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

Subject: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
Response to Request for Additional Information
Concerning Reactor Vessel PTS Assessment

Attached is our response to an NRC request for additional information provided by letter dated February 10, 1997, concerning the new reactor vessel pressurized thermal shock (PTS) assessment submitted by our letter dated August 2, 1996. This response provides information concerning the new PTS analysis that was performed to assess the effect of including updated reactor vessel data. The attachment provides each NRC item followed by our response.

Sincerely,

Sushil C. Jain

c: Mr. D. M. Kern, Sr. Resident Inspector
Mr. H. J. Miller, NRC Region I Administrator
Mr. D. S. Brinkman, Sr. Project Manager

A049

Item 1

Explain which data was used to determine $RT_{NDT(U)}$ for Plate B6903-1 and which data was used to evaluate the unirradiated Charpy reference curve for Plate B6903-1 surveillance material. If all of the data submitted in Table 10 of reference #1 are believed to be valid tests for determining the material properties of Plate B6903-1, provide a technical justification for the exclusion of certain data points if all of the data was not used in either of these evaluations.

Response 1

The drop weight test data from the tests performed by Combustion Engineering (CE) and recorded on the material certification and the transverse Charpy test data from the tests performed by Westinghouse and recorded in Table 10 of reference 1 were used to determine the initial RT_{NDT} of lower shell plate B6903-1.

At the time lower shell Plate B6903-1 was fabricated, only drop weight tests and longitudinally oriented Charpy tests were required. Hence, the vessel fabricator, CE, only performed drop weight tests and longitudinally oriented Charpy V-notch tests. When Westinghouse developed the Beaver Valley Unit 1 surveillance program, Westinghouse performed both transverse and longitudinal Charpy V-notch tests. Per NUREG-0800, "Standard Review Plan," Branch Technical Position - MTEB 5-2, "Fracture Toughness Requirements," the initial RT_{NDT} had to be determined using "specimens oriented in the weak direction (transverse to the direction of maximum working)". Hence, the initial RT_{NDT} of the Beaver Valley Unit 1 lower shell plate B6903-1 was determined using the transversely oriented Charpy data developed by Westinghouse (Table 10 of reference 1) and the drop weight test data developed by CE (reported on the CE material certification) following the ASME procedure given in NB-2331, "Material for Vessels."

Therefore, all the available transverse data which is presented in WCAP-8457 is valid. No valid data points were excluded.

Item 2

If any of this data was excluded in the determination of Plate B6903-1 $RT_{NDT(U)}$:

(a) Explain how DLC's analysis meets the requirement of ASME Code paragraph NB-2331(a)(4) which states that the reference temperature may be determined "...from a full C_v impact curve developed from the minimum data points of all the C_v tests performed."

(b) Evaluate what impact the inclusion of the additional data would have on DLC's determination of $RT_{NDT(U)}$ or σ_I.

Response 2(a)

The only available unirradiated transverse Charpy data for lower shell plate B6903-1 is documented in Table 10 of reference 1 and the only available drop weight test data for lower shell plate B6903-1 is documented on the CE material certification. Hence, per NUREG-0800, "Standard Review Plan," Branch Technical Position - MTEB 5-2, "Fracture Toughness Requirements," the initial RT_{NDT} is to be determined using specimens oriented in the weak direction (transverse to the direction of maximum working). Therefore, the available unirradiated transverse Charpy data for lower shell plate B6903-1 and the available drop weight test data for lower shell plate B6903-1 was used to determine the initial RT_{NDT}. Since the data from the unirradiated surveillance data constitutes the only valid data in the transverse direction it is by definition the minimum data points.

The following is an explanation of how the data was used to comply with the requirements of NB-2331(a)(4):

Per 10 CFR Part 50.61, the initial RT_{NDT} of a material is to be "evaluated according to the procedures in the ASME Code, Paragraph NB-2331" and per NUREG-0800, "Standard Review Plan," Branch Technical Position - MTEB 5-2, "Fracture Toughness Requirements," test results from Charpy specimens oriented in the weak direction (transverse to the direction of maximum working) are to be used when determining the initial RT_{NDT}. Hence, the initial RT_{NDT} of the Beaver Valley Unit 1 lower shell plate B6903-1 was determined by applying the ASME Code NB-2331 procedures to the drop weight test results developed by CE and the transversely oriented unirradiated Charpy test results developed by Westinghouse in Table 10 of reference 1.

