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February 7, 1991

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Document Control Desk

Subject: Dresden Nuclear Power Station Unit 2
Hydrogen Water Chemistry Fuel Surveillance
NRC Docket No. 50-237

References:
(a) D. Crutchfield (NRC) letter to D. Farrar (CECo), dated April 7, 1983.

(b) J. Silady (CECo) letter to T. Murley (NRC), dated November 30, 1987.

(c) J. Silady (CECo) letter to T. Murley (NRC), dated May 22, 1989.

(d) Hydrogen Water Chemistry Fuel Surveillance at Dresden-2, by B. Cheng, EPRI Report NP-6956-D, August 1990, EPRI Research Project 1930-10.

Dr. Murley:

Reference (a) transmitted Amendment No. 75 to Provisional Operating License DPR-19 in support of Dresden Unit 2 Cycle 9 operation and authorized operation with hydrogen addition to the primary coolant. Section 2.1.6 of the Safety Evaluation which supported Amendment No. 75 requested that Commonwealth Edison Company (CECo) provide the results of hydrogen uptake measurements on General Electric lead test assemblies exposed to the hydrogen environment. The results of the hydrogen uptake measurements following one cycle of hydrogen addition were presented in Reference (b), and the results of the measurements following two cycles of operation were presented in Reference (c). The data from the first two cycles of hydrogen water chemistry at Dresden Unit 2 indicated that there were no deleterious effects on the zircaloy components.

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Fuel measurements obtained after three cycles of hydrogen water chemistry are reported in Reference (d). The results of these measurements continue to indicate that hydrogen water chemistry at Dresden Unit 2 does not have an adverse effect on the hydriding performance of the zircaloy components. The Attachment to this letter, which contains excerpts from Reference (d), reports on the hydrogen uptake following three cycles of hydrogen water chemistry at Dresden Unit 2.

The results from the fourth cycle inspections will be provided when General Electric and EPRI have prepared and released the associated report. This report is expected to be available in February 1992.

Please contact this office should further information regarding this matter be required.

Respectfully,

Milton H. Richter

M.H. Richter
Nuclear Licensing Administrator

Attachment: Excerpts from EPRI Report NP-6956-D

cc: A.B. Davis - Regional Administrator, Region III
B.L. Siegel - Project Manager, NRR
D.E. Hills - Senior Resident Inspector, Dresden

MR:lmw
ZNLD743/2

ATTACHMENT

EXCERPTS FROM EPRI REPORT NP-6956-D

HYDROGEN WATER CHEMISTRY FUEL SURVEILLANCE

AT DRESDEN-2

(AUGUST 1990)

4.3 Hydrogen Uptake

The hydrogen uptakes of the non-heat flux water rods in the LTA bundles (0/1, 0/2, and 0/3) all have axial profiles with a peak at the bottom 20 to 40 inch elevations, as shown in Figure 4-9. The hydrogen uptake increases with increasing exposures. The peak value of 159 ppm at the 30 inch location of the 0/3 - E4 rod is still relatively low for three 18-month cycles. The origin of the axial hydrogen pattern can be correlated to the axial oxide pattern, which also showed a peak value at the 20 to 40 inch location, as discussed in Section 3 and shown in Figure 4-9.

