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October 2, 1980

U. S. Nuclear Regulatory Commission
Division of Licensing
Washington D.C. 20555

Attention: Robert L. Tedesco
Assistant Director for Licensing

Gentlemen:

SUBJECT: ADDITIONAL INFORMATION ON NEDO-24259, "GENERIC INFORMATION FOR BARRIER FUEL DEMONSTRATION BUNDLE LICENSING"

Attached is additional information in response to request 231.2 regarding the document NEDO-24259. During telephone conversations with members of the NRC staff, General Electric was informed that additional information on responses forwarded with the letter of September 11, 1980 was required. Based on conversations, General Electric believes that the attached information clarifies the previous responses and allows rapid approval of the document for the licensing of the barrier fuel demonstration.

General Electric would like to reiterate that the demonstration plans do not call for subjecting any of the fuel to conditions which exceed the limitations of the technical specifications and that none of the fuel will be subjected to conditions where, from the experimental evidence, any failures would be expected. A technical specification change may be requested by the plant operator because of test uncertainties.

As stated in the letter of September 11, timely implementation of the barrier fuel demonstration project requires that hardware manufacture begin in October 1980. Based on conversations, General Electric believes that the additional information attached provides all the information required and looks forward the approval of NEDO-24259 by October 7, 1980.

Very truly yours,

R E Engel

R. E. Engel, Manager
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a. On-Line Failure Detection

The current steam jet air ejector monitoring system is an on-line gamma-ray detection system that reads the dose rate and can detect changes in gamma-ray intensity within 2-5 minutes of changes in the core offgas (e.g. fuel failures). Inferences regarding the numbers of fuel rods failed in any time increment are now made by isotopic analyses of gas and coolant water samples.

Thus, the gamma-ray detector near the steam jet air ejector can be used to initiate a sampling sequence which can then yield an estimate of numbers of failed fuel rods. Relatively small changes in core offgas are reliably seen in the 2-5 minute interval which can be indicative of fuel failures. Presently, there is no direct calibration to link total gamma-ray intensity with the number of failed fuel rods; however, experience has shown that this system is a sensitive indicator of fuel failure.

Currently, the offgas samples indicate a total activity of ~90,000 μ Ci/s. It is expected that at the time of the first demonstration ramp, near the end of Cycle 6, the activity will be ~55,000 μ Ci/s. By suitable sampling of offgas and coolant water, it is conservatively estimated that failure of less than 10 fuel rods could be rapidly detected.

The demonstration will involve a step-wise movement of a control blade in a ramp cell; each movement will expose 1.5 ft. of the four bundles in the ramp cell. It is the intention of GE that the operating plan allow for evaluation of the number of failed fuel rods (if any) caused by each incremental movement of each ramp cell control blade. However, as was stated in the letter of September 11, the actual operating plan has yet to be developed pending approval by the NRC of the generic license, NEDO-24259. That operating plan will be developed jointly by GE and the utility.

General Electric has limited experience with other on-line fuel failure detection systems (e.g. Krypton-85 detectors). These systems have yet to be demonstrated as being reliable and effective indicators of fuel failures.

It is the belief of General Electric that the present on-line detection system is a demonstrated sensitive, reliable, and timely detector of fuel failures.

b. Post-Irradiation Surveillance

At refueling outages during the demonstration GE will recommend to the utility that all barrier fuel assemblies which were ramped in that cycle be sipped along with any buffer fuel assemblies which are scheduled to be returned to the core for additional irradiation. In the event that sipping results indicate that barrier fuel has failed, the core management plan (i.e. the operating plan) will be reevaluated.

Examinations directed toward detecting incipient fuel failures are not part of the current work scope for the demonstration fuel. However, it is the intention of GE to recommend examination of discharged demonstration fuel to assess its condition, including the possible presence of incipient defects.

A very detailed examination of the two Zr-liner lead test assemblies which are currently in Quad Cities Unit 1 is within the work scope. The first interim examination of those fuel bundles at a bundle average burn up of ~12 GWd/MT has been completed very recently, and results are very favorable. The nondestructive examination of these lead bundles includes ultrasonic and eddy current tests of fuel rods which have been fully pre-characterized prior to irradiation.

c. PCI Failure Prediction

In the letter of September 11, the ramp test data for reference (nonbarrier) fuel and for Zr-liner barrier fuel were shown in Attachment A2. Those data are from the controlled power ramp tests conducted in a test reactor (either the GE Test Reactor at Vallecitos or the R-2 reactor at Studsvik in Sweden). The data labeled CC are a thin-walled test fuel designed to accelerate and exacerbate the PCI effect so that data could be obtained in a relatively short time. The data indicated by SRP (the segmented rod program) are for fuel rods which were irradiated at low power in a commercial BWR to the indicated burn up and subsequently power ramp tested in a test reactor. The lower curve on Figure A2-1 defines the failure threshold for reference (i.e., conventional) fuel; that is, no failures are observed below this curve in this experiment. The upper curve defines the range for 100 percent failure of reference fuel. These data will be updated as additional tests are done. From this data base the risk to the demonstration fuel can be assessed directly. The risk to nonbarrier fuel in the core is assessed by use of both these data (Attachment A2-1) and the total BWR experience with 8x8 fuel. All power changes to be recommended for the demonstration will have been tested previously in a test reactor with fuel of equivalent (or higher) burn up. The demonstration will be within the range of burn up and power change of the data base. Thus, GE will recommend no operations in the demonstration for which test data would indicate a measurable risk of fuel failure. These test data are available to the NRC.

The demonstration ramps are designed so that the fuel in the ramp cells is ramped to power levels above the threshold curve where failure would be expected if the fuel in those bundles were not resistant to PCI. The final core nuclear design is still in progress, and the exact ramps will depend on the core specific situation at the time of ramping.

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