NRC FORM 195 (2-76)

U.S. NUCLEAR REGULATORY COMMISSION

DOCKET NUMBER 50-220

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TO: George Lear

FROM: Niagara Mohawk Power Corp/ Syracuse, NY G. K. Rhode

DATE OF DOCUMENT 7/22/77

DATE RECEIVED 7/26/77

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PLANT NAME: Nine Mile Point Nuclear Pwr Plt
Unit No. 1
RBT 7/27/77

ENCLOSURE

Enclosed info on the reactor vessel material and weld material used in fabrication of the reactor vessel.as requested in ltr dtd 5/20/77.
1p+3p

FOR ACTION/INFORMATION

SAFETY		ENVIRONMENTAL	
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NRC FORM 195 (2-76)

JUL 22 1977

Docket No. 50-220

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Niagara Mohawk Power Corporation
ATTN: Mr. Gerald K. Rhode
Vice President - Engineering
300 Erie Boulevard West
Syracuse, New York 13202

Gentlemen:

RE: TECHNICAL REPORT ON D.C. POWER SUPPLIES IN NUCLEAR POWER PLANTS (NUREG-0305)

Enclosed for your information is a copy of the subject report.

If you have any questions or comments please contact our staff.

Sincerely,

Karl R. Goller

Karl R. Goller, Assistant Director
for Operating Reactors
Division of Operating Reactors

Misc 7

OFFICE	ORB#1	ORB#3	ORB#3			
SURNAME	SSheppard:ar	SNowicki	GLear			
DATE	7/22/77	7/22/77	7/22/77			

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NIAGARA MOHAWK POWER CORPORATION

NIAGARA MOHAWK

300 ERIE BOULEVARD, WEST
SYRACUSE, N. Y. 13202

July 22, 1977

RECEIVED JUL 26 1977 U.S. NUCLEAR REGULATORY COMMISSION

Regulatory File Cy

Director of Nuclear Reactor Regulation
Attn: Mr. George Lear, Chief
Operating Reactors
Branch #3
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Gentlemen:

Your letter dated May 20, 1977 requested information on reactor vessel material and weld material used in fabrication of the reactor vessel. The attachment to this letter addresses itself to those concerns.

Very truly yours,

NIAGARA MOHAWK POWER CORPORATION

Gerald K. Rhode
Vice President - Engineering

PEF/szd

REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM

The Nuclear Regulatory Commission's staff's concern is that the materials used in reactor vessel fabrication may have a wider variation in sensitivity to radiation damage than originally anticipated. The Nuclear Regulatory Commission has suggested that some reactor vessels may incorporate more than one heat of materials, including weld materials in their beltline region. In addition, it has been indicated that all of the heats may not be included in the reactor vessel material surveillance program.

This response provides information to show that General Electric's program of reactor vessel surveillance is completely responsive to 10CFR50, Appendix H. Further, the effect on adjusted reference temperature for the most adverse materials in BWR/2 through BWR/4 plants irradiated to the maximum 40-year fluence observed is very small.

General Electric has addressed the problem of obtaining representative surveillance specimens since the beginning of its reactor pressure vessel surveillance program. The material for base metal specimens has been taken from a plate used in the vessel beltline region or from a plate of the same heat of material. The same plate used for base metal specimens is used for production of heat-affected zone specimens, and the weld specimens are produced by the identical weld practice and procedures used in the vessel fabrication. For vessels constructed from plate, as is the Nine Mile Point Unit 1 vessel, the vessel longitudinal welds are represented; while for vessels fabricated from forged rings, the girth welds are represented. When widely varying weld practices such as submerged metal arc and electroslag welding are used jointly in a vessel, both are represented in the surveillance program material. Thus, the surveillance specimens do represent the materials and processing of the vessel beltline region.

The procedures described above were used to select surveillance materials and to prepare specimens for all operating BWR 2 through 4 plants. Examination of this method of selection, even in light of the most recent data, reveals that the reactor pressure vessel surveillance specimens currently in use still provide a reasonable representation of the limiting materials in the reactor vessel beltline region.

