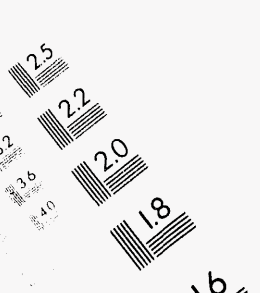

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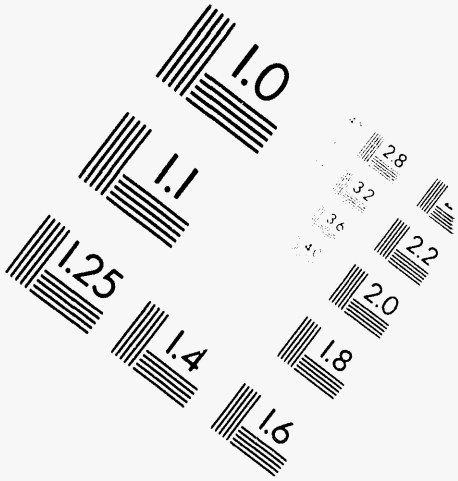

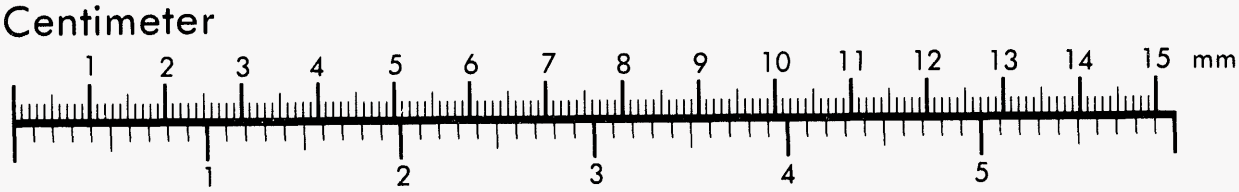

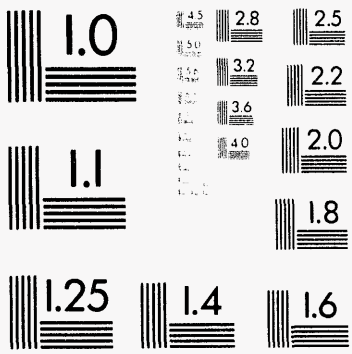
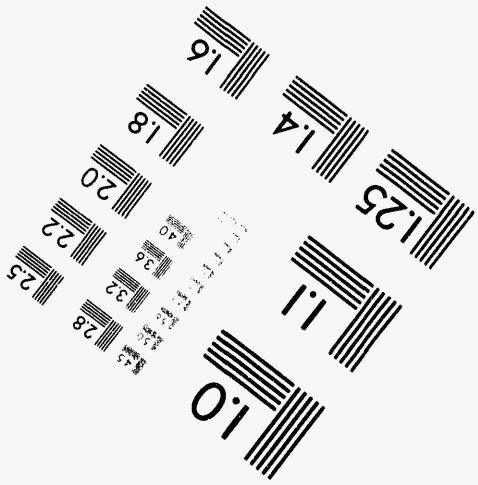
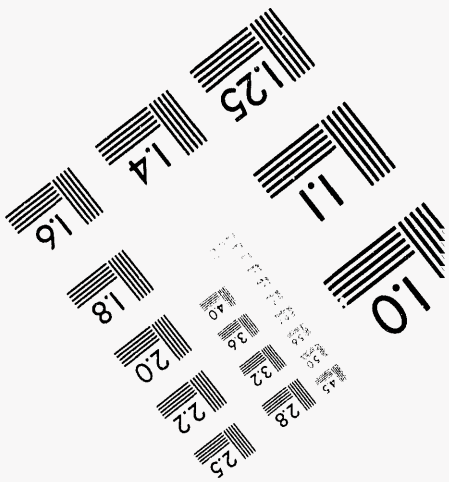