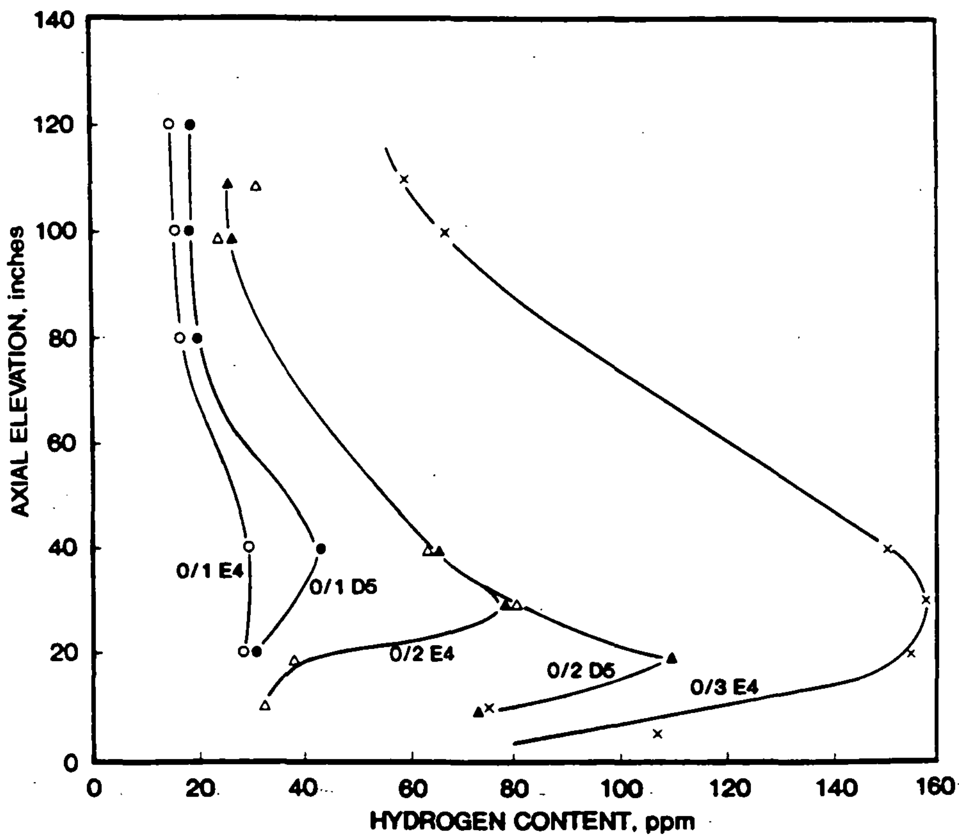

Figure 4-9 Axial Distribution of Hydrogen in the 0/1, 0/2, and 0/3 Water Rods

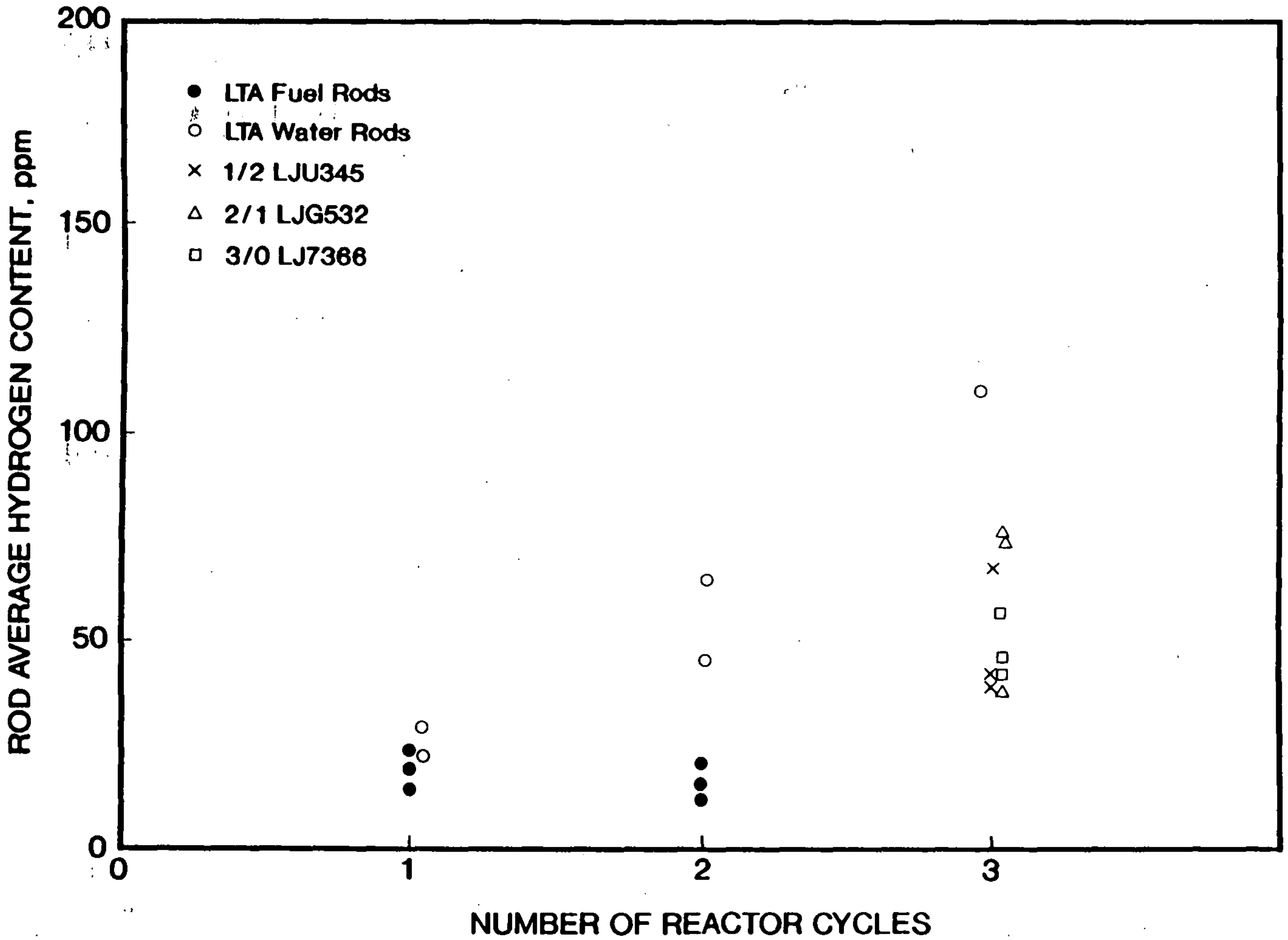

Figure 4-10 Rod Average Hydrogen Content as a Function of Reactor Residence Time for 0/1 and 0/2 LTA Fuel and Water Rods and 1/2, 2/1, and 3/0 Discharged Fuel Rods

The corrosion oxide thicknesses determined by metallography and the hydrogen contents determined by LECO analysis on the Dresden-2 fuel and water rods under the present program are tabulated in Table 3-3. The rod average hydrogen contents for all 0/1, 0/2, 1/2, 2/1, and 3/0 rods are shown in Figure 4-10. It can be seen that the rods that were exposed to only HWC (0/1 and 0/2 rods) show a trend of constant and low hydrogen uptake. Extrapolation of the LTA rod data to three cycle, based on the hydrogen data in Figure 4-10 and the low corrosion results discussed in Section 2, the hydrogen content in the LTA rods after three cycles of HWC is expected to be lower than the hydrogen contents in the 1/2, 2/1, and 3/0 rods. Thus Zircaloy-2 cladding operated under HWC at Dresden-2 is not expected to result in higher hydrogen uptake. Contrarily, lower hydrogen uptake can be realized if the HWC decreases cladding corrosion as indicated by the corrosion data discussed above.