The production of the vessel beltline region is generally accomplished by the welding of several plates and, most often, several heats of steel are involved. The vessel surveillance specimens are produced from one of these heats. The possible variation of the other beltline heats, however, is limited by the characteristic range of compositions resulting from the material production practices. Consultation with the domestic heavy-section pressure vessel steel mill, Lukens Steel, concerning process capability and a survey of 10 BWR vessels

reveals that the residual element of major importance, copper, lies consistently within the 0.15 to 0.20 weight percent range when special low-copper scrap selection procedures are not invoked in the mill process. This was the case when the Nine Mile Point Unit 1 vessel was fabricated.

Examination of the predicted effect of residual element composition on the irradiation behavior of pressure vessel steels is discussed in Regulatory Guide 1.99. A preliminary analysis of GE data in the BWR fluence range from 10 operating BWR's (representing copper contents in the range 0.01 to 0.30 weight percent and phosphorous contents in the range .007 to 0.02 weight percent) reveals a minimal impact due to the possible variation in base metal composition that could be present in the vessel beltline. Data at the upper end of the copper range (0.30%) was obtained from an atypical source. It represents a foreign plant with a forged ring produced by foreign practice. It does, however, provide additional support for predicting the maximum effect of elevated copper contents.

The predicted end of 40-year life fluence at the vessel wall 1/4T location is below 2×10^{18} nvt (> 1 MeV) as indicated in the FSAR Volume 1 Section V. For this fluence range, an estimated end of life variance of approximately 15°F in transition temperature shift would be indicated for a copper composition range of 0.15 to 0.20 weight percent copper. This variance represents the expected deviation in predicted transition temperature shift due to compositional differences. That is, at the end of life fluence, the predicted shift in transition temperature could vary by 15°F depending on the composition of the heat of plate material in question. Thus, even with the maximum predicted variability of copper content for the beltline plate material, a minimal variation in predicted transition temperature shift is expected.

Similarly, the variability of weld metal properties within the beltline region does not present a major obstacle to their effective representation by the current surveillance specimens. Typically, the range of residual element compositions present in weld metal falls within several major bands determined by weld process, electrode coating, and flux type. This variability inherent to process characteristic is already taken into account by the fact that the identical weld process and procedures used in vessel manufacture are used to produce the surveillance weld specimens. If the copper content range resulted strictly from heat to heat variations of filler metal composition within a given process, the surveillance specimens still adequately represent a limited range of weld metal composition. In the vessel beltline region one heat of filler metal was used for fabrication.

A survey of weld practices used in 10 BWR pressure vessels has characterized the ranges of copper contents expected for the weld metal in the vessel beltline. When compared in the fluence region of the BWR (based on the predications of Regulatory Guide 1.99 and a preliminary analysis of extensive GE data) the copper variations within a given process contribute only a minimal estimated variance in the predicted transition temperature shift. For standard submerged metal arc and electroslag welds a range of 0.15 to 0.20 weight percent copper result in approximately a 15°F variation in transition temperature shift at the end of a 40-year vessel life. For shielded metal arc welds a copper content less than 0.15 weight percent and an estimated end of 40-year life variation of 5° to 10°F in predicted transition temperature shift is expected. For the extreme case of submerged metal arc welds made with copper-coated electrodes used for circumferential welds in 6 BWR's, a range of 0.2 to 0.4 weight percent copper result in a projected end of life variability of approximately 25°F in transition temperature shift. The analysis of the effect of elevated copper in these welds produced with copper-coated electrodes is based on a maximum predicted fluence of 6×10^{17} nvt (> 1 MeV) at the 1/4T wall location for the six plants affected.

Based on the preceding discussion, the selection of materials for the reactor pressure vessel surveillance programs in BWR 2, 3 and 4's does reasonably represent the materials in the beltline region of the vessel. The steps taken by General Electric to assure adequate representation of the welds process and all subsequent material processing steps seen by the vessel materials limits the only possible variation between surveillance specimens and vessel material to the heat-to-heat variability of base metal and weld metal. The net, end of 40-year life effect of these possible variations, is projected to be only 10° to 25°F variability in the predicted transition temperature shift for the BWR fluence range.

Although it is still important to know the residual element composition of the vessel steel and surveillance specimens for complete analysis of surveillance test results, this information can easily be obtained by chemical analysis of archive material and analysis of specimens at the time of testing. General Electric believes that the steps taken during the production of BWR pressure vessel surveillance specimens adequately assure reasonable representation of the vessel material and that any variations in irradiation behavior between the surveillance materials and additional heats of vessel materials would be minimal in the BWR fluence range.