

LA--309

Copy 35

LOS ALAMOS NATIONAL LABORATORY



3 9338 00407 7078

SECRET

UNCLASSIFIED



LA - 309



June 14, 1945

This document contains 7 pages

SUMMARY OF KNOWN CRITICAL MASSES OF 25 AND 49

Compiled by

B. T. Feld

PUBLICLY RELEASABLE

Per B. Palominos, FSS-16 Date: no date

By M. Dellega, CIC-14 Date: 4-29-96



LOS ALAMOS NATL. LAB. LIBS.
3 9338 00407 7078

Classification changed to UNCLASSIFIED
by authority of the U. S. Atomic Energy Commission,
Per H. F. Carroll 1-15-57
By REPORT LIBRARY M. Allen 1-17-57

UNCLASSIFIED



This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, United States Code, Section 793 and 794, and the transmission or revelation of its contents in any manner to an unauthorized person is prohibited by law.

SECRET

SECRET



SUMMARY OF KNOWN CRITICAL MASSES OF 25 AND 49

UNCLASSIFIED

The following tables summarize our present knowledge of the critical masses of active materials in various configurations. By critical mass is meant the amount of active material (25 or 49) required to produce a chain reaction which will just maintain itself on all the neutrons (including the delayed) emitted in fission. The figures quoted have been experimentally determined whenever possible; where theoretical figures are the only ones available, an attempt is made to include a configuration which has also been investigated experimentally and for which the theoretical value has been calculated in the same way. Unless otherwise stated, the core of active material is spherical in shape.

In cases where it has not been possible to assemble enough material to reach criticality, the maximum amount of material assembled is given and, if measured, the multiplication of the assembled configuration is included. The multiplication, M , of an assembly may be connected with the multiplication constant, k ($k=1$ is critical), by the formula

$$M = 1/(1-k).$$

The tables run from the case of complete hydration (water boiler) through the hydrides to metal assemblies containing no hydrogen in the core of active material. In the case of metal dispersed in a hydrogenous medium, the mass of metal effective in producing a water boiler has been found to be approximately that contained in a surface layer of thickness equal to a quarter of the mean free path of thermal neutrons in the metal ($\lambda/4$ equals approximately .01 cm in 25 metal of density 18.8 and .005 cm in 49 metal of density 19.4).

**UNCLASSIFIED**

UNCLASSIFIED

-3-



The figures quoted represent the work of many individuals and groups; references to reports in which the experiments have been discussed in detail are given wherever such reports are available.



UNCLASSIFIED

UNCLASSIFIED

25 CRITICAL ASSEMBLIES

CORE COMPOSITION

TAMPER

CRITICAL MASS OF 25

COMMENTS

UO₂SO₄, 14.7% 25,
in 15.4 liters H₂O
solution

BeO, 1 ft thick,
density 2.7 gms/cm²,
effectively infinite

565 gms

Low-Power Water Boiler (Lo Po)(IA-134)

"

C, density 1.6
effectively infinite

760 gms

Lo Po extrapolation (IA-134)

"

H₂O, effectively infinite

1200 ± 50 gms

Lo Po extrapolation (IA-244)

UO₂(NO₂)₂, 14.7% 25,
in 13.6 liters same con-
ditions as Lo Po except
for the nitrogen

BeO, density 2.7,
effectively infinite

643 gms

The measured value of the critical mass
of the High Power Water Boiler (Hi Po)
is 806 gms. This is for a 25 concentra-
tion of 14.0% and includes the effect of
a cooling coil, a central empty tube,
and a thicker wall than was used in the
Lo Po (the net effect of these additions
corresponds to about 130 gms of 25). By
courtesy of L.D.P. King and Group F-2

UNCLASSIFIED

Pure 25 in H₂O solution
11.4 liters

H₂O, infinite tamper

600 gms

Calculated, Christy (LAMS-18)

Pure 25 in H₂O solution
33.5 liters

None

1500 gms

"

UH₃, 70% 25

BeO, density 2.7,
thick tamper

1.4 kg

All the hydride experiments were per-
formed by Group G-1 under the supervision
of Holloway. The active material was in
the form of 1/2" cubes of UH₃ of density 3.
The rest of the hydrogen was introduced
as polyphene. The self absorption effects
for this high hydrogen concentration were
rather large. For a homogeneous mixture,
the critical mass is probably much closer
to 1 kg.

UNCLASSIFIED

APPROVED FOR PUBLIC RELEASE

APPROVED FOR PUBLIC RELEASE

25 CRITICAL ASSEMBLIES (Cont.)



<u>CORE COMPOSITION</u>	<u>TAMPER</u>	<u>CRITICAL MASS OF 25</u>	<u>COMMENTS</u>
UH ₄₅ 70% 25	BeO, density 2.7, thick tamper	1.5 kg	
UH ₂₀ 70% 25	"	2.3 kg	
UH ₁₅ 70% 25	"	2.9 kg	
UH ₁₀ 70% 25	BeO, density 2.7, 12" tamper thickness	2.65 kg	Calculated value 2.26 kg Feynman (LAMS-201)
"	BeO, density 2.7, 6" tamper	3.34 kg	Calculated value 2.79 kg (LAMS-201)
"	BeO, density 2.7, thick tamper; Cd between core and tamper	5.5 kg	
"	WC, density 15.5	6.9 kg	Calculated value 4.2 kg (LAMS-201)
"	Tu, density 18.8	7.0 kg	Calculated value 4.5 kg (LAMS-201)
"	Fe, density 7.8	8.4 kg	
"	Pb, density 11.0	9.3 kg	Calculated value 6.0 kg (LAMS-201)
UH ₃ Cd, 70% 25, density 9	Perfect	7.6 kg	There are no experiments on UH ₃ ; all values are calculated by Feynman and his group (LAMS-149)
"	BeO, density 2.7, infinite	8.5 kg	"
"	WC, infinite	8.2 kg	"
"	Tu, infinite	9.4 kg	"

APPROVED FOR PUBLIC RELEASE

APPROVED FOR PUBLIC RELEASE



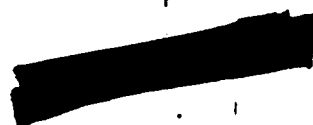
031700

DOCUMENT ROOM

REC. FROM C.S.

DATE 6-15-75

REC. NO. REC. ✓



031700