

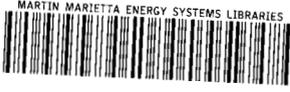
M-49-A

AEC RESEARCH AND DEVELOPMENT REPORT

REMOVE THIS PAGE

REPORT NO. _____
This document contains _____ Pages
of Text and _____ Pages
of Figures.
This is copy _____ of _____ Series
_____.

ISSUED TO: _____



3 4456 0360225 1

THIS IS A CLASSIFIED DOCUMENT

1. This [REDACTED]
2. [REDACTED]
3. [REDACTED]
4. [REDACTED]
5. [REDACTED]
6. [REDACTED]
7. [REDACTED]

Classification Cancelled

Or Changed To

By Authority Of AEE 9.13.71
By G. Goldberg Date 11.3.71

Route to	Read by	Date	Route to	Read by	Date	Route to

89
AUG
P.G.

09
AUG

89
AUG

ORNL-6
Administrative-General
March 1, 1948

ABSTRACTS OF REPORTS ADDED TO THE LIBRARIES
FOR THE WEEK ENDING FEBRUARY 13, 1948

by

W. H. Bridges

This document contains information affecting
[REDACTED]
meaning of the Espionage Acts, USC 50, 31 and
32. The transmission or the revelation of
[REDACTED]
[REDACTED] is prohibited by law.

OAK RIDGE NATIONAL LABORATORY
DIVISION OF
CARBIDE AND CARBON CHEMICALS CORPORATION
OAK RIDGE, TENNESSEE

MARTIN MARIETTA ENERGY SYSTEMS LIBRARIES



3 4456 0360225 1

DISTRIBUTION:

1. A. O. Allen
2. M. B. Arnette
3. E. B. Ashcraft
4. S. Bernstein
5. E. Bohmann
6. C. J. Boskowski
7. G. E. Boy
8. M. A. Breding
9. W. H. Bridges
10. R. B. Briggs
11. A. R. Brosi
12. J. R. Coe
13. R. R. Coveyou
14. F. L. Culler
15. S. DeBenedetti
16. T. DeWitt
17. J. R. Dietrich
18. L. B. Emlet
19. H. Etherington
20. M. H. Feldman
21. J. S. Felton
22. S. Freed
23. W. B. Harrison
24. Ruth Hassler
25. A. Hollaender
26. A. S. Household
27. J. E. Hudgens
28. J. R. Huffman
29. G. H. Jenks
30. W. A. Johnson
31. K. Kasschan
32. K. A. Krane
33. J. A. Kyser
34. M. C. LeCrett
35. H. A. Levy
36. P. W. Levy
37. R. Livingston
38. R. M. Lyon
39. M. J. Mann
40. F. P. Miles
41. K. Z. Morgan
42. T. Newman
43. H. W. Newson
44. R. T. Overman
45. G. W. Parker
46. M. D. Peterson
47. H. Pomerance
48. M. E. Ramsey
49. W. H. Ray
50. D. G. Reid
51. L. M. Reynolds
52. L. B. Rogers
53. A. P. Rupp
54. H. J. Schweinler
55. M. M. Shapiro
56. J. Siegel
57. R. W. Stoughton
58. J. A. Swartout
59. E. H. Taylor
60. **Central Files**
61. K. Way
62. J. T. Weills
63. I. B. Whitney
64. E. O. Wollen
65. Gale Young
66. 706A Library
67. Central Files
68. Central Files
69. 706B Library
70. Training School
71. Library Branch - Technical
Information Division
72. A. H. Snell

[REDACTED]

ABSTRACTS OF REPORTS ADDED TO THE LIBRARIES FOR THE WEEK
ENDING FEBRUARY 13, 1948

ADMINISTRATIVE REPORTS

- BNL-12 REPORTS AVAILABLE IN BROOKHAVEN CLASSIFIED LIBRARY AS OF
DECEMBER 6, 1947 - FEBRUARY 12, 1948
Brookhaven National Laboratory February 11, 1948 32 pages
(Secret)
- ANL-4106 ADDITIONS TO THE LIBRARY-REPORT FOR THE PERIOD JANUARY 12,
1948 TO JANUARY 23, 1948'
H. D. Young January 26, 1948 9 pages (Secret)

