NRC-00-077

NMC
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Kewaunee Nuclear Power Plant
N490, State Highway 42
Kewaunee, WI 54216-9511
920-388-2560

Operated by
Nuclear Management Company, LLC

September 26, 2000

10 CFR 50.12 and 10 CFR 50.90

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

Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Proposed Technical Specification Change Regarding Heatup and Cooldown Limit Curves and Request for Exemption to 10 CFR 50.60, 10 CFR 50.61, and Appendices G and H of Part 50

References:
1) Letter from M.L. Marchi (WPSC) to Document Control Desk (NRC) dated June 7, 1999
2) Letter from T.J. Kim (NRC) to M.L. Marchi (WPSC) dated July 16, 1999
3) Letter from C.M. Craig (NRC) to WPSC dated November 16, 1999
4) Letter from M. L. Marchi (WPSC) dated February 4, 2000
5) Letter from T.J. Kim (NRC) to Wisconsin Public Service Corporation dated July 20, 2000

In reference 1 Wisconsin Public Service Corporation (WPSC) proposed changes to the heatup and cooldown curves contained in the Kewaunee Nuclear Power Plant (KNPP) Technical Specifications (TS). In references 2 and 3 the Nuclear Regulatory Commission (NRC) staff requested additional information to support NRC review of the proposed TS amendment and exemption request. In reference 4 WPSC provided the NRC staff with the requested information. Reference 5 summarizes a meeting between WPSC and the NRC and identifies two open items that need to be resolved prior to completion of the staff's review. The open items are:

1) To determine the magnitude of the bias term to be applied, and

2) To provide a detailed understanding of the structure of the Kewaunee RPV surveillance program and how it will be used to support this methodology for evaluating RPV integrity.

The attachment to this letter provides Nuclear Management Company's (NMC's) response to the questions raised in reference 5.

A001

Please contact Mr. Tom Webb at 920-388-8537 or Mr. Charles Tomes at 920-433-1729 if there are any questions or if we can be of any assistance regarding the review of this proposed amendment request.

Sincerely,

Kenneth H. Weinhauer
General Manager-Kewaunee

CAT

Attach.

cc - US NRC – Region III
NRC Senior Resident Inspector
Electric Division, PSCW
Lou Libitory, Chairman WOG
Andrew Drake, Project Manager-WOG

ATTACHMENT 1

Letter from Kenneth H. Weinhauer (NMC)

To

Document Control Desk (NRC)

Dated

September 26, 2000

Regarding

Response to NRC's Request for Additional Information on
Proposed Amendment 160

Request 1

Provide information regarding the magnitude of the bias term to be applied to account for non-conservatism associated with the use of data from irradiated precracked Charpy V-notch specimen tests.

WPSC Response 1

The NRC Staff has developed an evaluation methodology using the Master Curve approach that differs from the one WPSC submitted for the Kewaunee vessel. In the NRC methodology, four bias terms are identified to account for potential differences in the measured T_o values between precracked Charpy three-point bend tests and larger specimen compact fracture-type specimens for both irradiated and unirradiated conditions. The methodology submitted by WPSC used available data from both precracked Charpy tests and larger specimen results when available, and did not have an explicit bias term identified. The Staff has requested WPSC to provide the magnitude of the bias terms that could be used by the NRC Staff in their independent evaluation. The following information provides the requested discussion.

The bias terms that may exist for irradiated 1P3571 weld metal cannot be determined directly for this application because there have been an insufficient number of larger specimens tested. Therefore, an effort was made to identify the bias terms for other irradiated Linde 1092 and 0091 weld metals, since the main point of our direct measurement analyses is related to the measurement of fracture toughness at the irradiation of interest. Our review of available industry data reveals that this also can not be accomplished because there has been an insufficient number of precracked Charpy and larger specimens tested. There are no known measurements of both large specimen and precracked Charpy Master Curve fracture toughness for the same heat of irradiated weld materials. This lack of data is due to space and cost constraints. It was surprising that no irradiated precracked Charpy data was available from the HSSI program on weld heats 72W and 73W, since there is a vast amount of large specimen data (up to 4T compacts).

