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L-10-243

10 CFR 50.90

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Davis-Besse Nuclear Power Station
Docket No. 50-346, License No. NPF-3
Response to a Request for Additional Information Related to a License Amendment Request to Incorporate the Use of Alternative Methodologies for the Development of RPV P-T Curves, and Request for Exemption from Certain Requirements Contained in 10 CFR 50.61 and 10 CFR 50, Appendix G (TAC NOS. ME1127 AND ME1128)

By letter dated April 15, 2009 [Agencywide Documents Access and Management System (ADAMS) Accession No. ML091130228], as supplemented by letter dated December 18, 2009 (ADAMS Accession No. ML093570103), the FirstEnergy Nuclear Operating Company (FENOC), submitted to the Nuclear Regulatory Commission (NRC) a license amendment request and an exemption request for the Davis-Besse Nuclear Power Station (DBNPS). The proposed amendment would incorporate the use of alternate methodologies for the development of the reactor pressure vessel pressure-temperature (P-T) limit curves into the DBNPS Technical Specifications. The proposed exemption would exempt DBNPS from certain requirements contained in 10 CFR 50.61 and 10 CFR Part 50, Appendix G.

By letter dated July 14, 2010 (ADAMS Accession No. ML101940393), the NRC staff requested additional information (RAI) on the proposed amendment to complete its review. Attachment 1 contains the response to the RAI.

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NRR

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager - Fleet Licensing, at (330) 761-6071.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 26, 2010.

Sincerely,

Barry S. Allen

Attachment:
1. Response To Request For Additional Information

cc: NRC Region III Administrator
NRC Project Manager
NRC Resident Inspector
Executive Director, Ohio Emergency Management Agency,
State of Ohio (NRC Liaison)
Utility Radiological Safety Board

By letter dated April 15, 2009 [Agencywide Documents Access and Management System (ADAMS) Accession No. ML091130228] (Reference 1), as supplemented by letter dated December 18, 2009 (ADAMS Accession No. ML093570103) (Reference 2), the FirstEnergy Nuclear Operating Company (FENOC), submitted to the Nuclear Regulatory Commission (NRC) a license amendment request and an exemption request for the Davis-Besse Nuclear Power Station (DBNPS). By letter dated July 14, 2010 (ADAMS Accession No. ML101940393), the NRC staff requested additional information on the submittal to complete its review. The NRC staff questions are presented in bold type, followed by the FENOC responses.

1. Provide the end of license neutron fluence value(s) for the RPV inside diameter (clad-to-base metal interface) used to calculate the ΔRTNDT for the Linde 80 weld materials listed in Table 1 of Enclosure B to Reference 2.

FENOC Response

The information requested by the NRC was modified during a teleconference conducted between the NRC and FENOC staffs on July 7, 2010. During this teleconference, the NRC stated that fluence values for the 52 Effective Full Power Year (EFPY) fluence (n/cm^2) at the wetted surface of the reactor vessel for these two welds would be acceptable. The following table contains the fluence information.

Location / Weld	Wetted Surface[A]	1/4T Location (x = 2.24 inches)[B]	3/4T Location (x = 6.46 inches)[B]
WF-233	2.29E+18 n/cm^2	1.34E+18 n/cm^2	4.87E+17 n/cm^2
WF-182-1	1.69E+19 n/cm^2	9.89E+18 n/cm^2	3.59E+18 n/cm^2

Note A: The wetted surface is the reactor coolant system to cladding interface.

Note B: The value of "x" is the distance between the wetted surface and the 1/4T or 3/4T locations, including the thickness of the cladding.

2. Provide the maximum EFPY for which the neutron fluence values are valid.

FENOC Response

The fluences listed in the first response are valid to 52 EFPY of operation.

3. Describe how the reactor coolant to RPV metal temperature at the controlling location was calculated; i.e., using ASME Code, Section XI, Appendix G or other method. Provide the inputs used to calculate the temperature difference such as RPV thickness and heatup rate.

