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April 29, 1974

Mr. D. L. Ziemann, Chief
Operating Reactors - Branch 2
Directorate of Licensing
Office of Regulation
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: Dresden Station Unit 3 - Fuel Performance Report, End of Cycle 1, Special Report No. 35, Supplement A (Proprietary), AEC Docket 50-249

Dear Mr. Ziemann:

In response to requests from members of your staff, the attached Dresden Special Report No. 35 Supplement A discussing fuel performance at Dresden Unit 3 during Cycle 1 is submitted. The report describes the operating parameters during Cycle 1, the results of the fuel inspection at the end of Cycle 1, and to the extent available information recommended by your staff.

To supplement the attached report, the following discussions of fuel failure mechanisms and reactor operation to mitigate offgas release are provided.

Fuel Failure Mechanisms

During the Dresden 3 refueling outage in the Spring of 1973, a total of 103 leaker bundles were detected during the sipping operation. The failures appeared to occur from two basic mechanisms: 1) pellet-clad interaction, and 2) localized internal hydride. The pellet-clad interaction mechanism appears to involve localized mechanical strain due to pellet-to-cladding interaction at pellet interfaces and cracks. The localized strain at a point in time is both material property and power history dependent, and a statistically significant, but small, number of failures occur during normal reactor operation. This mechanism has been observed, and reported earlier, for exposed Dresden 1 fuel (NEDO-10505). The localized internal hydride is random in nature and appears to be the result of excessive moisture left in the rod during fabrication. Zirconium hydride blisters are formed from hydrogen impurity attack. Depending on the size of the blister and fuel operating history, the fuel rod may perforate at various times during a cycle.

Reactor Operation to Mitigate Offgas Release

1. The mitigation of offgas release resulting from fuel failures associated with the pellet-clad interaction mechanism has been approached on a broad front. Fuel design changes to reduce this mechanism as a cause of failure

have been implemented on current fuel designs by the General Electric Company (GE), and development on future fuel is continuing. In addition, recommendations for operating procedures to minimize this mechanism in existing fuel have been made by GE, and Edison is participating in this program to reduce the statistical occurrence of fuel failures.

2. In 1971 General Electric provided operational recommendations termed Interim Operating Management Recommendations of IOMR's. These procedures did not provide the anticipated reduction in offgas during subsequent operation, and prior to Dresden 3 re-start following the Spring 1973 outage, General Electric provided modified operation recommendations for improving performance. These were termed Preconditioning Interim Operating Management Recommendations or PCIOMR's. Commonwealth Edison's large BWR's have been operating with the PCIOMR's with one revision since May 10, 1973.

The PCIOMR's are implemented through a periodic, slow ascent to full power, which preconditions the fuel for subsequent normal full power generation. In practice, the reactor is preconditioned with two to three control blade patterns that provide a broad envelope for movement to allow two or three months' burnup compensation prior to additional preconditioning.

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3. Following are the generating operating recommendations presently applied with the intent of minimizing fuel-clad interaction:

a. Base loaded whenever possible,

b. Minimize control rod movements,

c. Use flow control for load changes above half load,

d. Increase power in accordance with generalized constraints and detailed procedures,

e. Compensate for xenon and burnup via use of a minimum of rod motion maintaining nodal power with precondition envelope,

f. Extend preconditioned envelope when necessary to allow for maintenance of rating, and

g. Derate when necessary to maintain offgas within license and/or plant limits.

Hydriding

The presence of excessive internal hydrogenous impurities in BWR fuel rods has been progressively reduced. Edison has been assured that internal hydriding should not be a primary cause for failure in its current or future fuels. There still exists the potential for failure of a significant, but limited number of fuel rods in Edison's reactors by the internal hydriding mechanism. GE has made recommendations to Edison intended to reduce the rate of failure of rods by this mechanism. Edison has and will continue to operate its fuel in accordance with these recommendations to minimize fuel rod failures by internal hydriding.

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To reduce hydriding failure potential, Edison has further limited the rate of power change on some of its large BWR's. This action is normally taken when the offgas of a unit is high or when the unit has experienced a rapid rise in offgas levels and the core average exposure is low. Under these conditions, internal hydriding of the fuel rod is highly suspect as the failure mechanism and the following restrictions, in addition to preconditioning, are applied:

1. The unit is base loaded whenever possible and power changes are minimized.

2. Power changes are made slowly, both increasing and decreasing via flow control whenever possible.

3. In addition, the rate of change of power is applied over the full power range of 0% - 100% of rated power.

4. When system demands preclude the use of the recommended rate, the lowest rate of power change acceptable is used to meet system conditions.

The above discussions are provided to allow you and your staff to maintain a current understanding of the state of development of fuel failure technology. Much of the information provided is preliminary and developmental in nature; therefore the current operation recommendation should not be considered as proven, effective techniques. We are continuing to work with GE to develop improved fuel design, fabrication, and operating specifications which will result in optimum fuel performance.

This letter and report contain General Electric Company Proprietary Information which is available on a "need to know basis" only. It is requested that the information contained in this letter and Supplement A receive proprietary treatment under the provisions of 10 CFR, Part 2.790. A non-proprietary version of the letter and report are submitted separately.

Ten copies of this report are submitted. If you require additional copies, notify us.

Very truly yours,

J. S. Abel
Nuclear Licensing Administrator
Boiling Water Reactors

cc- Mr. James G. Keppler
Region III