Due to this situation, both the WOG and WPSC decided create a process that would inherently account for any bias since the bias can not be determined independently. The Kewaunee surveillance material was tested in the irradiated condition at an end of life (EOL) fluence of 3.36×10^{19} n/cm^2 (E > 1 MeV). The testing included reconstituted precracked Charpy tests coupled with a two 1X-WOL specimens. The approach taken by WPSC was to combine all of the data using the multi-temperature maximum likelihood method of Wallin that is now being added to the ASTM E 1921 Practice. The effect of including these 1X-WOL specimens is an increase in the measured T_o of 12°F for the irradiated Kewaunee surveillance weld. This 12°F is an effective bias value that was included in the WPSC evaluation for the Kewaunee vessel. In the unirradiated condition, ½-T compacts were tested, in addition to the precracked Charpies. The analyzed results from the unirradiated data was biased by about 21°F using the same approach as for the irradiated data.

When the Maine Yankee surveillance weld was tested, only reconstituted Charpy specimens were tested at a fluence of 6.11×10^{19} n/cm^2 (E > 1 MeV), which corresponds to greater than end of life extension (EOLE). The T_o value reported in WCAP-15075 was not correct, as identified by the NRC in their evaluation of the Kewaunee submittal. A transcription error was made between the actual measured T_o and that reported; i.e., the error was a transposition of two numbers. The correct value

is 223°F and the reported value was 232°F. This 9°F difference is conservative for evaluating the Kewaunee vessel using the Maine Yankee surveillance weld data. In the unirradiated condition, only precracked Charpy specimens were tested.

In response to this request for information, WPSC has compared two cases in order to investigate the magnitude of bias that is inherent in the WPSC submittal (due to testing 1X-WOL specimens and combining all of the data using the multi-temperature maximum likelihood method). This comparison involves an evaluation in which the WPSC submittal values for T_o were corrected and compared to the case in which the transcription error was corrected and only precracked Charpy data were used (rather than using the combined sets of precracked Charpy and larger specimen data). The WPSC Master Curve methodology was used for this assessment. The net effect of including the biased values for the irradiated conditions is 4°F. When the transposition error is corrected the resulting ART value for EOLE is 245°F and the value for using precracked Charpy data alone is 241°F.

In summary, we are not able to provide values for the requested bias terms because there has been an insufficient number large specimens tested. However, for the WPSC submittal, an attempt has been made to quantify the magnitude of the bias that may exist due to any non-conservatism associated with the use of data only from irradiated pre-cracked Charpy V-notch test specimens. As stated above, the difference in ART values, for the case when using only Charpy V-notch test specimens compared to the case using the combined sets of precracked Charpy and larger specimen data for EOLE conditions is 4°F. This information leads WPSC to believe that the magnitude of a bias term for the WPSC submittal is small and on the order of approximately 4°F.

Request 2

Provide a detailed understanding of the structure of the future Kewaunee RPV surveillance program and how it will be used to support this methodology for evaluating RPV integrity.

WPSC Response 2

The Kewaunee RPV radiation surveillance program consists of six (6) material test capsules. Four (4) of these radiation surveillance capsules have previously been removed from the Kewaunee reactor vessel and tested. In addition, WPSC has performed additional fracture toughness testing over and above that required by 10CFR50 in order to obtain RT_{T_0} values for the core region weld metal that correspond to end of life (EOL) and end of life extension (EOLE) reactor vessel fluence. The augmented testing that has been performed to date includes:

1. Pre-cracked three point bend tests per ASTM E1921-97 for IP-3571 weld metal from
   - KNPP Capsule S (Reconstituted)
   - Maine Yankee Capsule A-35 (Reconstituted)
   - KNPP unirradiated surveillance capsule material
   - Maine Yankee unirradiated surveillance capsule material
2. ½-T compact tension tests
   - KNPP unirradiated surveillance material
3. 1X-WOL specimens
   - KNPP Capsule S

This augmented testing along with the methodology described in ASTM E1921-97, WCAP 15075, and ASME Code Case N-629 provides the basis for WPSC's submittal to evaluate the integrity of the KNPP RPV circumferential beltline weld using the Master Curve methodology.