CHEMISTRY REPORTS

- ISC-14 THE CHELATE COMPOUNDS OF PLUTONIUM
F. J. Wolter May 25, 1946 105 pages (Secret)

One of the objects of the Plutonium Project was to learn enough of the chemistry of plutonium to devise an efficient method of separating Pu²³⁹ in a state of purity useful for military purposes. In connection with studies on the general chemistry of plutonium, one of the programs authorized was the study of the chelate compounds of plutonium. Because of the unique properties of such inner complex compounds, suitable organic reagents specific for plutonium might prove of value in such operations as extraction, decontamination, concentration, or purification of plutonium.

I THE CHELATE COMPOUNDS OF PLUTONIUM

Exploratory experiments designed to observe the chelating activity of various organic reagents with plutonium were conducted in the following manner. Aqueous solutions containing plutonium (IV) tracer were buffered to the desired pH's with sodium or ammonium acetic acid. The solutions, usually 20 ml in volume, were agitated with 20 ml of chloroform containing 10 to 20 mg of the organic reagent. The extractions were carried out in separatory funnels and the two phases were separated and assayed radiochemically for plutonium. If more than 10 per cent of the plutonium activity was transferred to the chloroform fraction it was assumed that some inner complex formation had occurred. In most such explanatory experiments the pH's of the aqueous solutions ranged from 2 to 8.

[REDACTED]

██████████

Forty-five different bidentate reagents were examined for complexing activity with plutonium (IV). All of the reagents examined were known to form chelate compounds with certain other metal ions. The bidentate reagents which formed chelate compounds with plutonium (IV) include quinalizarin, *o*-hydroxyacetophenone, *o*-hydroxyacetophenone semicarbazide, benzoylacetone, dibenzoylmethane, trifluoroacetylacetone, salicylal-[2-hydroxyphenyl] imine, and 8-hydroxyquinoline.

Twenty-six different quadridentate reagents were examined for chelating activity with plutonium (IV). The most active quadridentate reagents are the Schiff's bases prepared by condensing ethylenediamine with various derivatives of salicylaldehyde. Almost all of the disalicylaethylenedimine derivatives were effective in complexing plutonium (IV) to a certain degree at pH's below that at which plutonium hydroxide precipitates, but the most active derivative was di-[2-3-dihydroxy-5 or 6-tert.-butylbenzal]-ethylenedimine. This reagent, referred to hereafter as "disal", effects more than 95 per cent complexing of tracer amounts of plutonium (IV) in the pH range from 2.75 to 6.00.

Rather extensive studies on the nature of the plutonium-disal complex were conducted. Fourteen different organic solvents were investigated for their solvent properties with the complex. It was found that when chloroform solutions of the complex were agitated with solutions of nitric acid as dilute as 0.01 molar practically all of the plutonium was transferred to the aqueous phase. The efficiency of disal extractions of plutonium was found to be reduced markedly by the presence of sulfate, oxalate, or ferron in the aqueous solution. The composition of the plutonium (IV) - disal complex was determined, using milligram amounts of plutonium, and gave proof that the coordination number of plutonium (IV) is eight.

Plutonium (IV) forms a very stable water-soluble complex with ferron (γ -iodo-8-hydroxyquinoline-5-sulfonic acid) at pH's between 2.5 and 8. Spectrophotometric examination of plutonium (IV)-ferron solutions at different pH's showed that there are no marked absorption peaks in the region between 500 and 800 millimicrons. It was suggested that it might be possible to use the ferron method of Swank and Mellon (Ind. Eng. Chem., Anal. Ed., 9, 408(1937) for the estimation of iron in plutonium.

II THE CHELATE COMPOUNDS OF PLUTONIUM (III)

Exploratory attempts to produce tracer plutonium (III) did not prove particularly successful, especially at pH's high enough for the formation of stable organic complexes. The anions present in most buffer systems complex plutonium (IV) quite strongly, shifting the potential of the plutonium (III)-

~~SECRET~~

plutonium (IV) couple. Therefore, in experiments with plutonium (III), it was necessary to use microgram and milligram amounts of plutonium so that the oxidation states could be identified with certainty by spectrophotometric methods.