The ASME Code NB-2331 procedures were applied to the CE drop weight test results and the Westinghouse transversely oriented Charpy test results as follows:

Per ASME Section III, Division 1, NB-2331, "Materials for Vessels," pressure retaining material for vessels, other than bolting, shall be tested as follows.

(a) Establishing a reference temperature RT_{NDT} shall be done as follows.

1) Determine a temperature T_{NDT} that is at or above the Nil-ductility transition temperature by drop weight tests.

CE performed drop weight tests that resulted in a T_{NDT} of -50°F. Hence, T_{NDT} of lower shell plate B6903-1 = -50°F

2) At a temperature not greater than T_{NDT} + 60°F, each specimen of the C_V test (NB-2321.2) shall exhibit at least 35 mils lateral expansion and not less than 50 ft-lb absorbed energy. Retesting in accordance with NB-2350 is permitted. When these requirements are met, T_{NDT} is the reference temperature RT_{NDT}.

The transverse Charpy tests did not exhibit 35 mils lateral expansion and greater than 50 ft-lb absorbed energy at 10°F (T_{NDT} + 60°F). Thus, this criteria is not met for lower shell plate B6903-1.

3) In the event that the requirements of (2) above are not met, conduct additional C_V tests in groups of three specimens (NB-2321.1) to determine the temperature T_{Cv} at which they are met. In this case the reference temperature RT_{NDT} = T_{Cv} - 60°F. Thus, the reference temperature RT_{NDT} is the higher of T_{NDT} and (T_{Cv} - 60°F).

Based on the Charpy test results given in Table 10 of reference 1, Charpy tests were not performed in groups of three to determine the temperature T_{Cv} at which the transverse Charpy test results exhibit 35 mils lateral expansion and greater than 50 ft-lb absorbed energy. Thus, this criteria is not met for lower shell plate B6903-1.

4) When a C_V test has not been performed at T_{NDT} + 60°F, or when the C_V test at T_{NDT} + 60°F does not exhibit a minimum of 50 ft-lb and 35 mils lateral expansion, a temperature representing a minimum of the 50 ft-lb and 35 mils lateral expansion may be obtained from a full C_V impact curve developed from the minimum data points of all the C_V tests performed.

Based on a curve developed using the minimum transverse Charpy test data points, 35 mils lateral expansion is reached at 62°F and 50 ft-lb absorbed energy is reached at 87°F.

The initial RT_{NDT} is defined as the higher of T_{NDT} and (T_{Cv} - 60°F). In other words,

$RT_{NDT} = T_{NDT}$, if $T_{NDT} \geq T_{50(35)}$ - 60°F
and
$RT_{NDT} = T_{50(35)}$ - 60°F, if $T_{50(35)}$ - 60°F > T_{NDT}

For the Beaver Valley Unit 1 lower shell plate B6903-1:

T_{Cv} - 60°F = $T_{50(35)}$ - 60°F = 87°F - 60°F = 27°F
and
T_{NDT} = -50°F

Hence, T_{Cv} - 60°F (27°F) is greater than T_{NDT} (-50°F). Therefore, for Beaver Valley Unit 1 lower shell plate B6903-1:

Initial RT_{NDT} = 27°F

Response 2(b):

There is no additional data to be considered for the determination of $RT_{NDT(U)}$ since there is only one data point. Additionally the standard deviation, σ_I is zero since this is a single discrete measured value determined from the minimum Charpy curve.

Item 3:

Assess what impact any changes in $RT_{NDT(U)}$ or σ_I from DLC's response to question (2b.) would have on DLC's evaluation of RT_{PTS} value for Plate B6903-1.

Response to 3:

There is no impact on the RT_{PTS} value for Plate B6903-1.

Item 4:

Submit for NRC staff review WCAP-14554, "Beaver Valley Unit 1 Fluence Reevaluation," dated June 1996 and referenced as the basis for the fluence values used in the BVPS-1 PTS assessment. The NRC staff must review the fluence results to assess DLC's determination of the vessel's end-of-license fluence values and the fluence values associated with the vessel's surveillance capsules.

Response 4:

WCAP-14554 has been reviewed by DLC and is attached for your reference and review.

Reference

1. DLC's response to Generic Letter (GL) 92-01 dated July [illegible] 1992 (J. D. Sieber (DLC) to the U.S. Nuclear Regulatory Commission Document Control Desk)