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By Authority of D.S. Lewis
1-20-94, CG-PR-2
By J. E. Savelly 491-94
Verified By Gerri Maly,
4-21-94.

- 1-10. HOO-AEC: Attn: AT Gifford
11. FW Albaugh
12. JJ Cadwell
13. JH Johnson
14. JE Minor
15. R. Neidner
16. 300 Area File
17. Records Center

September 17, 1959

REQUEST FOR IRRADIATION

REQUEST FOR EXAMINATION AND EVALUATION OF NEW,

IMPROVED FUEL ELEMENTS IN ETR FACILITIES

(Extension of GEH-10)

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THIS DOCUMENT IS PUBLICLY
AVAILABLE

MASTER

U. S. ATOMIC ENERGY COMMISSION
REQUEST FOR IRRADIATION

To be filled out by Irradiation Services Board

RFI No.
AEC Priority
Limitations

Budget Bureau No. 38-R0413
Approval expires June 30, 1957.

This form should be filled out as completely as possible by AEC cost type contractors (in lieu of Form AEC-375) for requesting irradiation services in testing reactors (such as MTR, ETR, etc.). The original and seven copies, signed by the requestor, should be forwarded through appropriate channels to the Director, Division of Reactor Development, U. S. Atomic Energy Commission, Washington 25, D. C., Attention: Irradiation Services Board.

1. REQUESTING ORGANIZATION

General Electric Company, Hanford Atomic Products Operation, Richland, Washington.

2. DATE OF REQUEST

September 17, 1959.

3. REQUESTOR'S SYMBOL GEH-10 (Please retain this number to preserve accounting and program continuity).

4. REQUESTOR'S TECHNICAL CONTACT

J. J. Cadwell

5. NATURE OF PROPOSED IRRADIATION

a. SHORT TITLE Evaluation of New or Improved Fuel Elements for Hanford Reactors

b. OBJECTIVE(S)

- (i) Determine irradiation behavior of new or improved fuel elements under high power, high temperature, high flux conditions.
- (ii) Evaluate service life of elements for new reactor by irradiating prototypes under required flux, temperature, flow conditions.
- (iii) Determine failure characteristics of metallic elements by rupturing clad of

c. BRIEF DESCRIPTION OF EXPERIMENTAL SETUP (accompanied by a sketch where helpful) elements under known time, temperature flow conditions.

Loop facilities have been installed to permit irradiation of proposed and improved fuel element geometries in high pressure, high temperature coolants. Both present Hanford loops are capable of sustaining fission breaks in experimental elements without to permit deliberate failure of elements and subsequent operation with the defective element, or operation with an element defected before charging.

The attachment covers typical experiments which will be performed during the next eighteen months.

JUSTIFICATION FOR PROPOSED IRRADIATION

Attainment of the objectives listed above will (i) aid in increasing production (ii) promote greater economy at Hanford (iii) establish limits to reactor power imposed by fuel elements and (iv) establish design criteria for new and future Hanford reactors.

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FORM AEC-200

AEC PROJECT TO WHICH IRRADIATION IS RELATED (If known)

Hanford Atomic Products Operation operated under Prime Contract AT-42-1-1350.

WASHINGTON DIVISION RESPONSIBLE FOR PROJECT (If known)

Division of Production.

PROJECT IDENTIFICATION, SUCH AS BUREAU ACTIVITY AND ITEM NUMBER WHERE AVAILABLES (If known)

2000

IRRADIATION FACILITY OR LOCATION IN REACTOR DESIGN (List in order of preference)

C69 R33P7

IRRADIATION CONDITIONS

THERMAL NEUTRON FLUX	6×10^{14} DESIRED to 2×10^{14}	MINIMUM ACCEPTABLE 1×10^{14}
FAST NEUTRON FLUX (energy > 1 mev)	Not pertinent.	

