reactor Pressure Vessel Head Inspection Results North Anna Power Station Unit 2

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**REACTOR PRESSURE VESSEL HEAD INSPECTION RESULTS**  
**NORTH ANNA POWER STATION UNIT 2**

## **Introduction**

During the North Anna, Unit 2, 2007 refueling outage (N2R18), Virginia Electric and Power Company (Dominion) performed a comprehensive examination of the reactor vessel (RPV) head and head penetrations to meet the First Revised NRC Order EA-03-009 issued February 20, 2004. This examination included a bare metal visual examination of 100% of the head surface (including 360 degrees around each RPV head penetration nozzle); ultrasonic (UT) examinations of sixty-five (65) control rod drive mechanism (CRDM) penetrations and one (1) vent line penetration. A liquid penetrant (PT) examination was also performed on the vent line J-groove weld and end of nozzle surfaces.

## **Inspections**

### **Bare Metal Visual Examinations**

The bare metal visual examination used remote techniques to examine the vessel head surface and penetration areas behind the shroud. Direct visual examination techniques were performed to examine the vessel head surface outside the shroud down to the vessel flange.

Due to masking of a majority of the head penetrations (50 of 66), which prevented an effective as-found bare metal visual examination, an examination of the head penetrations from under the head (volumetric and surface) was performed to assist in the interpretation of the head surface condition. The head penetration masking was due to the accumulation of debris. The debris consisted of paint chips and residue from the intermediate lift rig. Samples of this debris did not identify the presence of boric acid. The bare metal visual examination performed consisted of a combination of an as-found condition and as-left condition examination. An as-found visual examination of the head surface and head penetration annulus region was performed to document the condition of the unmasked regions of the head and extent of the masking. The head surface was then cleaned to remove all debris that obstructed an effective bare metal visual examination. An as-left visual examination was performed of the entire head (> 95%) to determine the condition of the head and to establish a baseline condition for comparison with future bare metal visual examinations.

### **Volumetric Examinations**

The volumetric (ultrasonic) examinations of the head penetrations were performed from under the head to provide additional confirmation of the head surface condition by means of a leak path assessment to determine if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel.

During the ultrasonic examinations, each penetration was scanned to examine the required area of the First Revised NRC Order EA-03-009 issued February 20, 2004 as described below.

CRDM penetrations 1 through 65, excluding 47, 49, 51, and 53 were examined with the blade probe. Penetrations 47, 49, 51, and 53 were examined with the rotating probe due to funnels installed directly on the penetration.

Each CRDM penetration was scanned starting from the position at which probe contact could be established on the end of the penetration up to at least 2 inches above the highest point of the J-groove weld.

A small 0.080 inch radius on the end of each penetration examined with the blade probe precludes probe contact at the end of the penetration; however, this only affects required coverage on those peripheral penetrations 55 through 65 where the weld is within 2 inches of the end of the penetration. Coverage for each penetration examined with the blade probe, except 55 through 65 was obtained over a distance that includes at least 2 inches below the lowest point of the J-groove weld up to at least 2 inches above the highest point of the J-groove weld.

CRDM penetrations 47, 49, 51, and 53 have funnels installed directly on the penetration. The funnel bore on penetrations 47, 49, and 53 is smaller than the nozzle bore, which presents a physical obstruction with the transducer. This limitation precludes scanning low enough in the penetration to obtain the 2 inches of coverage below the weld. The J-groove weld on nozzle 51 did not extend as low as the welds on nozzles 47, 49, and 53 which allowed coverage of the required 2 inch examination zone.

The vent line penetration material was ultrasonically examined from the end of the penetration nozzle up to at least 2 inches above the weld. No flaws were detected in the vent line penetration material or the J-groove weld. The vent line J-groove weld surface was examined by PT with a color contrast solvent removable liquid penetrant examination technique. No indications were recorded during this PT examination.

## **Examination Results**

### **Bare Metal Visual Examinations**

The as-left bare metal visual examination revealed no evidence of degradation of the head surface or evidence of leakage. Greater than 95% of the head surface and 360 degrees around each head penetration was effectively examined with the bare metal visual examination. The area of the RPV head surface obscured by support structure interferences, which are located at RPV head elevations downslope from the outermost RPV head penetration, was unable to be effectively examined with the bare metal visual examination. However, the bare metal visual examination of the remaining head surface included those areas of the RPV head upslope and downslope from the support

structure interference to specifically identify any evidence of boron or corrosive product. No evidence of any boron or corrosive products was identified in these regions.

### Volumetric Examinations

The ultrasonic examination discussed above revealed no crack indications or UT leak path signals in the 65 CRDM penetrations. No crack indications were detected in the vent line penetration. In addition, no crack indications were detected during the vent line J-groove weld and end of nozzle liquid penetrant (PT) examination.

To support the UT examination coverage identified above, a finite element stress analysis of the CRDM penetrations was performed to ensure that the ultrasonic coverage of the penetrations encompasses at least 1.0 inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater. The following table identifies the penetrations with coverage less than 2.0 inches below the weld toe or to the end of the nozzles, the distance ultrasonically examined below the weld toe (downhill side of penetration), and the distance below the weld toe at which the stresses decay to 20 ksi (downhill side of penetration).

Penetrations with < 2 Inches of Coverage below Weld Toe

Penetration #	Distance Below Weld Toe Examined	Distance the Stresses Decay to 20 ksi
47	1.80"	1.06 inches below weld toe
49	1.80"	1.06 inches below weld toe
53	1.80"	1.06 inches below weld toe
55	1.86"	0.99 inches below weld toe
56	1.74"	0.99 inches below weld toe
57	1.89"	0.99 inches below weld toe
58	1.70"	0.94 inches below weld toe
59	1.85"	0.94 inches below weld toe
60	1.30"	0.94 inches below weld toe
61	1.56"	0.94 inches below weld toe
62	1.82"	0.94 inches below weld toe
63	1.82"	0.94 inches below weld toe
64	1.82"	0.94 inches below weld toe
65	1.67"	0.94 inches below weld toe

Each CRDM head penetration with less than 2.0 inches of coverage below the weld toe obtained at least 1.0 inch of coverage including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater.