VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

July 2, 2002

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

Serial No. 01-490G
NL&OS/ETS R0
Docket Nos. 50-338/-339
License Nos. NPF-4/-7

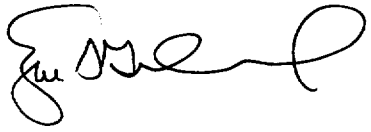
Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
REQUEST FOR ADDITIONAL INFORMATION
RESPONSE TO NRC BULLETIN 2001-01
RESULTS OF REACTOR VESSEL HEAD PENETRATION INSPECTIONS

In a letter dated June 13, 2002 (Serial No. 01-490F), Virginia Electric and Power Company (Dominion) provided a revised evaluation of the remaining service life for those penetrations with flaws identified during the recent inspections performed on reactor vessel head penetration (RVHP) nozzles for North Anna Units 1 and 2. The flaws in the affected penetrations were initially evaluated and reported using WCAP-14552 methodology, which included an assumed flaw aspect ratio of 6:1. However, some of the flaws found at North Anna had aspect ratios larger than 6:1. Subsequently, additional curves were prepared for flaw aspect ratios of 15:1, 20:1, 30:1, 65:1 and 100:1. Using the appropriate bounding aspect ratio, the flaws were reanalyzed for North Anna Units 1 and 2. In a July 1, 2002 telephone conference call, the NRC staff requested additional information regarding the flaws on the affected penetrations. The additional information for the affected penetrations is presented in the attachment to this letter.

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

Very truly yours,



Eugene S. Grecheck
Vice President – Nuclear Support Services

Attachment

AD88

cc: U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Suite 23 T85
Atlanta, Georgia 30303-8931

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

Mr. J. E. Reasor, Jr.
Old Dominion Electric Cooperative
Innsbrook Corporate Center, Suite 300
4201 Dominion Blvd.
Glen Allen, Virginia 23060

Mr. M. Grace
Authorized Nuclear Inspector
North Anna Power Station

SN: 01-490G
Docket Nos.: 50-338/339
Subject: RAI – NRC Bulletin 2001-01

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Eugene S. Grecheck, who is Vice President - Nuclear Support Services, of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 2nd day of July, 2002.

My Commission Expires: March 31, 2004.

Notary Public

(SEAL)

Attachment

NRC Bulletin 2001-01, Circumferential Cracking of Reactor Pressure Vessel Head (RVHP) Penetration Nozzles

Request for Additional Information
Remaining Service Life of Identified Flaws
In Reactor Vessel Head Penetration Nozzles

North Anna Units 1 and 2
Virginia Electric and Power Company
(Dominion)

Request for Additional Information on the Remaining Lifetime of Identified Flaws In Reactor Vessel Head Penetration Nozzles

NRC Question 1

For all flaws on the CRDM penetration tubes having revised service life below 4 years, please provide their flaw lengths, depths, locations (distances below or above the tip of the J-groove weld for both flaw ends). Confirm that the original version of the revised curves that were used in your evaluation is Figure 6-1a of WCAP-14552, Revision 2.

Response:

Penetrations With Life Less Than Four Years
(The most limiting flaw is listed for each penetration)

Penetration	Flaw Length (mm)	Flaw Depth (mm)	Location for Start of Flaw	Location for End of Flaw
North Anna Unit 1				
31	44	3.27	102 mm Below Tip of Weld	58 mm Below Tip of Weld
33	63	2.23	32 mm Below Tip of Weld	31 mm Above Tip of Weld
52	26	1.7	80 mm Below Tip of Weld	54 mm Below Tip of Weld
60	45	<1	113 mm Below Tip of Weld	68 mm Below Tip of Weld
North Anna Unit 2				
62	Cluster*	<1	60 mm Below Tip of Weld	53 mm Above Tip of Weld

* Number of short axial flaws

The revised curves represent the same information that is provided on Figure 6.1a in Revision 2 of WCAP-14552 for different aspect ratios. These curves were also created with a different size of initial flaw.

NRC Question 2

Provide stress, stress intensity factor, and crack growth rate values at a/t = 0.1, 0.2, 0.4, 0.6, 0.75, and 0.95 for Penetration 31 which has a revised service life of 2.37 years. In addition, provide detailed information on your stress calculation, including justification for considering or not considering residual and thermal stresses in your stress calculation.

Response:

North Anna Unit 1 Penetration 31
Actual Aspect Ratio 13.45:1 (15:1 aspect ratio used)

a/t	Stress* (ksi)	Stress Intensity Factor K_I (ksi $\sqrt{in}$)	K (mPa$\sqrt{m}$)	Crack Growth Rate at 330° C ** (m/sec)
0.1	38.4	18.964	20.86	4.93×10^{-11}
0.2	38.4	26.819	29.50	9.31×10^{-11}
0.4	38.4	45.952	50.55	2.11×10^{-10}
0.6	38.4	70.221	77.24	3.76×10^{-10}
0.7	38.4	85.60	94.16	4.86×10^{-10}
0.8	38.4	101.935	112.13	6.06×10^{-10}
0.9	38.4	119.176	131.09	7.37×10^{-10}

* 38.40 ksi is the yield stress of the material. The applied stress is close to 38.4 ksi. Minor fluctuations in the stress were observed because of the modeling of elements.

The total stress is from residual stress and pressure stress. The steady state thermal stress is insignificantly small. Thermal transient stresses were insignificant because the quick fluctuations do not affect stress corrosion cracking. These locations experience very small fatigue.

** Crack Growth Rate = $(2.800 \times 10^{-12}) (K - 9)^{1.16}$ m/sec at 330° C. A temperature correction factor of 0.526 is applied to correct the growth rate to 316° C. Crack growth rates in the last column must be multiplied by 0.526. The growth rate used in the North Anna analysis is $(1.473 \times 10^{-12}) (K - 9)^{1.16}$ m/sec.