Virginia Electric and Power Company
Richmond, Virginia 23261

June 22, 1999

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

Serial No.: 99-320
NL&OS/GDM: R0
Docket Nos.: 50-280, 281
50-338, 339
License Nos.: DPR-32, 37
NPF-4, 7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY AND NORTH ANNA POWER STATIONS UNITS 1 AND 2
GENERIC LETTER (GL) 96-06
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

In a letter dated May 25, 1999, the NRC requested additional information regarding Virginia Electric and Power Company's supplemental response to Generic Letter 96-06 dated March 30, 1999 (Serial Number 99-134). The supplemental response provided a structural integrity evaluation of thermally induced over-pressurization of containment penetration piping following a postulated design basis accident (DBA). Our response to the three questions included in the request for additional information is provided in the attachment.

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

Very truly yours,

D. A. Christian
Vice President - Nuclear Operations

Attachment

A072

Commitments contained in this correspondence: None.

cc: U.S. Nuclear Regulatory Commission
Region II
Atlanta Federal Center
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Atlanta, Georgia 30303

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

Mr. R. A. Musser
NRC Senior Resident Inspector
Surry Power Station

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mr. D. A. Christian, who is Vice President - Nuclear Operations, 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 22 day of June, 1999.

My Commission Expires: May 31, 2002

Vicki L. Hull
Notary Public

(SEAL)

Attachment

Response to NRC Request for Additional Information
Surry and North Anna Power Stations

In a letter dated March 30, 1999 (Serial Number 99-134), Virginia Electric Power Company (Virginia Power) submitted a structural integrity evaluation of thermally induced overpressurization of containment penetration piping following a postulated design basis accident (DBA), specifically a loss of coolant accident (LOCA) or a main steam line break (MSLB). The evaluation was performed using the linear elastic method and acceptance criteria of ASME Boiler and Pressure Vessel Code Section III, Appendix F, "Rules for Evaluation of Service Loading with Level D Service Limits." The specific criteria used in the analyses was submitted in our letter dated February 25, 1998 (Serial No. 96-516C) and was subsequently discussed in a telephone conversation with members of the NRC staff.

During their review of Virginia Power's March 30, 1999 submittal, the NRC staff generated the following questions and provided them in a May 25, 1999 request for additional information (RAI). Virginia Power's response to these questions is provided below:

Question 1

Load Combinations (*Reference Page 5 of Attachment 1 of Submittal*)

Note 2 states that seismic loading is not considered concurrent with a loss-of-coolant accident (LOCA). Provide the basis for not combining seismic and LOCA loads and also state how the requirements of General Design Criterion 2 of 10 CFR 50, Appendix A, which in part states "design bases shall reflect appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena" are met.

Response 1

Note 2 to Table 5.1 actually states that "Seismic loading is not considered concurrent with the event." The "event" stated is the thermally induced peak pressure event that results from a LOCA, not the LOCA (and associated dynamic loading) itself. To meet General Design Criterion 2 (GDC-2), safety related systems are designed for seismic loading under normal operating conditions and accident conditions. During accident conditions seismic loading is considered to occur concurrent with the design basis accident (LOCA) dynamic loading. For example, the dynamic loading associated with a LOCA is considered to be concurrent with the loading associated with the design basis earthquake and these peak loading effects are combined by the square root of the sum of the squares.

Seismic loading is not considered to be a credible, concurrent event with postulated thermally induced peak pressure loading. The reason these two events were not taken concurrently is that the seismic loading and the peak loading due to thermally induced over-pressure will not occur at the same time. As stated in the paragraph above, seismic loading and the DBA event are taken concurrently (i.e., they begin at the same instant in time). However, thermally induced peak pressure loading, which results from the process of heating of isolated piping sections by the steam released to the containment environs as a result of the DBA, sufficiently lags the initiation of the DBA, such that seismic loadings would have subsided prior to the imposition of peak pressure stresses. Thermally induced peak pressure only occurs for a short period of time because of containment cooling systems (Quench Spray/Containment Spray and Recirculation Spray) which are seismically designed and available after a design basis seismic event.

Furthermore, the frequency of core damage resulting from a seismic event occurring concurrently with a DBA is very small (i.e., $<10^{-6}$) and therefore risk insignificant. A seismic event occurring at the same time as the thermally induced peak pressure in the containment penetration piping caused by a DBA is therefore even less likely and of even less risk significance.

Based on the above, Virginia Power concludes that not considering peak seismic loading concurrent with peak thermally induced over-pressure loading is reasonable from a risk significance perspective and is not a departure from GDC-2.

Question 2

Stress Intensity: *(Reference Page 5 of Attachment 1 of Submittal)*

Clarify if the allowables in note 3 are given for membrane stress intensity and the values listed in column 4 under "Applied Membrane Stress" are stress intensities which are calculated considering pressure and all other applied loads. Provide details of the methodology including an example how the values in column 4 have been calculated.

