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Wisconsin Electric POWER COMPANY
231 W. MICHIGAN, P.O. BOX 2046, MILWAUKEE, WI 53201

November 8, 1978

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. C. 20555

Dear Mr. Denton:

DOCKET NOS. 50-266 AND 50-301
REACTOR VESSEL MATERIALS SURVEILLANCE
CAPSULE TEST REPORTS
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

Reactor vessel materials surveillance for Unit 2 (Capsule "T") and for Unit 1 (Capsule "R") were removed from the Point Beach Nuclear Plant reactor vessels in accordance with the schedule set forth in the plant technical specifications. The testing, except for wedge-open-loading (WOL) specimens, has been completed and the results are contained in Westinghouse Electric Corporation reports WCAP-9331 and WCAP-9357. One copy of each report is enclosed for your immediate information and use. Five additional copies of each report are being transmitted under separate cover.

A summary of the results of these capsule tests is provided in Attachment A hereto. The results clearly demonstrate the conservatism in the curves used to predict the change in transition temperature as a function of fluence. Also, the data indicate that irradiation-induced embrittlement reaches a level of material damage and then stabilizes, at least for radiation levels to which these specimens have been exposed.

At the present time, we have the WOL specimens from Capsules S and R for Unit 1 and Capsules V and T for Unit 2 in storage. These specimens have not been tested because of the lack of agreement as to how the testing should be performed. We would appreciate your advising us of the acceptable criteria for performing this testing, if available, so that we may complete our efforts in this regard.

Very truly yours,

Executive Vice President

Sol Burstein

Attachment

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ATTACHMENT A

SUMMARY REPORT OF RECENT
POINT BEACH NUCLEAR PLANT
REACTOR VESSEL MATERIALS TESTING

A. WCAP-9357: Analysis of Capsule R From The Wisconsin Electric Power Company Point Beach Nuclear Plant Unit No. 1 Reactor Vessel Radiation Surveillance Program

Unit 1 was shutdown on October 4, 1977, for its fifth refueling and Capsule R was removed from the reactor vessel. Capsule R resided within the reactor vessel for approximately 5.1 effective full power years of operation. Because of the capsule lead factor (2.5), this capsule represents about 40% of the reactor vessel life for radiation embrittlement considerations.

The capsule received an average fast fluence of 2.22×10^{19} n/cm^2 (E>1 Mev) versus a predicted fast fluence of 1.80×10^{19} n/cm^2 (E>1 Mev). The fluence variation from the front side (closest to the reactor core) to the back side was about $\pm$9.2% of the average value.

The evaluation of the thermal monitors contained within the capsule indicated that the maximum temperature to which the test specimens was exposed was less than 579°F.

Due to the accumulated radiation exposure, the average upper shelf energy level of the weld metal Charpy Impact specimens decreased from about 65 ft-lbs (unirradiated) to 51 ft-lbs (average of 4 results above 200°F). This test result indicates that there has been no additional radiation induced embrittlement beyond that observed from the Capsule "S" test results. The Capsule "S" exposure was 7.05×10^{18} n/cm^2 (E>Mev) and the upper shelf energy level dropped to 52 ft-lbs for the weld metal (see WCAP-8739).

The change in transition temperature due to irradiation for all of the materials in the capsule is summarized in Table 5-6 (page 5-26) of the report. For the weld metal, the increase in temperature is reported as 165F° at the 30 ft-lb level, 205F° at the 50 ft-lb level, and 200F° at the 35 mil lateral expansion level. The results from Capsule "S" are included in Table 5-7 for comparison purposes. A temperature shift comparison of the two capsules also indicates that no further radiation induced embrittlement has occurred.

The temperature shift of 165F° (at the 30 ft-lb) for a fluence of 2.22×10^{19} n/cm^2 is about 45°F less than that predicted by the delta RT_{NDT} versus fluence curve (0.20% weld line). Thus, the prediction curve is quite conservative.

The wedge-opening-loading (WOL) fracture mechanics specimens were not tested and thus no WOL test results are contained with the report. The specimens are being stored at this time and will be tested after the methods can be agreed upon between Licensee and the NRC staff.

B. WCAP-9331: Analysis of Capsule T From The Wisconsin Electric Power Company Point Beach Nuclear Plant Unit No. 2 Reactor Vessel Radiation Surveillance Program

Unit 2 was shutdown on March 4, 1977, for its third refueling and Capsule T was removed from the reactor vessel. Capsule T resided within the reactor vessel for approximately 3.46 effective full power years of operation. Because of the capsule lead factor (1.6), this capsule represents about 17% of the reactor vessel life for radiation embrittlement considerations.

The capsule received an average fast fluence of 9.45×10^{18} n/cm^2 (E>1 Mev) versus a predicted fast fluence of 8.02×10^{18} n/cm^2 (E>1 Mev). The fluence variation from the front side (closest to the reactor core) to the back side was about $\pm$10.8% of the average value.

The results of the fast neutron dosimetry, in comparison to the original plan and what would have been expected, indicated that Capsule T was rotated 180 degrees when installed in the reactor. While of interest, this has no effect on the test results.

The evaluation of the thermal monitors contained within the capsule indicated that the maximum temperature to which the test specimens was exposed was less than 579°F.

Due to the accumulated radiation exposure, the average upper shelf energy level of the weld metal Charpy Impact specimens decreased from about 65 ft-lbs (unirradiated) to about 56 ft-lbs (average of 3 readings at 225°F and above). This upper shelf drop of about 8 ft-lbs is substantially less than that reported for Capsule V (which also had a lower fluence exposure). Other than the possibility that the specimens from Capsule V were tested at too high a temperature (3 were tested at above 300°F while only a total of 5 were tested above 145°F), there is no ready explanation for this behavior.

The change in transition temperature due to irradiation for all of the materials in the capsule is summarized in Table 5-1 (page 5-8) of the report. For the weld metal, the increase in temperature is reported as 145F° at the 30 ft-lb level, 140F° at the 50 ft-lb level, and 145F° at the 35 mil lateral expansion level. The results from Capsule V are included in Table 5-2 for comparison of the effects of the two levels of irradiation exposure.

The temperature shift of 145F° (at the 30 ft-lb level) for a fluence of 9.45×10^{18} n/cm^2 is about 40F° less than that predicted by the delta RT_{NDT} versus fluence curve (0.25% weld line). Thus, the predicted curve is quite conservative.

The wedge-opening-loading (WOL) fracture mechanics specimens were not tested and thus no WOL test results are contained within the report. The specimens are being stored at this time and will be tested after the methods can be agreed upon between Licensee and the NRC staff.