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By Authority of CG-PR-2CA BULMAN 7-12-91 - 1 -By PM Eick 5-5-94

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This Document consists of

Pages No. 12 of

Copies, Series 12

author: W E Jordan

June 14, 1946

100 AREAS

June 4 through June 10
 (For Technical Progress Letter No. 101)

PhysicsE Pile

An additional foil irradiation was performed in Tube 1363 on June 4. The foil count indicated a flux density of 116 neutrons/cm² sec. The results so far indicate an equilibrium mv of 107; this corresponds to a sub-critical condition of 1.5% k with all rods out. The mv at shutdown was 850. The component due to photo-neutrons has been decreasing with a half-life of 12.5 days, so that possible reactivity trends have been masked.

D Pile

The D Pile was shut down for about 20 hours on June 4. The power level was reduced to 25 MW below rated level for four hours on June 10 for the purpose of measuring the power coefficients and graphite relaxation period. During the remainder of this report period, the pile operated at rated level.

Special Request Samples 9-2 (BeO, mixed oxides) and 25-2 (Be₃N₂, U. of Cal.) were charged into Tube 3574 during the shutdown of June 4. Other work performed during this shutdown included the changing of the orifices on the bismuth Tubes 0980, 2088, 2788, and 3880 from 0.100 to 0.240 inches, and the borescoping of Tube 2692, which was then recharged with lead dummy pieces.

Preliminary results of the power coefficient test are given below:

Overall power coefficient, C _o	0.19 ih/MW
Graphite power coefficient, C _g	0.36 ih/MW
Metal power coefficient, C _m	-0.18 ih/MW
Graphite relaxation period	60 minutes

Data obtained from the drop in power agreed well with those obtained from the rise in power, but the averages given above differ considerably from those expected on the basis of other recent measurements. Further investigation of these results is in progress.

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F Pile

Except for a scheduled shutdown on June 5, the unit was operated throughout the week at 50 MW below rated level.

Due to the unexpected loss of 10 ih. reported last week the excess reactivity held in the rods was in the neighborhood of 35 ih prior to the shutdown of June 5. Since some loss, due to the discharge of metal, was expected during the shutdown, the P-column strength was reduced at that time. The net strength of the P-column pattern was reduced 20 ih by weakening Columns 3179 and 1569. These two columns were chosen in accord with the plan to distribute the poisoning power more evenly around the circle of absorbing columns. At present, the two most recently added columns are weak while the adjacent ones are strong. Tube 3179 was therefore chosen for weakening since it was the strongest column in the pattern. Since only two columns could be changed, the tube diametrically opposite to Tube 3179 was chosen as the second tube since such a change would have the least effect on the temperature moments. The changes are summarized below:

<u>Tube</u>	<u>New Pattern</u>	<u>New Nominal Strength</u>	<u>Old Nominal Strength</u>
3179	2L-3P	51 ih	68 ih
1569	3L-1P-2L-1P	30	41
Other 9 columns plus one load column		316	316
Total nominal strength		397 ih	425 ih
Net strength		293	313
Net change		-20 ih	

The reactivity changes during the shutdown were in reasonable agreement with expectations as indicated in the following table:

In rods before shutdown	38 ih
Increased Xe due to decreased flattening	-4
P column change	20
Metal discharge	-3
Net long term gains	3
Expected in rods after shutdown	54 ih
Observed in rods after shutdown	51 ih

The 10 ih unexpectedly lost during the shutdown of May 29 have not reappeared, and no cause for the loss has yet been discovered.

General

Special Requests 9-2 and 25-2 were charged into Tube 3574 of the D Pile on June 4; Requests 9-1 and 13, discharged on May 28, were scheduled for shipment on June 12. The present status of all active items of this program is tabulated below. Requests No's. 1, 2, 4, 8 and 18 have been completed. No's. 21, 22, and 23 are as yet unallocated.

<u>Request No.</u>	<u>Material</u>	<u>Quantity</u>	<u>Exposure</u>	<u>Status on June 10, 1946</u>
3	Thorium	Indefinite	2-3 mos.	First installment of 33 slugs to be discharged June 11.
5	Np ²³⁷	200 Area item		

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Request No.	Material	Quantity	Exposure	Status on June 10, 1946
6	U ²³³	1 slug	1 year	Charged 3282F on 4/2/46
7	Np ²³⁷	5 mg.-1 slug	120 days	Charged 1565F on 5/2/46
9-1	BeO, mixed oxides	8 slugs	30 days	Charged 3574D on 4/30/46; discharged 5/28/46
9-2	BeO, mixed oxides	8 slugs	60 days	Charged 3574D on 6/4/46
9-3	BeO, mixed oxides	8 slugs	120 days	Charged 1565F on 5/2/46
10A	Sm oxide	1 slug	120 days	Charged 1565F on 5/2/46
10B	Gd oxide	1 slug		Postponed
11	Radium	1 gram		Under study
12A	U ²³⁵			Postponed
12B	Pu ²³⁹	540mg-1 slug	8 mos.	Charged 3378F on 4/18/46
13	Be ₃ N ₂	Indefinite	30 days	First 8 slugs charged 3574D on 4/30/46; discharged 5/28/46
14	Al-U alloys	3 slugs	2, 12, >12 mos.	Slugs in preparation at another site
15	LiF	50-100 slugs	10, 50 days	First installment of 3 slugs completed; second set (15-1) to be charged within 2 weeks.
16-1	95-241	2mg-1 slug	120 days	Charged 1565F 5/2/46
16-2	95-241	4mg-1 slug	8 mos.	Charged 3378F 4/18/46
17	Graphite	16-lb. pieces		One piece shipped 3/22/46; another ready to ship 6/12/46
19	Mercury	100 mg.	30 days	Slug being recanned
20	Thallium nitrate	5 mg.	3 mos.	Slug being recanned
24	X slugs	40 tons	Fabricate	Awaiting delivery of cans and caps
25-1	Be ₃ N ₂ (U. of Cal.)	1 slug	30 days	Ready for charging
25-2	Be ₃ N ₂ (U. of Cal.)	1 slug	60 days	Charged 3574D 6/4/46
25-3	Be ₃ N ₂ (U. of Cal.)	1 slug	90 days	Ready for charging