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HW-14220

August 22, 1949

100 AREAS TECHNICAL ACTIVITIES REPORT - PHYSICS

JULY, 1949

PILE PHYSICS GROUP - U. M. Staebler

Reactivity Power Coefficients - Production Test No. 105-248-P

The power level of the F Pile was lowered from 275 MW to 251 MW for ten hours on July 1, 1949, in order to determine the current values for the reactivity power coefficients. Analysis of the test data using the accepted rod calibration curve yielded a value for the overall power coefficient which was more than twice the value obtained from a similar test performed on January 19, 1949. The range of rod motion and the rod configuration were very similar for the two tests but several uranium columns along the path of the "A" control rod have been displaced by other material during the time between the two tests. Analysis of the test data using the rod calibration curve for the "A" rod of the D Pile yielded values more nearly in line with established trends but there is a wide disagreement between results from the two parts of the test in either set of results. The data indicate a reduction in "A" rod effectiveness or an error in the xenon equations for the conditions of the test.

Ten hours prior to the scheduled shutdown of the D Pile on July 20, 1949, the power was reduced from 305 MW to 270 MW for the purpose of measuring reactivity power coefficients. A preliminary examination of data suggests difficulties similar to those described above in connection with the test of July 1, with the F Pile.

Water Leak - B Pile

The rate of collection of water in the dryers in the circulating gas system of the B Pile appeared to have increased to several times the normal rate by July 7, so the pile was shut down as an extension of a shutdown scheduled for July 8. The cross-headers were tested hydrostatically but no leaking joint was found. Moisture analysis of gas samples from plenum chambers showed three to four times the

[redacted]

normal moisture content for samples from chambers at the bottom between columns 84 and 89. No reactivity effect could be detected nor was there any noticeable change in the distribution of exit water temperatures. The rate of water removal continued to increase during the almost three weeks of operation following the shutdown of July 7, so that it had reached a rate of 100 pints per day by the time of the scheduled shutdown of July 26. During this shutdown it was determined that tube 0283 B would not hold pressure so this tube was discharged and left as an air tube pending further test and possible replacement. At month's end the rate of water removal appears to be dropping.

Graphite Properties

The current status of central graphite temperatures and local relaxation periods is summarized in the following table.

Area	$\%CO_2$	Power	Temperature	Relaxation Period
B	40	275 MW	195 ° C	80 minutes
D	40	305 MW	270 ° C	135 minutes
F	60	275 MW	280 ° C	160 minutes

Determination of rates of changes in the relaxation periods has been clouded by the effects of the gradual addition of higher concentrations of carbon dioxide.

Xenon Equations - B Shutdown of March, 1946

A least squares adjustment of the xenon decay data from the shutdown of the B Pile in March, 1946, has been completed with the assistance of IBM equipment to accomplish the more laborious arithmetic. A term for the variation in xenon cross-section and values of xenon and iodine at shutdown were obtained from this analysis. The values appear reasonable. Values obtained from this part of the analysis will now be used in conjunction with data from the 150 MW run just prior to the shutdown in order to obtain values for the constants in the xenon equations for that operation.

Reactivity Balance

The reactivity status of each pile at the beginning and the end of this report period is summarized in the following table.

	B Pile		D Pile		F Pile	
	6-30-49	7-27-49	6-30-49	7-31-49	6-30-49	7-31-49
In Rods	92 ih	75 ih	83 ih	65 ih	50 ih	66 ih
In Xenon	479	473	498	498	468	466
In Special Requests	385	408	358	373	407	431
In "P" Cols.	0	0	0	0	0	0
In Bismuth	114	114	114	114	84	84

[redacted]

	B Pile		D Pile		F Pile	
	6-30-49	7-27-49	6-30-49	7-31-49	6-30-49	7-31-49
In Plant Ass't.	0	0	30	25	0	0
In Dummy Cols.	0	1	26	24	48	32
Corr. For C_o	-180	-180	-201	-201	-235	-235
Cold, clean reactivity	890	891	910	898	822	844

The above table shows net gains of 1 inhour for the B Pile and 22 inhours for the F Pile and a net loss of 12 inhours for the D Pile.