The pH range in the exploratory experiments with plutonium (III) was between 3 and 7. The organic reagent, in five- to ten-fold excess, was added to 1 to 2 ml of the buffered plutonium (III) solution, and after a reaction period of at least two hours the aqueous solution or suspension was extracted with an equal volume of chloroform in a specially designed micro-extraction apparatus. The distribution of plutonium was determined by radioactive assays of the aqueous and chloroform fractions.

Twenty-seven different bidentate reagents were examined for their chelating activities with plutonium (III). Positive results were obtained with 8-hydroxyquinoline, benzohydroxamic acid, 6-hydroxybenzohydroxamic acid, m-nitrobenzohydroxamic acid, 1-naphthohydroxamic acid, phenylacetohydroxamic acid, n-valerohydroxamic acid, phenylacetamide oxime, and n-valeramide oxime.

The composition of plutonium (III)-1-naphthohydroxamate was determined, using milligram amounts of plutonium, and showed that the coordination number of plutonium (III) is six.

III THE USE OF ORGANIC REAGENTS IN THE DECONTAMINATION AND PURIFICATION OF PLUTONIUM

The behavior of disal with various cations was determined with radioactive isotopes of cesium, barium, thorium, zirconium, and the rare earths at different pH's. Effective separations of plutonium from cesium and the rare earths can be obtained, less than 0.4 per cent extraction of these elements by chloroform occurring at pH's at which plutonium extractions are complete. Barium is complexed by disal, but not to as great an extent as is plutonium. Both uranous and uranyl ions are complexed by disal, so that the reagent cannot be used directly for the separation of plutonium from uranium solutions.

The reactions of zirconium and thorium with disal are so similar to those of plutonium (IV) that no effective method of separating these elements by disal extractions could be devised. Both zirconium and thorium are complexed almost as completely as is plutonium over the same pH range, and the stabilities of the complexes toward dilute acids are quite nearly the same. It is not likely that plutonium (III) would be complexed by disal but the use of oxidation-reduction procedures for changing the valence state of plutonium results in the destruction of the disal reagent, so that no fractionations of plutonium from zirconium and thorium could be obtained.

~~SECRET~~

The most active organic reagents for plutonium (III) were the hydroxamic acids and amide oximes. Attempts to adapt the use of these reagents for the decontamination and purification of plutonium were not successful. The hydroxamic acids complex manganese, copper, mercury, silver, iron, cerium, uranium, zirconium and thorium, while the amide oximes, particularly phenylacetamide oxime, complex zirconium thorium, iron, copper and uranium. The behaviors of zirconium and thorium with hydroxamic acids and amide oximes are so similar to that of plutonium that there could not be devised a method for applying these reagents to the separation of plutonium from zirconium and thorium.

CRC-342 THE INDUSTRIAL SEPARATION OF PLUTONIUM - PART I - INTRODUCTION AND REVIEW OF PROCESSES
Chalk River, Ontario July 31, 1947 26 Pages (Unclassified)

The factors affecting the time during which uranium from the production pile is allowed to decay are discussed and a table of activities of long lived fission products is given. After touching briefly upon the dissolving problem and describing the various possible methods for the separation of plutonium, it is suggested that a process of the solvent extraction type should be considered for the production plant.

CRC-345 THE INDUSTRIAL SEPARATION OF PLUTONIUM - PART IV - COMPARATIVE STUDY OF SOLVENTS - PARTITION COEFFICIENT
Chalk River, July 31, 1947 - 29 pages - (Secret)

New partition coefficient data together with existing data, relative to uranium, plutonium and fission products is classified, for the solvents ether, dibutyl carbitol, dibutyl cellosolve, hexone and triglycoldichloride, these solvents having been selected as the most promising amongst those which had previously been studied. Analysis of the data indicates that ether is the best solvent for the extraction of uranium alone (Type I process) with dibutyl carbitol as next best while dibutyl carbitol is most efficient for the extraction of uranium and plutonium together (Type II process), hexone being second.