To assist in selecting the most highly irradiated of the seven 16-lb. cylinders of graphite now on hand for shipment to the Metallurgical Laboratory, the electrical resistivity of these cylinders was measured. Variations in resistivity from bar to bar were of the order of 5%; further, no periodic variation of resistivity along the bars could be detected.

Test hole samples which had received an exposure of 1007 Mw-days/CT in the D Pile showed a stored energy of 75 cal/gm., with some evidence of thermal annealing. The test hole temperature was 60°C.

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Water, Corrosion, and Engineering

Process Water Control and Pressure Drop Studies

The iron content of the process water averaged 0.040, 0.008 and 0.015 ppm at B, D and F Areas, respectively. Analyses show that the iron content of the filter effluent water at B is no higher than that at the other areas. The higher iron content of the process water is believed to be due to the low water flow rate through the system and to the relatively frequent switching of pumps and other equipment. The coagulant feed rate at both D and F is about 28 - 30 ppm.

The rates of pressure drop increase for D and F Areas were 0.43 and 0.24 lbs./ (sq.in.)(day), respectively.

Corrosion

On June 4, a borescope examination was made of Tube 2692D which had been difficult to discharge on May 7. Previous examination of the slugs discharged from this tube revealed that one slug was definitely bowed and showed some abrasion. Bore-scope examination of this tube indicated that this bowed slug had been located about 20 feet from the upstream nozzle of the tube. It was possible to locate the position occupied by this slug in the tube by two marks on the inside top of the tube. These marks, about 8 inches apart, indicate the points where the ends of the slug bowed up and made contact with the top of the tube. Downstream of these marks, severe abrasion of the top inside portion of the tube was noted. Abnormal wear on the tube ribs downstream of these points was also noted. It was impossible to estimate the depth of the abrasion but it appeared deeper than the Alclad layer of the tube. Due to the severe abrasion noted in the tube, it was recommended that the tube be reloaded with dummies and the tube replaced at the first opportunity.

Graphite Expansion

Replacement of the neoprene seal strip at the top of the far side at B was started on June 10. The new seal is being joined to the old seal in front of the concrete wall which encloses the discharge area. The new seal is about 5 inches wider than the old seal in the region opposite the central part of the pile.

In an effort to determine the cause of binding of the inlet gun barrel for Tube 3671 at B, a second elevation traverse was made, using the mercury-filled equipment. The data indicated that the gun barrel had sagged an additional 0.025 inches following tube replacement and push-pull tests. The ends of the gun barrel are at the same elevation, the total downward bow is about 0.1 inch, and the sharp curvature near the inner end suggests that the downward force which causes the bowing is in the vicinity of the thermal shield blocks.

Tests with the 1500 lbs. tube jack have been continued at B, following the demonstration that the main resistance to tube movement on Tube 3671 was in the gunbarrels, and following the sticking of the front gunbarrel in the "in" position to such an extent that a 1500 lb. pull would not withdraw it. The testing of 10 selected tubes to explore the pile-wide extent of this tendency to bind has been agreed upon and will proceed until evidence of the binding of a second tube is obtained. It is anticipated that the tendency to bind will be found greatest in the "flattened" portion of the pile, and may be greater at higher elevations in the pile. The following order of testing was decided upon: Tubes 0276, 0756, 0791, 2552, 2595, 4056, 4091, 1476, 2574, and 4574.

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The testing of the first three tubes has been completed with no evidence of binding, and the following quantitative data were obtained on jacking the tube and gunbarrels as a unit from the front:

	<u>Tube 0756</u>	<u>Tube 0275</u>	<u>Tube 0791</u>
Total front face travel	34/32"	35/32"	31/32"
Total rear face travel	32/32"	32/32"	28/32"
Travel from normal* position of the gunbarrel key:			
To "in" position - front	21/32"	20/32"	18/32"
To "in" position - rear	15/32"	17/32"	11/32"
Forces required to produce full movement:			
Gunbarrels and tube as a unit	300-400 lbs.	200-300 lbs.	400-500 lbs.
Front gunbarrel alone	200-300	100-200	100-200
Rear gunbarrel alone	100-200	200-300	100-200
Tube alone	5	5-100	5

- * The normal position of the gunbarrel key corresponds to its outer end flush with the outside of the centering flange; this corresponds to 12 inch protrusion of the gunbarrel beyond the tie strap on the front face and 12-3/4 inch on the rear face.

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100-300 TECHNICAL

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