UNCLASSIFIED
CONFIDENTIAL COVER SHEET

OAK RIDGE NATIONAL LABORATORY
Operated By
UNION CARBIDE NUCLEAR COMPANY

UCC
POST OFFICE BOX P
OAK RIDGE, TENNESSEE

External Transmittal
Authorized

ORNL
CENTRAL FILES NUMBER

56-4-160

UNCLASSIFIED

DATE: April 24, 1956
SUBJECT: Minutes of Meeting Held at Oak Ridge National Laboratory April 19, 1956 on the APPR-1 Control Rod Program
TO: J. H. Frye
FROM: R. J. Beaver

COPY NO. 20

Distribution

1. R.J. Beaver, ORNL
2. H.W. Behrman, AEC, ORO
3. A.L. Boch, ORNL (Y-12)
4. D.O. Campbell, ORNL
5. J.E. Cunningham, ORNL
6. J.F. Gallagher, ALCO
7. A. Giambusso, APB (U.S. Army)
8. J.F. Haines, ALCO
9. W.R. Johnson, ALCO
10. K. Kasschau, ALCO
11. J.B. Lambert, APB (U.S. Army)
12. R.S. Livingston, ORNL (Y-12)
13. L. Meem, ALCO
14. F.H. Neill, ORNL (Y-12)
15. J.D. Plawchan, APB (U.S. Navy)
16. R.D. Robertson, ALCO
17. H.M. Roth, ORO
18. L.D. Schaffer, (U.S. Army)
19. R.C. Waugh, ORNL
- 20-22. TIE, ORO
23. ORNL, RC
- 24-25. Lab Records
26. J.D. Anderson, Schenectady Operations Off.

UNCLASSIFIED

NOTICE

RESTRICTED DATA

This document contains Restricted Data as defined in the Atomic Energy Act of 1954. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited.

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report.

CONFIDENTIAL COVER SHEET

DECLASSIFIED

1 3335
110 001

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

~~CONFIDENTIAL~~
-2-

UNCLASSIFIED

X-847

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

To: J. H. Frye, Jr.

Subject: Minutes of Meeting Held at
ORNL April 19, 1956, on the
APPR-1 Control Rod Program

Copies: Listed Distribution

Those in attendance were:

R. J. Beaver, ORNL
H. W. Behrman, AEC
D. O. Campbell, ORNL
J. E. Cunningham, ORNL
A. Giambusso, APB
W. R. Johnson, ALCO
C. F. Leitten, Jr., ORNL
F. H. Neill, ORNL
J. D. Plawchan, APB
R. D. Robertson, ALCO
L. D. Schaffer, Army-Y-12
R. C. Waugh, ORNL

The meeting was opened by Beaver who outlined the primary program of the APPR-1 Control Rod Project. Basically, this program is centered around fabricating a type 304L stainless steel clad powder metallurgy B-10 dispersion in iron. In view of the difficulties which have been experienced by WAPD and KAPL on irradiation of boron bearing materials, a backup effort was considered appropriate.

The Army's views on the control rod situation were presented by Plawchan. He stated that the Army has primarily two objectives in the APPR-1 control rod, these being:

1. The rods placed in the APPR-1 core should be effective for an entire core life.
2. The rods used should be dependable and suitable for other type reactor applications.

The question of expected B-10 burnup in the APPR-1 was discussed by Johnson. He estimated that a burnup of 68% of the B-10 atoms in the

Restricted Data.

This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmission or the disclosure of its contents in any manner to an unauthorized person is prohibited.

110 002

~~CONFIDENTIAL~~

DECLASSIFIED

first eight inches of the five control rods could be expected in the normal core life with complete burnup at the rod tips.

The control rod programs of WAPD and KAPL were reviewed by Schaffer. Particular emphasis was given the dispersion of B-10 and Eu_2O_3 in stainless steel. For details of these programs see ORNL-56-4296.

The subject of a substitute for B-10 from a loading standpoint was discussed by Johnson. He presented approximate values for europium and gadolinium required to equal the B-10 loading. These values are as listed:

1. The B-10 requirements per plate - 14 gms
2. The europium requirements per plate -235 gms
3. The gadolinium requirements per plate -450 gms

It should be stressed that the rare earth values are approximated to be equivalent to the B-10 loading.

