Consumers
Power
Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

June 12, 1978

Director, Nuclear Reactor Regulation
Att: Mr Dennis L Ziemann, Chief
Operating Reactors Branch No 2
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 -
BIG ROCK POINT PLANT - REACTOR
VESSEL SURVEILLANCE ADDENDUM

By letter dated July 29, 1977, Consumers Power Company responded to an NRC staff request to provide information concerning reactor vessel materials and associated surveillance programs. Much of the information required by the staff was unavailable at the time. A search of vendor documentation was conducted and all available information was retrieved. Thus, a revised response is now being submitted as follows:

ITEM

1. Provide the estimated maximum fluence (E > 1 Mev) at the inner surface of the reactor vessel wall as of March 31, 1977.

RESPONSE

1. 1.5×10^{19} m/cm^2.

ITEM

2. Provide the effective full power years (EFPY) of operation accumulated as of March 31, 1977.

RESPONSE

2. Approximately 10.5 EFPY.

ITEM

3. Identify the firm that fabricated your reactor vessel.

RESPONSE

3. The vessel was fabricated by Combustion Engineering for General Electric.

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ITEM

4. a) Provide a sketch of the reactor vessel showing all material welds in the beltline region and provide an identification number for each material.

RESPONSE

4. a) Combustion Engineering Dwg No E-201-794-8 is provided. A single 360° circumferential weld exists in the beltline. Additionally, the two longitudinal welds above the circumferential weld and the two below are shown.

ITEM

4. b) Provide the following information for each of the welds in the beltline region:

(1) Shop control number of procedure qualification number;
(2) Filler metal and heat number;
(3) Type of flux and batch number;
(4) Welding process (sub arc, electroslag, manual metal arc, etc);
(5) Post-weld heat treatment;
(6) Chemical composition (particularly Cu, P and S content);
(7) Drop weight T_{ndt};
(8) RT_{ndt};
(9) Charpy upper shelf energy (unirradiated);
(10) Tensile properties (unirradiated);
(11) Firm performing weld if more than one firm participated in welding;
(12) The maximum end-of-life fluence at the vessel inner wall.

RESPONSE

4. b) (1-3) No definitive records are available. As noted on Dwg No E-201-794-8, a very general GE specification along with a CE general welding procedure were employed. ASME Boiler Code Section I (1953Ed) and appropriate nuclear code cases were considered. GE reactor vessel specification DP-19889 also provided some specific welding guidelines.

4. b) (4) A submerged metal arc welding process was employed - CE Specification SAA-33A(3).

4. b) (5) The post-weld heat treatment involved 21.0 hours of total stress relief heat treatment at 1125°F ± 25°F.

4. b) (6) The chemical composition is documented in weight percent as: .12C, 1.25Mn, .28Si, .014P .012S, .10Ni, .19Cr, .53Mo, .03V, and .27 Cu.

4. b) (7-8) There were no tests conducted to determine these characteristics. There were no drop weight tests and no full Charpy curves.

4. b) (9) Three Charpy V-notch tests were per coupons welded as a continuation of the circumferential weld seam. These tests were conducted at + 10°F and yielded 50.0, 53.5 and 53.5 ft-lb energy. Assuming that each of the specimens realized .035 in lateral expansion, present day ASME Section III requirements would provide for an RT_{ndt} of -50°F.

4. b) (10) Two .505 in tests were performed to result in a yield/ultimate data pair of 64.75/83.0 KSI and 64.0/82.0 KSI. Two reduced section transverse tensile tests were also performed to provide a yield/ultimate data pair of 102.5/133.5 KSI and 102/5/133.75 KSI.

4. b) (11) All welding was performed by Combustion Engineering.

4. b) (12) The maximum end-of-life fluence at the vessel inner wall is estimated to be $5.8 \times 10^{19} m/cm^2$ (E > 1 Mev) for 40 years at 240 MW.

ITEM

4. c) Provide the following information for each of the plates for forgings in the beltline region:

(1) Plate or forging serial number;
(2) Plate or forging heat number;
(3) Plate or forging material specification number;
(4) Plate or forging supplier;
(5) Plate or forging heat treatment;
(6) Chemical composition (particularly Cu, P and S content);
(7) Drop weight T_{ndt};
(8) RT_{ndt} (unirradiated);
(9) Charpy upper shelf energy (unirradiated);
(10) Tensile properties (unirradiated);
(11) The maximum end-of-life fluence at the vessel inner wall.