The oxidation and reduction of plutonium solutions is dealt with in Appendix I and the preparation of uranium free from uranium X is described in Appendix II.

CRX-350 SOLVENT DIETHYL ETHER
G. E. Haddeland September 12, 1947 29 pages (Secret)

This report deals with the use of diethyl ether as a uranyl nitrate solvent, its separation from solute and with conditions of ether peroxide formation and removal.

[REDACTED]

The results are not intended to be conclusive or detailed, but rather to suggest a direction for continuing chemical engineering development. Original data and calculations are available in the Chalk River library (Reference 18).

Descriptions and results while all dealing with the behaviour of diethyl ether have been separated into four distinct sections within this report.

- I. Ether extraction of UNH from Saturated Ammonium Nitrate solutions,
- II. Water Stripping of Ther-UNH solutions
- III Ether Vaporization from aqueous UNH solutions,
- IV Removal of Peroxides from Diethyl Ether.

This experience and information, supported by that of other investigators, is the basis of a proposal for a continuous 49 process pilot plant (Section V).

HEALTH AND BIOLOGY REPORTS

UCRL-35

THE METABOLISM OF CURIUM IN THE RAT

K. G. Scott, D. Axelrod, and J. G. Hamilton January 15, 1948
11 pages (Restricted)

The close similarity of the metabolic characteristics of americium to those of the lanthanum group of rare earths is discussed. The almost identical behavior of americium and curium in the animal body is compared. The three most striking metabolic properties of these two heavy elements are their high uptake and comparatively rapid excretion by the liver, their deposition and prolonged retention by the skeleton, and the curious pattern of distribution in the region of the osteoid matrix and about the small blood vessels of cortical bone.

LA-391

CHEMISTRY AND METALLURGY HEALTH HANDBOOK OF RADIOACTIVE MATERIALS

P. C. Aebersold, et al August 17, 1945 (Confidential)

The purpose of this Handbook is to apprise workers on the project of the various possible health hazards that arise from nuclear radiation. These hazards are described, and the Health-Safety procedures for dealing with them are outlined. In the interests of compactness the discussion is brief and general. However, it was deemed essential to indicate to the reader the intensive effort being made to eliminate radiation health hazards, hence, the detailed description of monitoring instruments and, as an example, the chemical assay for 49 and Polonium in the urine. For

██████████

more detailed information on any radiation hazard the worker should consult Dr. Louis Hempelmann. Finally, the worker exposed to nuclear radiations is emphatically urged to follow the two basic rules: (1) know all the possible radiation hazards in a given job, and (2) see that proper protective procedures are followed in the job.

ANL-4100

THE EFFECTS OF X IRRADIATION ON THE PERIPHERAL BLOOD AND BLOOD FORMING TISSUES OF SPLENECTOMIZED RATS
S. P. Stearner, E. L. Simmons and L. O. Jacobson
October 1, 1947 (43 Pages) (Confidential)

White rats were splenectomized and after 6 days, exposed to 100 r and 100 X radiation. Although a leucocytosis was frequently seen after splenectomy, in some cases no significant change in the peripheral leucocyte count was observed. The lymphopenia and granulopenia that followed exposure to radiation were as severe in splenectomized rats as in intact rats.

Histological studies indicated that splenectomy did not produce a significant hyperplasia of lymphopoietic or granulopoietic tissues in the rat. Therefore, there was no opportunity to compare the effects of radiations on normal and hyperplastic leucocyte-forming tissues.

The functions of the spleen are not clearly understood, but appear to be complex. It is possible that splenectomy may produce numerous physiological changes which complicate the interpretation of radium effects on the blood-forming organs. Although the reason is not clear, the results make it apparent that splenectomy is not a satisfactory technique for producing a hyperplasia of lymphopoietic or granulopoietic tissue.