FENOC Response

Temperature differences between the reactor coolant temperature and the 1/4T wall location are needed for the determination of the low temperature operating pressure (LTOP) system's effective temperature in accordance with Article G-2215 of the American Society of Mechanical Engineers Code Section XI, Appendix G. The temperature differences are calculated rather than relying on the figure included within the ASME Code. The specific values included in the calculation are represented by the variables listed below. The reactor vessel thickness used is 8.563 inches, which includes the clad. The temperature transients evaluated include both the ramp and step heatup cases. Various aspects of the calculation procedures utilized in the development of pressure-temperature (P-T) limits follow.

The through-wall temperature distributions are determined by solving the one-dimensional transient axisymmetric heat conduction equation:

$$\rho C_P \frac{\partial T}{\partial t} = k\left(\frac{\partial^2 T}{\partial r^2} + \frac{1}{r}\frac{\partial T}{\partial r}\right)$$

subject to the boundary conditions:

at the inside surface ($r = R_i$)

$$-k\frac{\partial T}{\partial r} = h(T_w - T_b)$$

at the outside surface ($r = R_o$)

$$\frac{\partial T}{\partial r} = 0$$

where:
ρ = density
C_P = specific heat
k = thermal conductivity
T = temperature
r = radial coordinate
t = time
h = convection heat transfer coefficient
T_w = wall temperature
T_b = bulk coolant temperature
R_i = inside radius of vessel
R_o = outside radius of vessel

The above equation is solved numerically using a finite difference technique to determine the temperature at 17 points through the wall as a function of time for prescribed changes in the bulk fluid temperature, such as multi-rate ramp and step changes for heat up and cool down transients.

A computer code was used to determine the reactor coolant system (RCS) to vessel 1/4T depth temperature difference assuming a 50 degree Fahrenheit/hour (°F/hour) uniform ramp heatup rate. The temperature difference was 44.4 percent at the 1/4T depth. This compares well with the 43.5 percent obtained from the temperature gradient curve included in ASME Section XI, Appendix G, Article G-2214.3. For a 75°F/hour uniform ramp heatup rate, the analysis indicated a temperature difference of 44.7 percent, which again compares well to the ASME curve value of 43.5 percent. A 75°F/hr step heatup transient was modeled by a series of steps consisting of a 15°F step increase followed by a 12 minute temperature hold period. This led to a temperature difference at the 1/4T depth of 45.5 percent. This also compares reasonably well with the ASME curve.

The DBNPS Pressure Temperature Limits Report contains requirements that limit the RCS to a maximum heat up of 50°F in any hour period. FENOC has applied the more conservative step change temperature difference in determining the range of LTOP applicability regardless of which type of temperature transient provides the actual pressure limit while the RCS is in the LTOP required range. FENOC has added a margin term of 4.57°F to the results to account for a revision of the adjusted reference temperatures during the development of the P-T curves. Using a 50°F/hour step change differential of 24.2°F + 4.57°F margin = 28.77°F, which is the value previously provided in Reference 2, Enclosure A, Section 3.2.

References

1. FENOC Letter L-09-072, Davis-Besse Nuclear Power Station Unit No. 1, Docket No. 50-346, License No. NPF-3, "License Amendment Request to Incorporate the Use of Alternative Methodologies for the Development of Reactor Pressure Vessel Pressure-Temperature Limit Curves, and Request for Exemption From Certain Requirements Contained in 10 CFR 50.61 and 10 CFR Part 50, Appendix G," (ADAMS Accession No. ML091130228), dated April 15, 2009.

2. FENOC Letter L-09-225, Davis-Besse Nuclear Power Station Unit No. 1, Docket No. 50-346, License No. NPF-3, "Supplemental Information Related to a License Amendment Request to Incorporate the Use of Alternative Methodologies for the Development of Reactor Pressure Vessel Pressure-Temperature Limit Curves, and Request for Exemption From Certain Requirements Contained in 10 CFR 50.61 and 10 CFR Part 50, Appendix G," (ADAMS Accession No. ML093570103), dated December 18, 2009.