The relatively low hydrogen contents in the 1/2 and 2/1 rods indicate that a switch from NWC to HWC did not cause an increase in the hydrogen uptakes of the relatively high corrosion rods A1 and H8 in the 2/1 bundle. Such a possibility of enhancement in hydrogen uptake when NWC is switched to HWC was proposed as a worst case scenario by Cox.[18]

Figure 4-11 shows the local oxygen weight gain (corrosion oxide) and hydrogen weight gain (hydrogen uptake) for the samples listed in Table 3-3. The majority of the 1/2, 2/1, and 3/0 cladding have local hydrogen pickup fractions between 3 to 15%. Higher local pickup fractions of up to 30% were found near the bottom of the C7 Gd rod in the 1/2 bundle (LJU345). It is, however, an isolated case, and whether the high values were due to higher local uptake rates or from axial migration is not clear. All the LTA rods (0/1 and 0/2) have pickup fractions of less than 2%. The results indicate that Zircaloy-2 fuel cladding operated at Dresden-2 under HWC have lower hydrogen pickup fraction than those operated before hydrogen injection was implemented. It is not clear how the HWC will result in lower hydrogen uptake. A broader data base is needed to confirm this trend. Also, the effect of HWC on the production of radiolytical species needs to be studied to support a more detailed analysis.

