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SUBJECT: Semi-Monthly Progress Report on ETR Development,
Covering Work up to and Including March 15, 1956.

TO: J. H. Frye, Jr.

FROM: R. J. Beaver

Distribution

- 1-6. J. H. Frye, Jr.
- 7. J. E. Cunningham
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OAK RIDGE NATIONAL LABORATORY
Operated By
Union Carbide Nuclear Company

To: J. H. Frye, Jr.   Subject: Semi-Monthly Progress Report on
ETR Development, Covering Work
Copies: Listed Distribution   Up to and Including March 15, 1956

I. Samples for Corrosion Testing Under Irradiation Conditions in the MTR.

- A. Ten samples of boron-aluminum alloy containing 0.068 wt % $\pm$ 0.006 boron have been machined to size and shipped to the MTR.
- B. Ten specimens of boron-aluminum alloy containing 0.075 wt % $\pm$ 0.008 boron have been machined to size and shipped to the MTR. This sample was prepared with a nickel-boride master alloy and contains approximately 0.6 wt % nickel.

II. Manufacture of Enriched MTR Type Fuel Element in which the Fuel Plates are to be Clad with 0.10 wt % Boron-Aluminum Alloy.

Sufficient 0.10 wt % boron-aluminum alloy has been cast, rolled into coverplate material and sampled. It is expected that by March 20 the core-clad thickness measurements will be completed and fabrication of the fuel plates can be initiated immediately. It is expected that this fuel element will be brazed by March 23 and should be shipped to the MTR by March 30.

In view of the urgency and the short time required to manufacture this fuel element, the analyses of the alloy material will not be available until after the fuel element has been fabricated. The actual boron content in this fuel element will therefore be calculated from the analytical results and will not be available until April 1.

III. Fabrication of Forty Plates to ETR Specifications.

Alloy castings for the cladding material to be used in manufacturing these plates will be cast no later than March 20. It is estimated that during this week procedures will be developed to meet ETR plate specifications and immediately following determination of core-clad thickness these forty plates will be fabricated. Again because of the limited time available, analyses of the cladding material will not be obtained until after the plates have been fabricated. As soon as these results become available the boron content in the plates will be calculated.

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IV. Preparation of Ten Samples Containing 0.02 wt % Boron-10 -Aluminum Alloy.

This work has not been initiated.

V. Fabrication of Five-Ply Fuel Plates to ETR Specifications.

This work has not been initiated.

VI. Fabrication of Three-Ply Fuel Plates to ETR Specifications Containing 0.02 wt % Boron-10 -Aluminum Alloys as the Cladding Material.

This work has not been initiated.

VII. General Information.

- A. The master alloy containing approximately 3 wt % boron obtained from Cooper Metallurgical Associates has considerable inhomogeneity. In an attempt to make an addition with this master alloy and add as near a constant amount of boron, this alloy has been broken up into small pieces and blended. The addition is therefore made from this blended material.
- B. Analytical results obtained from additions of master alloy prepared from the Cooper 3% boron alloy; the ALCOA 1% boron alloy; and ORNL's nickel-boride alloy, revealed the following:

	<u>Recovery</u> (%)	<u>Index of Segregation</u> (%)
Cooper Master Alloy	74	90
ORNL Ni-B Alloy	92	74
ALCOA 1% B Alloy	100	60

Because of the low recovery of the Cooper Master Alloy, this alloy is not looked upon with favor at the present time; however, it is the only master alloy that is available to us immediately. The 0.10 wt % boron-aluminum prepared from these alloys all exhibited the same type of segregation; that is, the top and bottom portions of the cast slab showed a wide spread from the average boron content in the majority of material. It is therefore felt that the top and bottom of the slab must be rejected.

- C. In fabricating the 0.10 wt % boron-aluminum alloy into sheet, it was discovered that severe blistering of the material occurred. This condition was greatly minimized by casting material in an atmosphere of controlled humidity (approximately 35%), rolling

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the slab to 1/4-inch thick plate, flux annealing the plates, and subsequently rolling to finished coverplate approximately 1/8 inch in thickness. This procedure does not completely eliminate blistering and some material will be rejected because of this defect. It is felt that the blistering is due to entrapped hydrogen during the melting operation. It may be expected that this condition can be improved with further experience.

R. J. Beaver
Metallurgy Division

RJB:fwh

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