Regulatory File Cy.

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Commonwealth Edison Company

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October 8, 1971

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U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Additional Information concerning the fuel performance at Dresden Unit 2

Dear Dr. Morris:

This is in response to your letter of July 26, 1971, in which you requested additional information concerning the fuel performance at Dresden Unit 2 and the plans for future operation of this unit. The attached report addresses itself to your concerns. We would be happy to discuss this material further with you, should you have any additional questions.

In addition to three signed originals, 19 copies of this information are also submitted.

Very truly yours,

Wayne L. Stiede

Wayne L. Stiede
Nuclear Licensing Administrator

SUBSCRIBED and SWORN to
before me this 8th day
of October, 1971.

Patricia A. Nelson

Notary Public

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INTRODUCTION

Report No. 5 "Fuel Inspection and Evaluation Dresden Unit 2" dated June 4, 1971, detailed the tests and evaluations performed on the Dresden Unit 2 fuel from June 1970 through March 1971. During that period approximately 2000 fuel rods were examined by NDT tests. As a result of that testing 73 rod lots were classified as suspect. These suspect lots contained approximately 5000 fuel rods of which on the average, 30% of the fuel rods were faulted; i.e., perforated, defective, or questionable as defined in Report No. 5. These fuel rods were manufactured in San Jose and appear to have been subject to internal localized clad hydriding from hydrogenous impurities introduced into the rod during manufacture by some indeterminable means. The testing essentially defined two types of population for the rod lots; i.e., suspect and normal. The population of suspect rods was further divided into "suspect rods vacuum outgassed" and "suspect rods not outgassed". All suspect rods not outgassed were removed from the reactor as a result of removing 215 fuel assemblies during the last fuel replacement outage. The 911 suspect rods vacuum outgassed remain in the reactor in 184 fuel assemblies. No failures by hydriding phenomena are expected in these remaining suspect rods.

POSSIBLE FUEL FAILURES

The results of the tests on the suspect rod lots showed that the average number of faulted rods in the suspect rod lots was 30% and the maximum number of such rods was 83%. Therefore, the minimum and maximum number of rods from the 911 suspect rods remaining in the core which might fail due to the hydriding phenomena is 274 and 757. Fuel rod internal moisture testing on about 200 fuel rods manufactured for the Millstone Plant at the San Jose facility using the same manufacturing process showed that 1.2% of the rods in a normal rod lot contained enough moisture so that the possibility of failure due to hydriding existed. Continued testing at the Wilmington facility indicates that for the normal rod lot this number could be as high as 1.44%. The minimum and maximum (assuming high moisture in 1.2% and 1.5% of the rods) number of rods from the normal rod lots which might fail due to the hydriding phenomena is 288 and 360, assuming the 509 bundles not replaced have normal rod lots except for the 911 suspect rods discussed above. Therefore, the lower and upper bound on possible fuel rod failures is 562 (274 + 288) and 1117 (757 + 360).

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REVIEW OF DOSE CONSEQUENCES DUE TO DESIGN BASIS ACCIDENTS

Using as a basis the AEC issued technical specifications and the AEC Staff Safety Evaluation for Dresden Nuclear Power Station Unit No. 2, the dose consequences of the design basis accidents were recalculated as follows:

1. Loss of Coolant Accident

There is no change in the dose consequences as shown in Table 4.0 of the Staff Safety Evaluation because the staff evaluation assumes that all fuel rods are perforated.

2. Refueling Accident

The remaining 911 suspect rods are located in such a manner that no more than 9 faulted rods are in any one fuel assembly. Although the Staff Safety Evaluation considers that all the fuel rods (49) in one fuel bundle are perforated, later calculations by General Electric have shown that conservatively, up to 111 rods in 3 fuel bundles could be perforated. For purposes of this analysis, it is assumed that the 3 fuel bundles involved contain the maximum number of suspect rods. The 49 rods in the dropped bundle are assumed to fail and, in addition, 62 rods in the other 2 bundles fail, and then the suspect rods in the remaining 2 fuel bundles are also assumed to fail which results in a total of 129 rods. The calculated dose consequences are:

2 hour dose (rem)		30 day dose (rem)	
Thyroid	Whole Body	Thyroid	Whole Body
66	< 2.5	12	2.5

3. Control Rod Drop Accident

It was assumed that the maximum number of faulty fuel rods as previously calculated (1117) fail in addition to the 330 fuel rods which were previously calculated. Therefore, the total number of fuel rods assumed to fail is 1447. The calculated dose consequences are:

2 hour dose (rem)		30 day dose (rem)	
Thyroid	Whole Body	Thyroid	Whole Body
200	3.6	36	< 3.6

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4. Steam Line Break Accident

The dose from the steam line break is related to the activity in the reactor coolant. This activity is limited by the technical specifications to 20 μci/ml. The technical specification also limits the maximum closure time of the main steam line isolation valves (MSLIV) to 5 seconds. Because the time for any coolant from the reactor core to reach the break in the liquid phase is over seven seconds and the MSLIV close in five seconds, any additional activity in the reactor coolant which might be postulated from the accident would not reach the environment. However, to provide some estimate of margins available, it was assumed that reactor coolant activity increased to ten times the allowable limit; that is, 200 μci/ml. The calculated dose consequences are:

2 hour dose (rem)		30 day dose (rem)	
Thyroid	Whole Body	Thyroid	Whole Body
100	< 4	< 4	< 4

As can be seen from the results of the analyses, the resultant doses are still below the limits set by 10 CFR 100. It further can be stated that it has been shown in General Electric Topical Report NEDO-10208, Effects of Fuel Rod Failure on ECCS Performance (August 1970), which is applicable to the Dresden Unit 2 situation, that even large distortions in fuel geometry do not limit core cooling capability and further, the results of the completed examinations have not revealed any distortions which could conceivably limit core cooling.

OPERATING PLANS

Present operating plans for Dresden Unit 2 call for operation of the unit at 500 Mw(e) output until such time as the replacement fuel (509 assemblies) has been delivered and Unit 2 is ready for refueling. This is expected to occur about January 1972. Between now and January, the unit will be operated at a steady-state or base loaded condition. No start-up tests will be performed during this period. The 500 Mw(e) power level was chosen to minimize off-gas release from Dresden Unit 2. The basis for the 500 Mw(e) operating point is the peak center fuel temperatures. It has been found, by experimental data, that at peak center fuel temperatures corresponding to 600 Mw(e) output, fission gases are released from the uranium dioxide pellets. Below this peak center fuel temperature

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the fission gases are retained within the pellet except for a small amount of diffusion. Thus, we have chosen the operating point for Unit 2 to be on the conservative side of this fuel temperature. With respect to cancelling the remainder of the start-up test program, this decision was based on minimizing the number of transients which the fuel would be subjected to and thus again minimize off-gas release. The decision on operation of Dresden Unit 2 was arrived at by discussions between the management of General Electric and Commonwealth Edison Company. Commonwealth's President, Vice President of Engineering, Manager of Production, and members of these staffs, participating in these discussions.

CONCLUSIONS

Based on the information presented, it is concluded that although the risk of fuel failure has increased, the postulated dose consequences to the public are still within the requirements of 10 CFR 100. In addition, although it cannot be unequivocally stated that no further fuel failures can occur due to operational transients, operation of the Dresden Unit 2 plant within its technical specifications will ensure that the monitoring equipment and procedures provide sufficient protection so that the limits established in the Technical Specifications will not be exceeded.

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