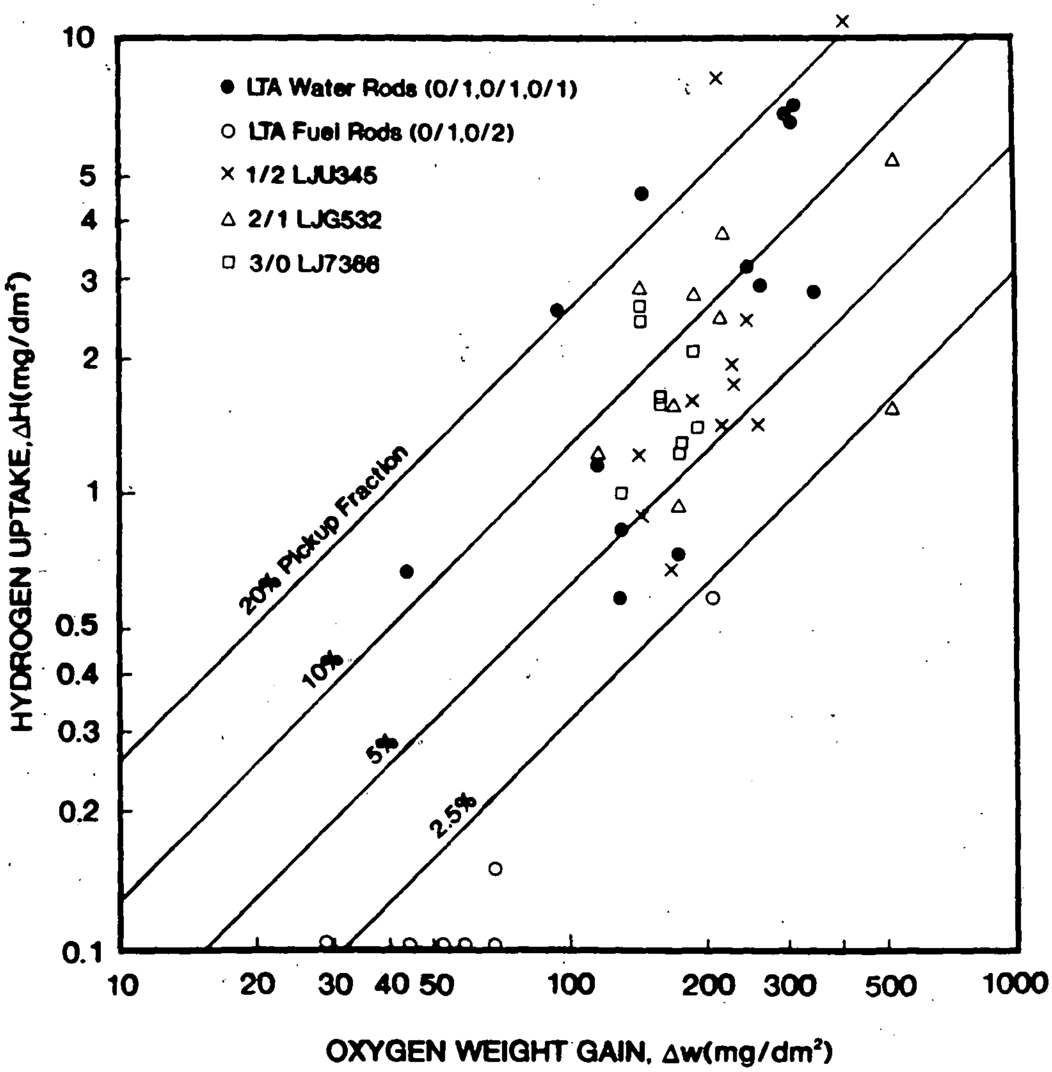

Figure 4-11 The Rates of Hydrogen Uptake of the 0/1 and 0/2 LTA Fuel and Water Rods and 1/2, 2/1, and 3/0 Discharged Fuel Rods

The results in Figure 4-11 indicate that the hydrogen pickup fraction does not decrease with increasing oxide thickness or oxygen weight gain, as reported by other workers. When the data of the LTA rods, which were exposed to HWC only, are separated from the remaining data, neither data group shows a dependence of hydrogen pickup fraction on the oxide thickness within the range up to 33 μm.

Figure 4-11 also shows that the non-heat flux water rods in the LTAs have hydrogen pickup fractions in the 3 - 25% range. The values are several times higher than that of the fuel rods in the same bundle. This can be attributed to the lack of heat flux on the water rod surface, which will reduce the rate of combination of hydrogen atoms into hydrogen gas bubble during corrosion reaction, hence, increasing the fraction of hydrogen pickup.