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September 16, 1982

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50-266

In the Matter of
Wisconsin Electric Power Company
(Point Beach Nuclear Plant, Units 1 & 2)

Dear Administrative Judges:

Enclosed is a copy of the text of Licensee's response to the Board's question on radiolysis in the sleeve/tube annulus, which was posed in the course of the September 9, 1982 conference call in this proceeding.

Due to the press of time, the enclosed response is not in the form of an affidavit. However, Licensee will tomorrow serve on all parties a notarized affidavit which attests to the precise text here enclosed, and which is signed by Mr. Douglas Fletcher of Westinghouse Electric Corporation.

Sincerely,

SHAW, PITTMAN, POTTS & TROWBRIDGE

By Delissa A. Ridgway
Bruce W. Churchill
Delissa A. Ridgway

Counsel for Licensee

Enclosure

cc: Service List

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
WISCONSIN ELECTRIC POWER COMPANY	)	Docket Nos. 50-266
	)	50-301
(Point Beach Nuclear Plant,	)	(OL Amendment)
Units 1 and 2)	)	

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ASLB QUESTION ON SLEEVING FOR POINT BEACH UNIT 2

Q. What are the consequences of radiolytic production of oxygen from water contained in the sleeve-tube annulus region with regard to corrosion resistance of thermally-treated Inconel 600 sleeve material?

A. The radiolytic decomposition of water is accompanied by the radiolytic recombination of hydrogen and oxygen species to reform water. This leads to steady-state concentrations of oxygen in the water. Radiolytic production of oxygen or oxidizing species radiolysis of water in the annular region between a sleeve and tube is expected to be insignificant at steady-state conditions because of the relatively low gamma radiation field in that region. The gamma radiation field in the sleeve-tube annulus at the steam generator inlet is only on the order of 100 R/hour with the plant operating at full power conditions. This gamma energy arises primarily from the N-16 content of the reactor coolant. Steady-state levels of oxygen from radiolytic decomposition of water at these low radiation levels are small, conservatively estimated to be less than 1 part per billion.

Due to the radiolysis of water in the reactor coolant system, excess hydrogen is employed as the basis for oxygen control. Small quantities of hydrogen from the reactor coolant diffuse through the Inconel sleeve wall at operating temperatures. Thus, the water assumed in the annulus between the sleeve

and tube is expected to have an excess hydrogen content. The presence of this hydrogen further reduces the concentration of oxidizing species formed from the radiolysis of water in the sleeve-tube annulus. Thus, the presence of an oxidizing environment in the sleeve to tube annular region due to radiolysis of water that may be present is not expected.

The corrosion testing program included corrosion tests where thermally-treated Inconel 600 was evaluated in comparison with mill-annealed Inconel 600 in the presence of oxygen or oxidizing environments. These tests demonstrated the enhanced corrosion resistance of thermally-treated Inconel 600. Examples of these tests are summarized as follows:

a. Stressed specimens of mill-annealed and thermally-treated Inconel 600 were exposed in high temperature water (572°F) containing 100 ppm chloride, as NaCl, and 7.7 ppm oxygen for 2,034 hours. Examination of the samples following this test indicated intergranular stress corrosion cracking in the mill-annealed material to have progressed to depth of 7 to 15 times that observed in the thermally-treated material. This indicates that thermally-treated Inconel is substantially more resistant to intergranular stress corrosion cracking than mill-annealed Inconel 600, even at oxygen concentrations several orders of magnitude higher than expected by radiolysis of water in the sleeve-tube annulus.

b. Oxidizing environments have also been included during corrosion tests by impressing an anodic electrical potential on the test specimens. Mill-annealed and thermally-treated Inconel 600 tubing specimens have been exposed to caustic solutions (0.1, 1, 10, 25 and 50 wt. percent) at 600 and 650°F where a range of electrical potentials of 0 to 250 millivolts was applied to the specimens. In these tests, the thermally-treated material showed better corrosion resistance than the mill-annealed material.

c. The effect of oxidizing species in the corrosion test environment has also been evaluated by including copper oxide in the caustic test solution. After 4,000 hours at high temperature (600°F) with a test mixture of 89 parts water, 10 parts sodium hydroxide and 1 part copper oxide only the mill-annealed material exhibited stress corrosion cracking. At more aggressive test conditions of 80 parts water, 10 parts sodium hydroxide and 10 parts copper oxide, mill-annealed and thermally-treated material showed approximately the same extent of stress corrosion cracking.