RESPONSE

4. c) (1-2) Four plates surround the vessel beltline region per CE Dwg No E-201-704-8. These plates and their heat numbers are:

Plate No (CE)	Heat No (Lukens Steel)
S-5503-1	19246-1
S-5503-2	19246-2
S-5503-3	19246-3
S-5503-4	19246-4

4. c) (3-4) The plate was purchased by CE to an ASTM A-302-56 Gr B specification modified by CE specification P-3-F2(b). The plate was provided by Lukens Steel.

4. c) (5) The plates were melted in a basic open hearth furnace and aluminum treatd in the ladle to achieve fine grain size. The plates were air cooled and hot rolled and shipped to Combustion Engineering. At CE, the plate was heat-treated as full plate as follows:

(1) 1600 ± 25°F for 4 hours.
(2) Brine quenched.
(3) 1225 ± 25°F for 4 hours.
(4) Furnace cooled.
(5) 1125 ± 25°F for 20 hours.
(6) Furnace cooled.

4. c) (6) The plate chemistry per Lukens Steel is weight per cent: .18C, 1.42Mn, .25Si, .016P, .021, .18Ni, .13Cr, .51Mo, .02V and .10Cu.

4. c) (7-8) There were no tests conducted to determine these characteristics. There were no drop weight tests or full Charpy curves.

4. c) (9) Charpy upper shelf energy information is not available for the vessel plate. However, a number of Charpy tests were conducted at +10°F. The results of these base metal tests are listed below:

Plate No	Heat No	Direction to Rolling	Charpy - V, 10°F in Ft-Lb
S-5503-1	19246-1	Parallel	69.5, 65.5, 54.0
		Transverse	30.0, 26.5, 30.0
S-5503-2	19246-2	Parallel	63.0, 54.0, 40.5
		Transverse	27.0, 26.5, 29.5
S-5503-3	19246-3	Parallel	54.5, 47.5, 32.0
		Transverse	20.5, 34.5, 28.0
S-5503-4	19246-4	Parallel	47.0, 44.0, 43.0
		Transverse	29.0, 22.5, 27.5

The above tests were cut from a full 6-inch plate after its heat treatment as is 4.c) (5) above.

4. c) (10) The tensile properties of the four plates were determined from Lukens tests during which samples were heat-treated as follows:

Austenitize	1650-1700°F - 4 Hours
Water Spray to	400°F in 12 Minutes
Temper	1200-1250°F - 6 Hours
Furnace Coal	to 600°F

Lukens Heat No	Yield Psi	Tensile Psi	% & Long (2 In)
19246-1	56,900	84,200	23
19246-2	58,200	86,100	22
19246-3	52,300	86,400	22
19246-4	56,500	81,500	20

4. c) (11) The end-of-life fluence used for all welds and plates is 5.8 x 10^{19} m/cm^2 (E > 1 Mev) evaluated at 240 MW for 40 years.

ITEM

5. a) List the weld, plate and forging materials included in the vessel surveillance program.

RESPONSE

5. a) For the surveillance program, the ends of two plates were provided to General Electric Company by Combustion Engineering. These ends were taken from plate numbers S-5503-2 and S-5503-3. The base metal samples for the surveillance program were taken from S-5503-2. A test weld for the surveillance program was fabricated to simulate a shell plate longitudinal weld. The details of this weld fabrication are in Appendix G of the surveillance program description (attached).

ITEM

5. b) For each weld listed in 5.a), provide the information in items (1) through (11) of 4.b).

RESPONSE

5. b) The weld specified in 5.a) was intended to simulate the actual characteristics of the vessel weld; therefore, the information of 4.b) applies. During the execution of the surveillance program, the weld metal surveillance coupons were tested. This test information is provided in the attached NRL report.

ITEM

5. c) For each plate or forging specimen listed in 5.a), provide the information listed in items (1) through (10) of question 4.c).

RESPONSE

5. c) Consistent with the response to item 5.b) above, the attached NRL report is again referenced for the tabular detail on vessel plate coupon testing.

ITEM

5. d) Provide a copy of the report which describes that surveillance program for your reactor vessel.

RESPONSE

5. d) The Manual is attached.

Eulish McKnight for

William S Skibitsky
Senior Licensing Engineer

CC: JGKeppler, USNRC

B0610-178

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FURNISHING REVISED RESPONSE TO APPLICANT'S SUBMITTAL OF 07/29/78 WHICH PROVIDED INFO CONCERNING THE REACTOR MATERIALS AND ASSOCIATED SURVEILLANCE PROGRAMS OF SUBJECT FACILITY...W/ATT.

See Report

PLANT NAME: BIG ROCK PT

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