EXPERIMENTAL PHYSICS GROUP - J. M. West

Graphite Testing

(A) Non - Experimental

The results of routine tests on purified graphite during July are summarized in Table I.

TABLE I

PURIFIED GRAPHITE SUMMARY

Type	Number of Heats	Average Δ ih (Purity)	Effective Δ ih Ave.	Max.	Min.	Density (gms./c.c.) Ave.	Max.	Min.
GBF	103	+.959	+.965	+1.03	+.80	1.647	1.667	1.624

The purity of GBF is continuing to improve, as evidenced by the average Δ ih (purity) values of +.928 and +.939 in June and July, respectively. The density has not changed appreciably.

Production of graphite for Hanford Works will cease early in August. The 11,000 ton order will have been filled at that time. Testing and sorting of production heats will continue for some time, however, because the heats could not be tested as fast as they were produced. During recent weeks only alternate heats have been tested.

(B) Experimental GBF

In last month's report, test values were listed for experimental heats in which the F_{12} addition was started at a lower temperature than usual. Twelve additional heats have now been made and nine of the heats tested. The addition of two tanks of F_{12} was begun after an energy input of 8,000 KWH. instead of the usual 10,100 KWH, and stopped at the usual time. The functional test results are shown in Table II.

[redacted]

TABLE II

F_{12} ADDITION AT 8,000 KWH

Heat	Δ ih (Purity)	Density	Heat	Δ ih (Purity)	Density
GEF-1673-X	+ .99	1.639	GEF-1681-X	+1.00	1.642
1675-X	.89	1.640	1682-X	.92	1.640
1677-X	1.01	1.639	1683-X	.99	1.637
1678-X	1.02	1.633	1684-X	.99	1.625
1680-X	1.00	1.637			
			Average	+.979	1.637

These heats are very little, if any, purer than GEF heats made recently according to standard procedure. The density is a little lower, which may indicate some reaction between the carbon and fluorine at low temperatures. Strength tests are yet to be made.

Twelve experimental heats have also been made with the addition of three tanks of F_{12} beginning at 8,000 KWH and extending over a four hour period. Functional tests have not yet been made on these heats.

(C) Experimental WSF

Approximately 700 WS (Whiting Coke - Standard Pitch) bars from production lot 2 were graphitized and then "F" processed. The remainder (47 bars) of graphitized lot 1 were also "F" processed. The results of functional tests on the WSF heats are shown in Table III.

TABLE III

WSF GRAPHITE

Heat	Number of Bars	Lot	Δ ih (Purity)	Density (gms./cc.)
WSF-1665	120	2	+ .98	1.730
1666	120	2	.90	1.716
1667	120	2	.97	1.731
1668	120	2	.95	1.726
1669	120	2	.98	1.739
1671	47	1	1.00 *	1.669 *
1671	33	2	1.03 **	1.736 **
	Weighted Average		+.960	1.720

* only 6 bars tested. Previous tests on lot 1 gave an average density of about 1.67.
** only 2 bars tested.

[redacted]

There can no longer be any doubt that high purity graphite is obtained by "F" processing WS bars which have previously been graphitized. Previous tests on "F" processed gas baked WS bars (CBWF type) showed that graphite made in this way is not suitable to use in a pile. A likely explanation of the necessity for the graphitization step is that many of the impurities in WS bars are volatilized at the high temperature (~ 2600°C) in the graphitization furnace. It is unfortunate that, due to a misunderstanding, none of the graphitized WS bars were sent to Hanford for testing before being "F" processed.

