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RESEARCH WORK BY H. L. ANDERSON UNCLASSIFIED

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I. Work done to Ascertain the Feasibility of a Nuclear Chain Reaction

The fundamental nuclear constants of uranium and carbon were determined and the first lattice structure was constructed and measured in the first exponential experiment. All of this work was done at Columbia University between January, 1940, and February, 1942, except for one research which was done at Princeton. The work was done with and under the general direction of Professor Fermi. The following reports were issued covering this work:

A-21 Production and Absorption of Slow Neutrons by Carbon - September, 1940.

A-6 Production of Neutrons by Uranium - January, 1941. Resonance Absorption of Neutrons by Uranium, Ph.D. Thesis-May, 1940.

A-2 Standard in Slow Neutron Measurements - June, 1944.

A-12 Capture of Resonance Neutrons by a Uranium Oxide Sphere Imbedded in Graphite - June, 1941.

C-83 Fission Cross Section for Fast Radon Plus Be Neutrons - January, 1942

C-74 Absorption Cross Section of Boron for Thermal Neutrons - January, 1942.

C-72 Absorption Cross Section of Radon Plus Be Fast Neutrons - January, 1942.

C-20 Neutron Reproduction in a Lattice of Uranium Oxide and Graphite - Exponential Experiment - January, 1942.

II. Work Leading to the Experimental Production of Nuclear Chain Reaction

Methods for testing and eliminating the impurities in uranium and carbon were investigated. Measurements on the fundamental nuclear constants were extended . Studies relating to power piles for producing 49 were made. This work was done at the Metallurgical Laboratory of the University of Chicago between February, 1942, and December, 1942. The following reports were issued:

C-21 Number of Neutrons Admitted by an Ra Plus Be Source.

C-117 Concentration of Impurities in Uranium Oxide.

C-218 Measurement of Neutron Absorption of Impurities in Uranium - July, 1942.

CP-226 Absolute Measurement of Thermal Neutron Flux - August, 1942.

CP-234 Heat Transfer in the Experimental Pile.

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CN-362 Liquid UF_6 Plant for the Production of Element 94 - November, 1942.

In addition, work was done and reported in the monthly reports of this period, under the following topics:

Standardization of Sources.
Resonance Activities.
Foil Standardizations.
Interpretation of the Cadmium Ratio in Exponential Experiments.
Thin Wall Dural Counters.
Standard BF_3 Counters.
Ether Extraction of Impurities.
Diffusion of Mean Free Path in Graphite.
Compressed Ra Plus Be Sources.
Beta Ray Studies.
Thermal Stability of Compressed Oxide Bricks.
Heat Transfer in Graphite Blocks.
Photoneutrons From the Gamma Rays of the Fission Products.
Balloon Cloth Housing for the Experimental Pile.
Exponential Pile Experiments.
Graphite Testing.

III.

The above work was climaxed by the construction of the first nuclear chain reacting pile which was completed December 3, 1942.

CP-413 Experimental Productions of a Divergent Chain Reaction.

The chain reacting pile was studied to extend the understanding of its operations. Application of the pile was made as a measuring instrument. It was used to investigate the special problems which arose in connection with the design of the high-power production piles which were then being planned for Clinton and Hanford. It was used for testing materials for impurities as well as for lattice studies. Fundamental nuclear physics research was carried out using the pile as a source of neutrons. This work was done between December, 1942, and March, 1943, at Chicago, after which a second and improved pile was constructed at the Argonne Laboratories in Chicago, where the work was continued until January, 1944. The work appeared in monthly reports issued during this period under the following headings:

Temperature Effect on Resonance Absorption.
Reproduction Factor of UF_4 and Graphite Lattices.
Standardization of the Argonne Pile.
Interference Effects with Thermal Neutrons.
Capture of Neutrons by Heavy Water.
Neutron Yields from Polonium.
Radioactivities of Commercial Materials.
Control Rod Design.
Energy Liberation in the Production of Plutonium.
Isotopic Cross Sections for Slow Neutrons.

During the latter six months of this period, a large fraction of time was spent in Wilmington as consultant on the design of the Hanford pile. The following report was issued:

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CP-1136 Loading for the Hanford 305 Pile

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The consulting work was covered by reports submitted to Dr. A. H. Compton during this period.

IV.

The full-time work with the Argonne pile was resumed during the period January, 1944, to November, 1944. Work was done on the determination of the fundamental nuclear constants of the isotopes Th^{232} U^{233} U^{235} U^{238} Pu^{239}, important in design of future plants. The following reports were issued:

CKN-1443 C Assay of Product by Fission.

CP2 -079 Thermal Neutron Absorption by U^{238} - August, 1944.

CP2-229 Neutron Production and Absorption by U^{233}.

Work was reported in monthly reports under the following heading:

Amplidyne Control Rod.
Range of Fission Neutrons in Water.
Fast Effect in Uranium Metal Spheres.
Range of Aluminum Recoils.
Yield of Alpha-n Reaction in Sulphur.
Delayed Neutrons from Plutonium.
Fission of Plutonium.
High Sensitivity Neutron Detector.
Dissociation Pressure in Water due to Fission.
Effect of Aluminum and Caps on W Slugs.
Absorption of Plutonium.
Neutrons from H_3 on D_2.
Boron Absorption on Fission Activities.
Total Cross Sections of Thorium and Uranium for Thermal Neutrons.
Isotopic Radio for Depleted Oxide.
Fission Chamber for Monitoring Pile.

V.

From November, 1944, to the present, work was done on the problem of determining the critical mass of spheres of U^{235} reported in LAMS 238. The present assignment is the determining of the nuclear efficience of an imploting plutonium gadget.

VI.

Applications are pending on patents on the following subjects:

Neutron Source.
Improved Beta Ray Counter.
High Sensitivity Neutron Detector.
Particle Ionization Chamber.
Testing Method.
Foil Detector for Absolute Neutron Measurements.
Reactor and Method of Using (UF_6 Plant)
Neutronic Reactor System - a Novel Apparatus.
Reactor Component and Production Thereof (Ether Extraction Method of Purification)
Reactor and Process (Gas Envelope)

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