OCT 25 1982

Docket No. 50-70

Mr. R. W. Darmitzel, Manager
Irradiation Process Operation
Nuclear Engineering Division
Vallecitos Nuclear Center
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Dear Mr. Darmitzel:

The enclosed "Technical Evaluation Report Safety Analysis of General Electric Test Reactor Temperature for Fuel Stored in the Canal in Air" should have appeared as an attachment to the Safety Evaluation Report, but was inadvertently omitted from the Amendment 9 package sent to you on October 15, 1982.

We hope the omission has not caused you any inconvenience.

Sincerely,

/s/

Cecil O. Thomas, Acting Chief
Standardization & Special
Projects Branch
Division of Licensing

Enclosure:
As Stated

cc: See next page

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TECHNICAL EVALUATION REPORT
SAFETY ANALYSIS OF GENERAL ELECTRIC TEST REACTOR
TEMPERATURE FOR FUEL STORED IN THE CANAL IN AIR

I. INTRODUCTION

This report provides the basis for the evaluation performed by the Los Alamos National Laboratory on the General Electric Test Reactor (GETR) - License TR-1, Docket 50-70. The following documents were reviewed.

1. Letter from R. W. Darmitzel, General Electric (GE), to Victor Stello, United States Nuclear Regulatory Commission (NRC), dated January 30, 1978, "Resumption of Operation of the General Electric Test Reactor (GETR)."

2. Letter from R. W. Darmitzel, GE, to Darrell G. Eisenhut, NRC, dated February 4, 1982," Technical specifications for the General Electric Test Reactor."

The above documents provide the basis for GE's request to amend the technical specifications by deleting requirements for certain tests and calibrations while the reactor is shut down.

II. BACKGROUND

The GETR is being maintained in a cold (defueled) shutdown condition by order of the NRC since October 1977. Under these conditions, all reactor fuel has been removed from the reactor core pool and is being held in the GETR storage canal. Because of the long decay time for the fuel, GE has calculated that the loss of water from the canal would not result in dose rates (primarily as a result of fuel melting at 900 K) that would pose a hazard to the health and safety of the public. They therefore contend that calibration of water level instrumentation for the canal is not necessary and, for operational purposes only, the surveillance provided by the radiation detection units and by the sump high-level alarm is adequate. The water level instrumentation will remain operative, but will not be calibrated. Also, as a logical consequence to the above, GE concludes that there is no longer a necessity to assure the availability of emergency power, although battery lights and manually started diesel power would be available.

III. COMMENTS ON SAFETY ANALYSIS SECTION

A. Introduction

The heat transfer analysis completed by GE is described in an attachment to letter 1 in the introduction. I concur generally in the approach that was taken to the analysis and in their selection of the heat generation rate and the position for the hottest element in the fuel storage rack.

B. Effect of Water Level

While it is apparently true for the GETR fuel in the storage rack, the blockage of natural circulation air flow by a water level just at the bottom of the fuel is not always a "worst case." For example, Refs. 1 and 2 provide examples where the axial heat conduction to the (nonboiling) water more than compensated for the cooling by natural circulation air flow. The net effect is sensitive to the length of the fuel elements (and other variables), so because GE had the added length of the fuel storage rack tubes to consider, their results are reasonable.

C. Effect of Steam Cooling

The analysis takes credit for the cooling by axially flowing steam, with the steam flow rate based on the amount of heat conducted down the fuel storage rack tube to the (assumed) boiling water in the bottom of the tank. I believe that this approach is not conservative because there is no basis for assuming that all of the heat conducted axially down the tube is absorbed in the latent heat of vaporization. For example, no steam flow would occur if GE had simply assumed the water in the pool to be at 1°F below the boiling point. This apparent unconservatism in the analysis can be corrected by neglecting the 13% of the predicted heat transfer that goes to the axially flowing steam. The total heat transfer capability is then reduced by 13% from 875 to 761 W, and the required cooling time increased (according to GE's Fig. 3) from 58 to 65 days.

D. Effect of Boundary Conditions

The heat generated in the fuel is transferred through the various layers in the model to ultimate heatsinks, which in GE's analysis are the remaining water in the pool, the air in the building, and the walls of the fuel storage tank. These heatsinks represent boundary conditions at constant temperature in GE's steady-state computer model. The steady-state approximation to the transient heat-up problem is adequate if either (1) a short (<1 h) interval exists between the loss of water and the time the storage canal is refilled or (2) there is a continuous resupply of cool outside air to the room and storage tank. Additional heatsinks such as massive concrete walls and floor of the building also help to make the steady state approximation more reasonable. In my opinion, a reasonable assumption is that massive heatsinks and a supply of cool outside air would be present.

E. Comparison with Previous Results

The peak volumetric heating rate in the hottest GETR fuel element (after accounting for the 13% reduction mentioned in C. above) is 1.41 MW/m^3. For comparison, a transient analysis for a full-core (0.626 m high by 0.468 m diam) of MTR-type fuel elements with the water level at the bottom of the fuel is reported in Ref. 1. The only heat transfer processes included in the model were conduction axially to the water and radiation and natural convection from the sides and top of the core. The peak volumetric heating in the fuel at the start of the transient was 1.51 MW/m^3, and fuel melting did not occur. Also, an experiment for a single MTR-type fuel element, suspended in air, with air flow blocked by water at the bottom end, is described in Ref. 2. No boiling of the water was mentioned in the report of this experiment. The peak volumetric heating rate for the fuel element was 1.98 MW/m^3. Considering the differences in the heating rates, boundary conditions, and analysis models, these results support the conclusions of the GE analysis.

F. Actual Decay Time

The actual decay time for the fuel in the GETR fuel storage canal is considerably longer (approximately 1600 days) than the 65 days (Sec. C) required by their analysis to preclude fuel melting.

IV. SUMMARY

I support the applicant's proposal to amend the technical specifications by deleting requirements for certain tests and calibrations while the reactor is shut down, in particular those relating to control of the water level in the fuel storage canal. This conclusion is based partly on the additional evidence given in Refs. 1 and 2 and on the very long decay time that currently exists (Item F. above).

I did have some reservations about the adequacy of the computer model and basic assumptions that were made in GE's analysis, but these are not judged to be crucial when balanced by the other items.

REFERENCES

1. R. J. Jiacoletti, G. E. Cort, J. M. Graf, A. M. Gage, and L. J. Walker, "Consequences of Sabotage of Nonpower Reactors," Los Alamos Scientific Laboratory classified report LA-7845-MS, NUREG/CR-0843 (May 1979).

2. J. F. Wett, Jr., "Surface Temperatures of Irradiated ORR Fuel Elements Cooled in Stagnant Air," Oak Ridge National Laboratory report ORNL-2892, April 1960.

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