Graphite Testing (E. Montgomery, V. Staebler, & H. Vandersall)

To investigate the sensitivity of the Argonne pile in connection with the testing of graphite purity, the critical positions of the control rod were determined when the three removable dead graphite stringers were loaded with different brands of graphite. The results are given in the following table: Column 1 gives the brand of graphite which filled the three stringers, column 2 the average of two determinations of the critical position, column 3 the change in critical position from that for AGOT, column 4 the atomic cross section as determined from sigma piles, and column 5 the sensitivity.

Brand	Crit.Pos. inhour	Δih	$\sigma \times 10^{27}$	$\frac{\Delta\sigma}{\Delta ih} \times 10^{27}$
AGOT (10,11)	125.59	0	4.84	
Speer 1	124.60	-.99	5.49	.66
U.S.	122.14	- 3.45	6.38	.45
AGX	121.66	-3.93	6.68	.47

The values of $\frac{\Delta\sigma}{\Delta ih}$ are to be taken as indications of the sensitivity of the method, since the cross sections given in column 4 are average values for large amounts of graphite, and not necessarily the true cross section of the relatively small amount of material used in these tests.

From the above results it appeared that substituting the graphite in the central portions of two stringers (total length 264") would give sufficient sensitivity. Such a procedure was calibrated by poisoning each of these bricks with a known cross section of cadmium, and measuring the shift in critical position of the rod. The cadmium, in the form of cylindrical pieces of diameter .101 cm and length 12.6 cm, had a total neutron cross section of 1 cm^2 per piece. This corresponds to a σ_{KT} of

$$\sigma_{KT} = \frac{2}{\sqrt{\pi}} \sqrt{\frac{395}{295}} \times 1 = 1.26 \text{ cm}^2$$

Since this poisoning was added to each graphite brick, the change in cross section per atom amounted to

$$\Delta\sigma = \frac{1.26}{3.29 \times 10^{26}} = 3.83 \times 10^{-27} \text{ cm}^2$$

The observed shift in critical position of the control rod was

$$\Delta ih = 7.45 \text{ inhours}$$

Thus, for the sensitivity we obtain

$$\frac{\Delta\sigma}{\Delta ih} = \frac{3.83 \times 10^{-27}}{7.45} = 0.51 \times 10^{-27} \text{ cm}^2 \text{ (atomic) per inhour}$$

from p11 to here MLC

Reproduction Factor of UO_2

We received from Mr. Spedding 14 cast cylindrical lumps of UO_2 (average weight 2122 grams and density 11.6 gms/cm^3). These were compared in the metal testing stringer with the 16 billet samples (average weight 1796 grams) composing Lot #81, which is the standard used in the metal testing comparisons.