In Bartonella-infected rats, splenectomy resulted in a severe anemia. In animals that survived, irradiation with 600 r, did not cause a more severe anemia, but markedly retarded the recovery. The bone marrow of these animals was shown to contain a hyperplasia of erythroblastic elements. A small percentage of erythroblasts persisted during the early stages following irradiation of splenectomized rats, although none were seen at this time in intact irradiated animals. Later, however, damage appeared to be equally severe in both irradiated groups.

M-4185

IODINE METABOLISM WITH REFERENCE TO I-131
S. T. Cantril and J. W. Healy October 22, 1945 13 pages
(Secret)

Metabolism of iodine with respect to geographic location and intake of ordinary stable I-127 from sea water versus intake of radioactive I-131 from the Hanford plant are discussed.

M-4188

BRIEF REVIEW OF HEALTH INSTRUMENTATION FOR FAST AND SLOW
NEUTRONS

H. M. Parker (HEW) March 21, 1946 7 pages (Secret)

All of the instruments for the detection of slow and fast
neutrons are reviewed and discussed.

METALLURGY AND CERAMICS REPORTS

NP-91

THE USE OF THE VACUUM SPINNING MACHINE IN THE CERAMIC TEST
PROGRAM

R. F. Kimpel, February 21, 1947 18 pages (Unclassified)

Initiation of a research program toward the possible develop-
ment of refractory ceramic materials for use in producing
an all-ceramic turbine wheel presented the problem of
devising suitable tests which would be sufficiently indicative
of properties of materials to warrant their further considerat-
ion. Inasmuch as tests performed upon materials in any
field of endeavor should be representative of service
conditions actually to be encountered, it remained to obtain
a means of spinning specimens of materials for above speeds
which turbines encounter in service.

A spinning machine for this purpose is described.

The high speed test stand consists essentially of vie parts.
They are the following: air turbine, lid, and silencer
assembly; stand and lid-lifting assembly; lubrication system;
vacuum system; instrument panel assembly.

The turbine is four inches in diameter with "Terry Type"
blading for the forward drive. It may be used for high
speed testing of rotors weighing approximately 200 pounds
at speeds up to 60,000 rpm. The test rotor is driven through
a replaceable 1/4 inch diameter spindle which is connected
directly to the turbine by a single 1/8" pin at the top of
the turbine wheel. The turbine rotor speed is limited to
a nominal maximum of 60,000 rpm, determined to give a safe
margin below the turbine rotor bursting speed and the allowable
bearing surface speeds.

Installation and operation details are furnished; photographs
are included.

NP-94

CERAMIC MATERIALS FOR APPLICATION IN THE DESIGN OF JET
PROPELLED DEVICES

A. R. Blackburn, T. S. Shevlin, and F. P. Sabol May 15, 1947
9 pages (Ohio State University)

A development in use of three types of high temperature
furnaces for the heat processing of cerametallic bodies is

[REDACTED]

presented. The three types of furnaces are: 1 - global tube furnace, 2 - induction furnace 3- molybdenum resistor atmosphere furnace.

M-4134

SLUG BLISTERING PROBLEM

T. W. Hauff June 23, 1947 8 pages (Secret)

The slug blistering problem is reviewed with comments on what has been done along exploratory and remedial lines and considers further attack on the problem.

PHYSICS REPORTS

NP-40

THE RESEARCH ON RARE EARTH SPECTRA BY O. DEUTSCHBEIN

J. J. Thiessen (BIOS) no date 3 Pages (Unclassified)

Dr. O. Deutschbein is a professor of the Technische Hochschule of Munich and was evacuated to Thumersbach where some research work was carried out under military supervision. Dr. Deutschbein had been engaged in investigation of the rare earth spectra particularly with reference to fluorescent effects. During the war he was engaged in a problem to do the application of fluorescence salts in order to distinguish between a stationary radar target and a moving one. The attempts were not very successful.

