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**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

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GENERAL ELECTRIC

HASTORF ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DATE

April 7, 1961

TITLE

PROPOSAL FOR CHARGING GEH-10-43 NINI
INTERIM MEASUREMENT TEST IN THE ETR.

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PROPOSAL FOR CHARGING GEH-10-43 NINI
INTERIM MEASUREMENT TEST IN THE ETR.

G. T. Geering and E. N. Heck

April 7, 1961

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PROPOSAL FOR CHARGING GEH-10-43 NINI
INTERIM MEASUREMENT TEST IN THE ETR.

G. T. Geering and E. N. Heck

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OBJECTIVE

The objective of this test is to irradiate an NPR fuel element inner tube in the ETR 3X3 Loop. The NPR fuel element is a tube in tube type. Both tubes are Zircaloy-2 clad uranium metal. The inner tube is identified by the Hanford designation NINI. In GEH-10-43 we plan to measure an NINI tube after each cycle for four cycles. An NPR inner tube with slightly larger diameter has been run in the ETR Hanford 3X3 Loop.⁽¹⁾ Two NINI elements are now running in the 3X3 Loop.

SUMMARY OF TEST CONDITIONS

The test conditions for this experiment will be identical with those reported for GEH-10-44 and 45⁽²⁾ except that the total weight of uranium will be slightly less and only one fuel element will be tested.

Total weight of uranium, gm - 6.650

Number of fuel assemblies - 1

DESCRIPTION OF THE FUEL ELEMENT AND BASKET

The fuel element is 24 inches long. The O.D. is 1.253 inch and the I.D. is 0.439 inch. The core of the fuel element is uranium metal and

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- (1) Call, R. L. and F. E. Young, "Proposal for Charging the Fifth Rupture Fuel Experiment, GEH-10-34 and 35" HW-66603, Confidential, August 25, 1960.
 - (2) Kemper, R. S. and F. E. Young, "Proposal for Charging Heat Treatment Test Elements, GEH-10-44, 45", (Confidential), January 10, 1961, HW-67946.
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is 23.5 inches long. The fuel clad is Zircaloy-2, 0.045 inch thick on the outside and 0.030 inch thick on the inside. The ends of the fuel tube are sealed with 1/4-inch thick Zircaloy-2 caps brazed in place with Be-Zr alloy and heliarc welded to the clad. There are three sets of three supports, one set at the center and one set on each end of the fuel element. They will maintain an annulus of 0.118 inch between the fuel element O.D. and the basket I.D. The basket will be double-walled and constructed from 0.030 inch thick stainless steel tubing. The I.D. of the basket will be 1.500 inch and the O.D. will be 2.062 inches. The basket tubing will be 50-1/8 inch long. Inlet and outlet coolant thermocouples will be provided and attached to the basket. (See Figure 1.)

THERMAL AND HYDRAULIC TABLE

TABLE I

Reactor Power Level, MW	175
Loop Flow Rate, lb/hr	29,400
Loop Flow Rate, gpm	71
Loop Pressure, psia	2,000
Saturation Temperature of Loop Water, F	636
Inlet Water Temperature, F	435
Outer Water Temperature, F	446

THERMAL CHARACTERISTICS

TABLE II

Total Heat Output, kw	73.3
BTU/hr	252,000

All other thermal data are identical with those reported in Reference 2.

HAZARDS

Tubular fuel elements of the type proposed for this test have been irradiated to 3200 MWD/T average exposure in a Hanford KER Loop. Outlet water temperature at KER was 280 C. The maximum fuel temperatures in KER tests have exceeded 500 C. For this test, the activity monitor will be connected to the reactor scram circuit. Temperature, flow, and pressure throughout the loop will be recorded. Should any of these parameters exceed operating limits, the reactor will be scrammed. If a fuel element failure should occur, the damage to the basket would be less than in the case of GEH-10, 34 and 35, the fifth rupture test. In GEH-10, 34 and 35, the reactor was operated for more than an hour

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after failure. In spite of this, there was no damage to the loop. In the test we propose the reactor would be scrambled immediately if a failure should occur. Damage to the loop would then be avoided.

ASSEMBLY OF THE FUEL INTO THE BASKET

To insert the fuel element into the basket, first remove the quick-disconnect assembly. Be careful not to bend the thermocouple wires. Insert the fuel element with the numbered end up. Orient the fuel element angular position, as shown in Figure 2. Replace the quick-disconnect assembly and lock in place.

The fuel element for GEH 10-43 is numbered 89-316. We use these numbers to define the extrusion number and lengthwise location of the element.

The charging and discharging of this experiment will be supervised by J. H. Johnson, Hanford's ETR representative. It is permissible to cut the inlet and outlet thermocouples after the first cycle.

APPENDIX I

HEAT TRANSFER CALCULATIONS

All heat transfer calculations are identical with those in Appendix I of Reference 2, HW-67946, except that the overall experiment ΔT is slightly lower. The lower ΔT is due to a reduced total fuel length. All fuel element dimensions are the same, except fuel length. The flow through the fuel element basket will be 60 gpm, as in GEH-10-44 and 45, but the experiment is orificed to require 71 gpm total flow.

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SPECIMEN INDEXING FOR GEH-10-43
EXPERIMENT

FIGURE 2

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FIGURE 1
GEH-10-43 FUEL BASKET ASSEMBLY

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