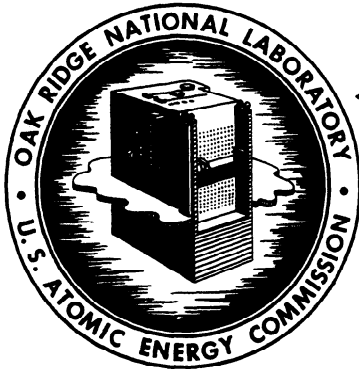


## REFERENCE 50

**J. K. FOX, L. W. GILLEY, R. GWIN, AND J. T. THOMAS, "CRITICAL PARAMETERS OF URANIUM SOLUTIONS IN SIMPLE GEOMETRY," IN NEUTRON PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 1, 1958," OAK RIDGE NATIONAL LABORATORY REPORT ORNL-2609 (OCTOBER 1958), P. 42.**

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ANNUAL PROGRESS REPORT  
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**E. P. Blizard, Director**  
**A. Simon, Associate Director**

**A. D. Callihan, Leader, Critical Experiments Facility**  
**C. E. Clifford, Leader, Tower Shielding Facility**  
**F. C. Maienschein, Leader, Bulk Shielding Facility**  
**W. Zobel, Leader, Lid Tank Shielding Facility**

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3.8. CRITICAL PARAMETERS OF URANIUM SOLUTIONS IN SIMPLE GEOMETRY

J. K. Fox

L. W. Gilley

R. Gwin

J. T. Thomas

The measurement of the critical parameters of solutions of the fissionable uranium isotopes in simple geometry has been a continuing program for a number of years. Part of this program has been the establishment of values for the minimum critical volume and minimum critical mass both with and without an effectively infinite water reflector. The accuracy with which these limiting values are desired necessitates the evaluation of various experimental uncertainties such as the effect of the solution container itself. The correction described and applied in the past<sup>1,2</sup> to some of the data from aluminum cylinders is suspect and is to be reinvestigated. Further, the critical height (and, hence, volume and mass) reported<sup>1</sup> for a

10-in.-dia cylinder of solution having a chemical concentration near that yielding minimum volume now seems to be in additional error for reasons unknown. The reported volume of 5.78 liters appears to be too small by perhaps as much as 10%.

What are believed to be the best data describing some recent measurements with spheres of both U<sup>233</sup> and U<sup>235</sup> solutions are given in Table 3.8.1. The limit of accuracy of the volume is ±0.5% and of the concentration and mass is ±1%. These data have not been corrected for the effect of the type 1100 aluminum of which the containers were fabricated.

<sup>1</sup>J. K. Fox and L. W. Gilley, *Appl. Nuclear Phys. Ann. Prog. Rep. Sept. 1, 1957*, ORNL-2389, p 72.

<sup>2</sup>J. K. Fox, L. W. Gilley, and D. Callihan, *Critical Mass Studies. Part IX. Aqueous U<sup>235</sup> Solutions*, ORNL-2367, p 22 (Feb. 5, 1958).

Table 3.8.1. Critical Parameters of Spheres of Uranium Solutions

Principal isotope	U <sup>235</sup>	U <sup>235</sup>	U <sup>235</sup>	U <sup>233</sup>	U <sup>235</sup>	U <sup>235</sup>	U <sup>235</sup>
Sphere radius, cm	27.9	34.6	34.6*	34.6*	11.5	11.8	27.9
Sphere volume, liters	91.1	174	174	174	6.40	6.96	91.1
Sphere wall thickness, cm	0.20	0.32	0.32	0.32	0.16	0.16	0.20
Salt	UO <sub>2</sub> F <sub>2</sub>	UO <sub>2</sub> F <sub>2</sub>	UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub>	UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub>	UO <sub>2</sub> F <sub>2</sub>	UO <sub>2</sub> F <sub>2</sub>	UO <sub>2</sub> F <sub>2</sub>
Uranium isotopic composition, %							
U <sup>233</sup>				97.65			
U <sup>234</sup>	1.14	1.14	1.04	1.63	0.98	0.98	0.98
U <sup>235</sup>	93.20	93.20	93.18	0.06	93.18	93.18	93.18
U <sup>236</sup>			0.27		-0.50	0.50	0.50
U <sup>238</sup>	5.66	5.66	5.51	0.66	5.36	5.36	5.36
Specific gravity of solution	1.03	1.02	1.03	1.02	1.40	1.24	1.03
Uranium concentration in solution, mg/g	24.4	19.6	19.6	16.9	249	172	21.4
H:U <sup>235</sup> or H:U <sup>233</sup> ratio	1112	1393	1379	1521	76.1	126.5	1270
N:U <sup>235</sup> or N:U <sup>233</sup> ratio			3.64	2.69			
Uranium loading, kg of U <sup>235</sup> or U <sup>233</sup>	2.13	3.25	3.27	2.93	2.08	1.39	1.86
Reflector	None	None	None	None	Infinite water	Infinite water	Infinite water
k (at 25°C)	1.0004	1.0000	1.0001	1.0003	1.0000*	1.0000	0.9999

\*These experiments were performed by D. W. Magnuson and are also reported in Sec. 3.2.