CRTec-326

MEASUREMENT OF ALPHA ACTIVE DUST IN THE ATMOSPHERE

H. Carmichael and P. R. Tunnicliffe (Chalk River)
August 12, 1947 46 pages (Unclassified)

Apparatus of two kinds for rapidly extracting the dust from large volumes of atmospheric air so that the alpha particle activity of the dust can readily be measured in a methane proportional counter is described. The performance of the apparatus has been studied using the natural alpha activity in the atmosphere due mainly to radon and thoron and their disintegration products. Suction, provided by a commercial vacuum cleaner, is at the rate of 2.0 cu.m./min. in the electrostatic precipitation apparatus, but only 0.8 cu.m./min. in the filter apparatus. Extraction of dust at these rates of flow is 40% for the precipitator and 100% for the filter. Counting efficiency is 49% for the precipitator but only 14% for the filter due to penetration of the dust into the paper. The overall counting yield of the precipitator, for a given time of extraction of dust, is nearly four times that of the filter. It is necessary to have both types of apparatus in order that experimental determinations of the counting yield of either can be made from time to time. At least six hours must usually elapse after collection of a dust sample before uranium or plutonium of about the present health toleration concentration can be measured, because the natural alpha particle activity of atmospheric dust must first be allowed time to decay.

CRC-336

THE PREPARATION OF BORON-COATED ION CHAMBERS
N. Moss (Chalk River) April, 1947 15 pages
(Unclassified)

A Static method for the deposition of pure boron on the mild steel electrodes of the type TQT ion chamber is described. The method used depends on the thermal dissociation of diborane at about 500°C. A full account of the preparation of diborane is given.

BR-499

ON CERTAIN INEQUALITIES INVOLVING THE NEUTRON BINDING ENERGIES OF Pb(208) AND Bi(209), WITH A NOTE ON THE PROBABLE VALUES OF DISINTEGRATION ENERGIES FOR THE $4n/1$ SERIES OF ELEMENTS
N. Feather August 14, 1944 10 pages (Secret)

The fact that the cross-sections for capture of thermal neutrons by Bi(209) and Pb(208) are known to be exceptionally low makes any reliable estimate of the neutron binding energies for the two nuclei concerned of considerable interest. An estimate is provided of the sum of the two binding energies which rules out the possibility that both should be abnormally low. The binding energy of Bi(209) is indicated as being comparatively large (4 - 6 Mev). That of Pb(208) is ~ 3-4 Mev.

By a process of deductive reasoning, using as many known disintegration energies as are available, (with interpolations) the estimates of binding energies are worked out by following a chain of transformations, some of which have been assumed.

Where uncertainties arise, due for example, to unpredictable dependence by β -lifetime on total disintegration energy of extrapolation of curves (charge number constant) towards small values of mass number an assumed probable error is included.

LA-511

DETERMINATION OF THE NUMBER OF FISSIONS IN TWO IRRADIATED SAMPLES OF U-235
M. Deutsch, M. Kahu, and J. A. Miskel March 22, 1946
18 Pages (Secret)

The gamma-ray activity of two samples irradiated in the Clinton and Hanford piles and of the barium and cesium extracted from them were compared with the activities extracted from a sample in which the number of fissions was determined by monitoring during the neutron exposure. The results obtained show good internal consistency and indicate that $(8.9 \pm 0.3) \times 10^{17}$ and $(4.8 \pm 0.25) \times 10^{18}$ fissions respectively had occurred in the two samples. These results are compared with mass spectrometer data obtained by Williams and Yuster on the same samples to find the ratio of the capture and fission cross-sections of U-235.

LAMS-632

A FAST DOUBLE COINCIDENCE CIRCUIT

Edward Dexter October 13, 1947 17 pages (Restricted)

A fast double coincidence circuit is described from which much valuable data may be obtained, which circuit yields a recording pulse every time the necessary conditions are fulfilled in a time interval less than the resolving time of the circuit. In this case of a double coincidence circuit, resolving time is defined as the minimum time separation between the arrival of two pulses for which no recording is produced. The double coincidence circuit described here enables one to limit the resolving time to three known values. Three gate lengths are provided, namely 0.25, 0.5, and 1.0 microseconds, and this length determines the resolving time of the circuit.