The density of WSF lot 2 is about 0.07 gms./cc. higher than the average of all CBF heats tested thus far. For an entire pile, this increase in density would contribute about 30 inhours of reactivity. If this high density could be produced consistently, WSF graphite would have a decided advantage over CBF, since its purity is about the same. The ingredients of WS graphite are cheaper and more plentiful than other types, so a high percentage of future effort on graphite development should be focused on the WS variety.

P-11 Project

The long awaited approval of Part I of the critical mass project finally appeared. The A.E.C. has directed that the project proceed as planned and has provided the required funds.

Since funds became available, a well has been dug at the Tract House S-1683 site. Renovation of the tract house and other site preparation work should begin early in August. The experimental building has already been ordered. Orders are being placed for instruments. Fabrication of equipment for the critical assembly apparatus should begin shortly.

Part II of the Project is in its final stages of preparation by the Project Engineering Division. It should be ready for approval signatures by August 10. This should allow ample time for approval by all parties concerned before the funds for Part II are required.

The writer witnessed the beginning of a series of Hanford sponsored experiments at Oak Ridge, July 22. Criticality measurements are to be made on U^{235} solutions containing nitrogen, bismuth, phosphorus, and ordinary uranium. These elements are also to be tried as tampers. The results of these experiments are expected to be useful in estimating the effects of bismuth phosphate, uranium and the nitrogen in plutonium nitrate, on the critical mass of plutonium in aqueous solution. A U^{235} solution will also be poisoned with boron to reduce the number of new neutrons per thermal neutron captured to the value for plutonium. It is hoped that the critical mass of this poisoned U^{235} will give a better idea of the critical mass of plutonium.

Shielding

Measurements of gamma intensity at various depths in A Test Hole of the F Pile are continuing. Results will be reported when the traverse is complete.

[redacted]

Gold foil measurements outside the F Pile shield in the neighborhood of the A Test Hole show that the number of thermal neutrons escaping through the laminated shield plugs in the hole is about 20 times as great as through the surrounding solid shield. It remains to be determined whether this factor of 20 is accumulated gradually throughout the biological shield section of the test hole or whether the number of neutrons incident on the shield plugs is greater by this factor due to leakage through an annular gap in the thermal shield.

EXPERIMENTAL PHYSICS GROUP II - E. B. Montgomery

The "Description of Hanford Facilities for Special Irradiations" is now finished and going to the printers. The "Final Report on the Measurement of Diffusion Lengths in the DR and H Piles" is also finished. The results of the diffusion length measurements are given below:

	The Corrected Value of Diff. Length	Ave. Density of White & Green Graphite	Diff. Length Corrected to Density of 1.600 g/cc.
DR	51.4 cm.	1.702 g/cc.	54.7 cm.
H	53.0 cm.	1.635 g/cc.	55.9 cm.

At the present time we will not specify the error in our measurements except to say that the diffusion lengths given are probably correct to better than ± 0.5 cm.

The measurements gave no indication of any large amounts of contaminant in any localized volume and through the high diffusion lengths no indication of a widespread large neutron absorber in lower concentrations.

In preparing for the DR and H tests many experiments gave results which will be of value to others of our group. Design, fabrication and successful use of the small size BF_3 counters proved far superior to the use of indium foils where large scale work is concerned. At the same time the low perturbation and the precision of positioning allowed by this method actually increase the accuracy over that of the foil technique.

Tests in the 305 pile of several component materials indicated desirable and undesirable materials where little perturbation is tolerable.

Material	Macroscopic Cross Section cm²/cm.
Aluminum tape (61 - ST)	.00403
Aluminum wire and asbestos cover	.0133
Apiezon - W wax	.0098
Kovar seals	.306
Cu wire and shield (polythene)	.0390
Polyethylene	.0173
Vinylite	.0165
Steatite Beads	.00503
Bi	.00178

Cadmium ratios for BF_3 counters were compared with those of indium foils. At five lattice units from the source the C.R. for BF_3 was 650; for indium foils 110.

Paul F. Gast

PFG:jr

PILE TECHNOLOGY DIVISION

DATE

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