ESTIMATED AMOUNTS OF MATERIAL IN EXPOSURE ZONE (include sample and auxiliary equipment) OR ESTIMATED ABSORPTION CROSS SECTION

Loop materials in exposure zone include aluminum, stainless steel of process tube, and basket. Loop facilities are in place.

Fuel materials will include uranium, uranium oxide, and thorium clad with aluminum alloys, zirconium alloys, or stainless steel. Fuel loadings will vary from 75 pounds of natural uranium metal in the C69 loop, to 12-24 pounds of metal, natural enriched up to 6 per cent, in the R33 loop.

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ESTIMATED DATE EXPERIMENT CAN BE READY FOR INSTALLATION

Now in place.

DURATION OF EXPERIMENT

Indefinite.

	<p>Approval:</p> <p>F. W. Albaugh <i>F. W. Albaugh</i> 7-22-57</p> <p>(Requester) (Date)</p>
	<p>(Director, Division of Reactor Development) (Date)</p>
	<p>(Manager, Atomic Energy Division, Phillips Petroleum Company) (Date)</p>
	<p>(Manager, Idaho Operations Office) (Date)</p>

TYPICAL EXPERIMENT - ETR FACILITIES - September 1959 to March 1961.
(From AEC-320 dated 9/17/59).

R-33 Loop

1. Deliberate rupture tests will be run to determine failure behavior of fuel elements. In a series of 3 to 8 tests, fuel elements previously defected and provided with a "defect cover" will be installed in the loop, together with a piston device which will permit failure of the clad at a set time by external signal. With the reactor operating at full power and the loop operating at steady state conditions, the element will be failed and the loop and reactor continued in operation for a pre-determined time. These experiments will be conducted with cluster and tubular geometries. The experiments will permit evaluation of clad distortion caused by failure, probability of fuel element lodging in flow basket, areas of zirconium damaged by imposed stress and hydrogen, capabilities of prototype instruments, piping locations where activity concentrations occur, and efficiency of decontamination procedures. Elements so failed will incur 0 to .35% burnup in other facilities prior to charging in ETR facilities. Each test will occur during a single cycle so that rupture tests will occur during 3 to 8 cycles.
2. Tubular elements containing enriched uranium bonded to zirconium cladding will be irradiated for periods varying from 1 to 6 cycles to evaluate supporting devices, closure methods, heat treatments, and rate and mode of distortion of tube wall.
3. Aluminum clad elements suitable for present reactors will be irradiated for periods varying from 1 to 6 cycles to evaluate new cladding alloys, new closure methods, and new or improved bonding methods.

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4. Cluster elements, typically 7-rod elements clad in Zircaloy, will be irradiated for periods varying from 1 to 6 cycles to evaluate closure methods, "spider," heat treatments, and dimensional stability of individual rods.

C-69 Loop

1. Tubular elements will be irradiated under flow, temperature, and flux conditions tailored to prototype new Hanford reactors. Irradiations will vary from 1 to 6 cycles. Use of this facility will permit irradiation of these elements under the full service conditions demanded by the new reactor. These experiments, combined with interim measurements and visual examination during examination and exhaustive destructive post-irradiation examination will permit determination of probable service life as well as optimization of fabrication methods, heat treatment, and support hardware.
2. Cluster elements, typically 7 rod elements, will be irradiated under full service conditions demanded by new Hanford reactors. Irradiation time will vary from 1 to 6 cycles. As in (1) above, interim examination and post-irradiation destructive examination will permit evaluation of fabrication methods and service life of element.
3. Elements will be fabricated with baskets and support devices such that the element can be disassembled in the basin, photographed and completely measured, reassembled, and installed in the reactor with all components in their original relative orientation. In a typical case, a cluster and a tubular element fabricated in this manner will be irradiated in alternate cycles so that each element can be disassembled and evaluated during the cycles in which the other experiment is being irradiated. The irradiation time for the individual elements will approximate 6 to 8 cycles, depending on results of the evaluation of element condition.

/lh
Attachment for ABC-320 Form.

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DATE
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7/27/94

END