Response 2

The allowables in note 3 are membrane stress intensity. The applied membrane stress listed in column 4 is derived using the code equation in NB-3641.1. This equation was used for simplicity because in a thin straight pipe subjected to pressure and moment loading, the maximum membrane stress intensity is close to the hoop stress due to pressure with little effect of longitudinal moment loading. An example that details how the values in column 4 of Table 5.1 were calculated is provided below:

Example: (Item 8 in Table 5.1, page 5, Attachment 1 of submittal)

Outside diameter of the pipe D_o =6.625 in.
Nominal pipe wall thickness t_n = 0.28 in.
Pipe wall thickness with manufacturer's tolerance t = 0.875 (t_n) = 0.245 in.
Applied faulted pressure P = 2765 psi
From code paragraph NB-3641.1, y = 0.4

Applied stress $= \frac{P D_o}{2t} - y P = 36280$ Psi

Allowable Stress (2.4 S_m =48000 psi , or 0.7 S_u = 42000 psi.) - OK

It is recognized that in article F-1430(a) of the code that the allowable pressure is 200% of the design pressure calculated in accordance with equation 2 of NB-3641.1 with use of S_m. Thus, it can be derived from the above equation that the stress due to the faulted pressure shall not exceed 2.0 S_m. A review of our results demonstrate that the applied stress is also less than 2.0 S_m in all cases. However, we have revised Table 5.1, page 5, Attachment 1 of our March 30, 1999 submittal to represent full compliance with paragraph F-1430.

Revised Table 5.1 - Pipe Stress Summary
Compliance to Code Article F-1430

Plant-Unit	Penetration No. [5]	Applied Faulted Pressure (psi) [9]	Design Pressure (psi) [3]	Allowable Faulted Pressure (psi) [3] & [9]	Applied Membrane + Bending Stress (psi) [4]	Allowable Membrane + Bending Stress (psi) [4]
SPS-1	20	5022	3810	7620	21620	45000
	28	2960	2377	4754	27170	45000
	46	7125	5623	11246	21520	45000
SPS-2	20	5022	4468	8936	21620	45000
	28	2960	5623	11246	27170	45000
	46	7125	5623	11246	21670	45000
NAPS-1	5	1247	740	1480	32870	60000
	12, 13, 14	2765	1524	3048	24630	60000
	20	5503	3810	7620	23400	45000
	25	2069	1342	2684	28110	60000
	46	7582	5623	11246	23460	46600
NAPS-2	5	1242	740	1480	17430	60000
	12, 13, 14	2555	1524	3048	18980	60000
	20	5337	3810	7620	22790	45000
	25, 26, 27	2347	1342	2684	26160	60000
	46	7936	5623	11246	24640	46600
	106	3171	2426	4852	20990	45000

Notes:

[1] Linear Elastic Analysis Method of analysis is used.

[2] Pressure and dead weight loadings are used. Seismic loading is not considered concurrent with this event.

[3] Allowable Faulted Pressure = 2 times the Design Pressure [F-1430(a)] where the Design Pressure is per Equation 2 of NB-3641.1.

[4] Allowable membrane plus bending stress = 3.0Sm or 2Sy whichever is lower [F-1430(b)].
Applied membrane plus bending stress is per Equation (9) of NB-3652.

[5] Only the piping with pressure greater than 1.2 times the design pressure is listed.

[6] Pressure increase is due to temperature effect on confined fluid inside piping on both sides of the Containment penetration.

[7] Allowable stresses are taken from ASME B & PV Code Section III, 1989.

[8] Adequate margins exist between applied stress and allowable stress.

[9] Allowable faulted pressure is greater than the applied faulted pressure.

Question No. 3

Appendix F Allowables: *(Reference Page 5 of Attachment 1 of Submittal)*

The allowable stress criteria in note 3 are derived from article F-1331.1(a) of Appendix F. Discuss why the requirements of F-1331.1(c) for primary membrane plus bending have not been used in note 4.

The allowable stress criteria in note 4 are derived from article F-1430(b) of Appendix F. Discuss why the requirement of F-1430(a) has not been evaluated.

From the above discussion, it is appears that complete requirements of either of the articles, F-1331.1 or the alternate F-1430, have not been satisfied. Provide a justification for the "hybrid" criteria used in the evaluation.

Response 3

Our original intention was to use detailed finite element elastic analysis for calculation of stresses and to use the criteria of F-1331.1(c). These criteria were presented in our letter dated February 25, 1998 (Serial No. 96-516C). In a subsequent discussion with the NRC staff we proposed to use code equation 9 of NB-3652 and the allowables derived from article F-1430 (b). The results of this evaluation were presented in Table 5.1 of the March 30, 1999 submittal. Consequently, the requirements of F-1331.1(c) were not used.

An evaluation to meet the requirements of F-1430(a) was not specifically completed. However, the results discussed in our response to question 2 above indicate that the requirements of F-1430(a) are satisfied.

Virginia Power has since completed an evaluation to meet the requirements of F-1430(a). Table 5.1 was revised to include results for compliance with the requirements of F-1430(a) and F-1430(b). These two criteria for piping are used as an alternative to the procedures of F-1331. Thus, the evaluation verifies full compliance to Appendix F of the Code without using hybrid criteria from F-1331 and F-1430.