M-4069

MOLECULAR DISTILLATION METHOD FOR THE SEPARATION OF URANIUM ISOTOPES

T. I. Taylor, et al. (National Bureau of Standards)
January 10, 1946 36 Pages (Secret)

The seven experiments carried out were designed to show the effect of operating conditions on the separation coefficient. Both the effect of rate of evaporation and of the difference in temperature between the evaporator and condenser were studied. Under conditions of practically complete condensation of the distillate (condenser at 18-25°C), measurements were made using three different temperatures for the evaporator to determine the variation of the separation coefficient with rate of distillation. The effect of fractional condensation upon the value of the separation coefficient was studied by maintaining a constant temperature of evaporation and varying the temperature of condensation by circulation of cooling liquid maintained at the appropriate temperature.

Two types of experiments were used for the determination of the separation coefficient, a . One consisted in distilling a large amount of material until only a small amount remained. This procedure resulted in a decrease in the concentration of U-235. The percentage change in the concentration of U-235 (percentage enrichment) is given by the following equation

$$x_1\% = 100 \frac{(a-1)x_2}{(ax_1 + x_2)} \ln C$$

$$C = \text{"cut"} = \frac{\text{volume of starting material}}{\text{volume of residue}}$$

a = separation coefficient

Δx_1 = mole fraction of "light" component in the starting material

~~SECRET~~

x_2 = mole fraction of "heavy" component in the starting material

This equation may be written in the form

$$\Delta x_1\% = -K \log C$$

$$K = \frac{100 (a-1) (x_2) (2.303)}{(ax_1 + x_2)}$$

In the present case where the changes are small and x_1 is small (0.00714) compared to 0.99286 for x_2 , the value of K is very nearly 230 (a-1). Hence

$$\Delta x_1\% \approx -230 (a-1) \log C$$

The second type of experiment consists in starting a large amount of material and distilling only a part of it, for example one-half. This process is repeated so that each time the "light cut" is successively enriched in U-235. Where small changes are involved the percentage enrichment in any one operation is given by

$$\Delta x_1\% = \frac{K \log C}{C - 1} \approx \frac{230 (a-1) \log C}{C - 1}$$

where C is again the ratio of the volume of starting to the volume of the residue. For n identical cuts

$$\Delta x_1\% = \frac{n K \log C}{C - 1}$$

However, if the cuts are not all the same size,

$$\Delta x_1\% = \sum_{i=1}^n \Delta x_1\% = K \sum_{i=1}^n \frac{\log C_i}{C_i - 1}$$

Thus it can be seen that by measuring the percentage change in the concentration of U-235 in these two types of experiments independent evaluations of a-1 can be obtained. The results of the experiments are tabulated.

It would seem reasonable to conclude from the experiments described that a separation coefficient of 1.001 is obtainable at rates of distillation in the neighborhood of 5 to 10 g./cm²-hr.

Estimates are included for the size and requirements of a plant for the production of U235 by molecular distillation.

PROGRESS REPORTS

- ISC-6 PROGRESS REPORT IN METALLURGY
F. H. Spedding and H. A. Wilhelm May 1, 1947 83 pages
(Secret)
- BMI-HWR-29 PROGRESS REPORT FOR THE MONTH OF NOVEMBER, 1947
H. W. Russell, H. R. Nelson, and H. A. Saller
(Battelle Memorial Institute)
December 1, 1947 6 Pages (Secret)
- P-865 PROGRESS REPORT FOR THE MONTH OF OCTOBER, 1947
Iowa State College 11 pages (Secret)
- M-3225 TECHNICAL PROGRESS REPORT FOR OCTOBER 6 THROUGH OCTOBER 12,
1946
A B. Greninger (HEW) October 17, 1946 10 pages (Secret)
- ANL-4092 REPORT FOR THE PERIOD MARCH 1, 1947 THROUGH NOVEMBER 30, 1947
PILE RESEARCH AND DEVELOPMENT DIVISION
W. H. Zimm December 22, 1947 38 pages (Secret)
- ANL-4097 REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER - EXPERIMENTAL
NUCLEAR PHYSICS DIVISION
D. J. Hughes January 5, 1948 52 pages (Secret)