A general discussion was held on the irradiation program of the B-10-iron-stainless steel clad plates. There are two main efforts involved in this program.

1. The irradiation testing of leaky rabbit type samples.

These samples will be approximately 7 x 1 x .156 inch. These will be irradiated in the MTR. The irradiation program proposed appears in the following table.

Table 1

Proposed Irradiation Tests for B-10-iron Samples

<u>Priority</u>	<u>% of B-10 Design Loading</u>	<u>*MTR Irradiation Cycles</u>	<u>% Densification of Matrix</u>
1	100	1	90
2	100	2	90
3	100	3	90
4	100	4	90
5	100	5	90
6	60	3	90
7	60	5	90
8	120	3	90
9	120	5	90
10	100	3	100
11	100	3	80
12	100	5	100
13	100	5	80

*One MTR cycle is assumed to give these samples approximately 20% B-10 burnup.

This irradiation program will be conducted by ORNL with Dr. Livingston as coordinator. Fabrication of the absorber section samples has already been initiated at ORNL.

The 60% B-10 loading irradiation samples were requested by Robertson so that ALCO could have some idea of the irradiation behavior at this loading in the event ALCO reduces the B-10 loading requirement of the APPR-1 control rod. The 120% B-10 loading was included in this program in order to submit the control rod material to a more rigorous test than expected of the design rod. The variations in densification of the matrix material at design loading is included to check the possible effects of the variation of void space in the matrix.

2. The second irradiation test consists of placing an entire APPR-1 absorber section in the MTR.

The feasibility of replacing the cadmium section in the MTR control rod by a clad B-10-iron section was discussed by Neill from the physics standpoint. He indicated that such a replacement is possible and could receive about 70% burnup before removal would be necessary. The rod is presently proposed to be placed in an MTR planned control position, or if this is not feasible, it would be inserted into the beryllium "A" piece. Such a test will be much more conclusive in determining the total volume effect of fission gas generation. The expense of this test was approximated at \$5000 which will, if necessary, be covered by the Army. The Army will be sent the uranium requirements for the fuel section necessary for fabricating the entire rod assembly. The fabrication of this rod will be initiated when necessary arrangements have been completed with Phillips.

Investigation of hafnium as an immediate replacement for the present APPR B-10 absorber plate was selected as an immediate backup effort, so that in the event the B-10 proved incompatible in the irradiation testing, hafnium plates could be substituted without delay. Due to personnel and equipment limitations, ORNL will not participate in this program. The feasibility of using hafnium in place of B-10 must be examined from a physics standpoint. ALCO has been asked to do this as well as establish specifications on a rod if it is found to be feasible. The Army Reactors Branch is checking into the availability of hafnium for such a proposal.

The zero power experiment was discussed by Johnson. He requested that ORNL Metallurgy furnish ALCO with two additional rods. One will have approximately 15% of the designed B-10 loading; the

~~CONFIDENTIAL~~

-5-

second will not contain any poison. These rods will be used in this experiment to determine more accurately the necessary B-10 requirements. ALCO will initiate a request for these additional sections. It was pointed out by Giambusso that if ALCO wants AEC payment, they must contact S00 who will approach OR00.

The final discussion centered around future control rod materials. The possibility of using Eu_2O_3 , Sm_2O_3 , Gd_2O_3 and indium compounds was discussed. It was pointed out by Cunningham that ORNL could do no preliminary work on such materials until after July 1, 1956 due to the tight APPR production schedule. Of the materials mentioned, Eu_2O_3 appeared to be the best from a quantity standpoint. Such a material would be dispersed in and clad with stainless steel. The feasibility of using any of these materials, however, rests on a physics evaluation. The ORNL Metallurgy Division felt that it would be possible for them to fabricate rods containing the rare earths for worth evaluations in the ALCO critical facility. However, it was pointed out that additional work on APPR control rods would interfere with the work planned for the Gas Cooled Reactor Program, and that any decisions to continue APPR control rod material evaluation by ORNL Metallurgy Division at the expense of interference with the Gas Cooled Reactor metallurgical development required coordination between APB and R. S. Livingston.

R. J. Beaver
Metallurgy Division

RJB:C. Leitten; L. Schaffer

fwh

110 005

DECLASSIFIED