The schedule for the remaining two radiation surveillance capsules, N and T, is the subject of this request for information.

Current plans are to remove either capsule N or T from the Kewaunee reactor vessel when the fluence of the capsule reaches a value that will be equal to or slightly greater than the projected fluence of the Kewaunee reactor vessel beltine weld corresponding to sixty (60) years of operation. The remaining radiation surveillance capsule will be held as a standby capsule that may be tested at a later time period.

A review of the surveillance capsule program indicates that both of the remaining radiation surveillance capsules (N and T) contain Charpy V notch impact specimens of 1P-3571 weld metal, correlation monitor, forging, and heat-affected-zone (HAZ) materials. WPSC intends to apply the Charpy and tensile testing methods prescribed in ASTM E185-82 to the correlation monitor and forging materials, as appropriate. Currently, we have no plans to measure the fracture toughness properties of the correlation monitor or forging materials using the Mater Curve method.

Both capsules N and T contain eight (8) weld metal (1P-3571) and eight (8) HAZ Charpy V-notch test specimens. WPSC plans to measure the fracture toughness of weld metal 1P-3571 using pre-cracked three-point bend testing in accordance with ASTM E1921-97. The primary goal of future weld metal testing is to determine, verify, and monitor the fracture toughness of the IP-3571 material at moderately high fluence levels at or near extended EOL of the reactor vessel. For this reason, emphasis will be placed upon obtaining valid fracture toughness data and RT_{To} from the ASTM E1921-97/ASME Code Case N-629/WCAP-15075 process.

In order to reach this goal, we plan to reconstitute un-tested HAZ material and test the pre-cracked HAZ specimens in three point bending. Additionally, we plan to test as many pre-cracked weld specimens in three point bending as required in combination with the pre-cracked HAZ specimens to define RT_{To}. Experience has shown that eight (8) to ten (10) irradiated specimens are needed to obtain a valid T_0 value. After having satisfied the primary objective of obtaining a valid RT_{To} value, the balance of the weld metal Charpy V-notch impact specimens will be used to construct a partial Charpy V-notch impact transition curve focusing on defining the 30 ft-lb transition temperature.

The radiation surveillance capsule test results will be used to update the Kewaunee RPV integrity evaluations as necessary. In general, adjusted reference temperature values will be established for the ID surface, ¼ T, and ¾ T locations for each of the core region materials. Specifically, the material properties of the forging material will be derived from the Charpy testing methods described in ASTM E185-82. ID surface, ¼ T, and ¾ T location weld metal material properties will be derived from RT_{To} values obtained in accordance with ASTM E1921-97, ASME Code Case N-629, and WCAP-15075.

The results from future testing of the weld metal located in surveillance capsules T and N will provide further confirmation of:

- the fracture toughness of IP 3571 at end of life extension fluence,
- the ratio adjustment, and
- the fluence function for fracture toughness.

This information is of particular interest because it is scheduled to become available prior to the end of the existing operating term and can be incorporated into the RPV integrity evaluations prior to start of the license renewal operating period.

Upper shelf energy projections for the core region materials will continue to be based upon testing methods described in ASTM E185-82. Although, limited testing of the weld metal may occur due to the more pressing needs to define RT_{To} and the 30 ft-lb Charpy transition temperature.

It is anticipated that either capsule N or T will be removed from the Kewaunee reactor vessel during the 2003 or 2004 refueling outage. In accordance with10CFR50, the surveillance capsule test results will be transmitted to the Nuclear Regulatory Commission within one year after capsule withdrawal. The report will include the data required by ASTM E185 and the results of all fracture toughness tests conducted on beltline materials in the irradiated and unirradiated conditions. If a change in the Technical Specifications is required, either in the pressure-temperature limits or in the operating procedures required to meet the limits, the expected date for submittal of the revised Technical

Specifications will be provided with the report. In the past, it has been WPSC's practice to submit any required change to the RPV integrity evaluations to the Nuclear Regulatory Commission concurrent with the surveillance capsule test results.