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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

WM DOCKET CONTROL CENTER

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APR 29 1987

MEMORANDUM FOR: Tom Jungling

FROM: Michael McNeil, WMB/DE/RES

SUBJECT: RADIATION EFFECTS ON CORROSION OF STAINLESS STEEL

The attached paper, "The Influence of Radiation on the Corrosion of Stainless Steel" by G. P. Marsh, K. J. Taylor, G. Bryan, and S. E. Worthington, appeared in the November 1986 Corrosion Science.

This paper is a careful study of the effect of radiation on corrosion of 304L stainless steel at 40°C in a solution with 300 ppm Cl^-. These experimenters were quite careful to screen their reference electrodes. The radiation fields reported varied from 1 to 2 x 10^3 sievert per hour. Sieverts are not directly convertible into rads (New Scientist June 12, 1986), but in this case, where the radiation is all gamma, it is fair to say that 1 sievert is equivalent to 100 rads; consequently these tests were done at 1-2 x 10^5 rads per hour.

The important conclusions from our standpoint are:

1. The radiation field increases the rest potential by between 200 and 300 millivolts.

2. The radiation field produces a significant increase in the H_2O_2 content, consistent with what is known about radiolysis effects in brines.

3. The radiation field passivates the surfaces of stainless steels in some experiments.

4. The radiation field has no effect on pit morphology.

The above observations are all consistent with the assumption that the radiation field affects corrosion behavior only by creating peroxide fragments which shift the rest potential, and consequently radiation effects on corrosion may be treated purely in terms of E_h.

5. Radiation does not qualitatively affect the growth of existing pits.

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It is not so clear to me that this is consistent with the assumption that only the creation of peroxide fragments matters; if this point is important I think somebody needs to do some fairly careful experimental work on the chemistry in pits.

I am satisfied that this is carefully done, good quality work.

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