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SUBJECT: Minutes of Meeting Held at ORNL November 27, 1956
on the APPR-1 Control Rod Irradiation Program

TO: J. E. Cunningham

FROM: C. F. Leitten, Jr.

Distribution

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11. F. H. Neill
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For The Atomic Energy Commission

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To: J. E. Cunningham

Subject: Minutes of Meeting Held at ORNL
November 27, 1956, on the APPR-1
Control Rod Irradiation Program

Copies: As Listed

Those in attendance were:

R. J. Beaver, ORNL
C. F. Leitten, ORNL
E. J. Manthos, ORNL
F. H. Neill, ORNL
A. E. Richt, ORNL
R. D. Robertson, ALCO
L. D. Schaffer, Army, Y-12

The meeting was opened by Schaffer who reported on the present status of the APPR-1 control rod irradiation program. The discussion was divided into three phases.

1. ORNL-MIR-28 Phase I.

This phase consists of irradiating miniature APPR-1 control samples to varying degrees of B-10 burnup. To date, two samples have been irradiated to B-10 burnups of 12 and 48 percent. These samples have been evaluated at the MIR site and showed promising results. The remaining three samples have been switched from MIR position L-51-SW to L-57, which has approximately a 50 percent increase in flux density. One of these samples will be removed from the reactor about mid-December and should have at this time a 30 percent burnup. The remaining samples will be irradiated for greater burnup values. It is hoped that by mid-January a sample which has been irradiated to a 70 percent burnup will be available for examination.

2. ORNL-MIR-29.

This request consists of irradiating a full-scale absorber unit in a rod position of the MIR. This test was inserted into the reactor on November 26, 1956. At present, the unit will be irradiated to a maximum burnup of 48 percent since MIR Safeguards Committee will not authorize irradiation of the rod to a greater degree than an examined irradiated miniature sample. It is hoped that a miniature having a greater percent

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2. (continued)

burnup than 48 percent will have been examined by the time the full-size rod reaches a burnup of 48 percent. Beaver indicated the possibility of reinserting the full-size unit in the event that higher burnup data on the miniature samples were not available prior to the time when the full-size rod has received a 48 percent burnup. An overall increase in the burnup is essential, since the latest estimates at ALCO indicate an increase from 40 to 70 percent burnup in their rods for one core life.

3. ORNL-MTR-28 Phase II.

This phase consists of samples containing 120 and 60 percent of the designed APPR-1 B-10 loading. Each type miniature will be irradiated to a 60 and 90 percent burnup, respectively. These samples were inserted into the reactor on November 26, 1956.

Since several changes have occurred in the program, a revision of the present irradiation schedule will be prepared by Schaffer.

Some difficulty has been encountered in obtaining irradiated samples for evaluation at ORNL. Schaffer was delegated to act as coordinator between ORNL and MTR on shipping the irradiated material. Two casks are available for this purpose; however, to date their use has not been approved. A letter will be submitted to the MTR personnel to determine the status of the authorization.

Richt, of the Solid States Division, indicated that examination of the irradiated samples could be initiated immediately. The following evaluating procedure was proposed by Robertson of ALCO and accepted by all for examining the irradiated samples:

1. Samples will be remeasured to determine dimensional stability. The measurements will be taken every half-inch along the sample.
2. The samples will be annealed at 600°F initially for 24 hrs and remeasured for dimensional stability, as indicated in number "1". In the event that dimensional changes occur during the first annealing, this annealing treatment will be continued at intervals of 24 hrs until dimensional stability is reached.
3. Upon completion of the annealing treatments, the samples will be sectioned for metallography at points indicating the maximum and minimum dimensional changes. The metallographic examination will consist of checking the following items:
 - a. Core-clad bonding.
 - b. Clad-frame bonding.

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3. (continued)

- c. Microcracking in core both in the matrix and boride materials.
 - d. Over-all evaluation of swelling and its predominate location.
4. A section adjacent to the metallographic section will be cut out and submitted for a B-10 burnup determination. This section will consist of only clad core material. A technique for obtaining burnup analysis was proposed by Robertson and is outlined on page 5. Other techniques will be investigated by Leitten.
5. Upon completion of metallography, a micro-hardness transverse will be made on the specimen. The measurements will be made on the core, clad and frame portions.
6. Depending on the contamination of the specimens, an x-ray analysis will be conducted in an effort to determine lattice strain due to irradiation.

A control sample will be used in each step of the evaluation to act as basis for comparing irradiated to non-irradiated results. This sample will also serve to determine the accuracy of the dimensional measurements.

The meeting was concluded by a brief description on the present status of the APPR-1 control rod back-up efforts. Little information was available on the hafnium effort. It was indicated by Beaver that the rare earth effort was awaiting approval for obtaining the Eu_2O_3 from Schenectady Operations Office.

C. F. Leitten Jr.
C. F. Leitten, Jr.

CFL:fw

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ALCO PRODUCTS, INC.
Schenectady - November 13, 1956

Procedure for Chemical Analysis of Lithium
After Irradiation of Boron 10 Stainless Steel

1. Dissolve a 1-2 gram sample in a solution of 10 ml HNO_3 , 20 ml HCl and 40 ml H_2O . Heat to about 50°C to hasten the reaction.
2. After the reaction ends, add 1.5 ml of H_2O_2 and heat for an additional hour.
3. Cool and transfer to a 200 ml volumetric flask.
4. Add 50 ml NH_4OH slowly while stirring.
5. Dilute to mark with distilled water.
6. Mix and allow to settle for 4 hours at room temperature.
7. Carefully remove a portion of the clear supernatant liquid.
8. Dilute (on the basis of estimated burn-up) to reduce the lithium concentration to the 0-10 PPM range.
9. Atomize the solution in a flame photometer and record the galvanometric readings.
10. Refer readings to the standard curve, obtained as follows:
 - a. Treat an unirradiated sample of the material under consideration as described above through step 7.
 - b. To separate portions of the supernate add sufficient lithium to give concentrations of 0, 2, 4, 6, 8, 10 PPM when diluted to the same extent as the sample.
 - c. Read these on the photometer and plot a curve of lithium vs % transmission.
11. Obtain lithium concentration.
12. Calculate the burn-up.

NOTE: The ammonia step was introduced as a decontamination measure. If the sample can be analyzed remotely, the lithium may be determined on the dissolver solution after proper dilution.

Above information furnished by: D. Dutina - KAPL
EX3-6611, Extension 369

/s/ R. D. Robertson