UCRL 438
Copy 2

UNIVERSITY OF CALIFORNIA

Radiation Laboratory

BERKELEY, CALIFORNIA

COPY 2

UCRL 438
Unclassified Distribution

UNIVERSITY OF CALIFORNIA

Radiation Laboratory

Contract No. W-7405-eng-48

UNCLASSIFIED

NEW LOW MASS ISOTOPES OF EMANATION (ELEMENT 86)

A. Ghiorso, W. W. Meinke, and G. T. Seaborg

September 5, 1949

Berkeley, California

INSTALLATION	Number of Copies
Argonne National Laboratory	8
Armed Forces Special Weapons Project	1
Atomic Energy Commission, Washington	2
Battelle Memorial Institute	1
Brookhaven National Laboratory	8
Bureau of Medicine and Surgery	1
Bureau of Ships	1
Carbide and Carbon Chemicals Corp. (K-25)	4
Carbide and Carbon Chemicals Corp. (Y-12)	4
Chicago Operations Office	1
Cleveland Area Office	1
Columbia University (Dunning)	1
Columbia University (Failla)	1
Dow Chemical Company	1
General Electric Company, Richland	6
Hanford Operations Office	1
Idaho Operations Office	1
Iowa State College	2
Kansas City	1
Kellex Corporation	1
Knolls Atomic Power Laboratory	4
Los Alamos	3
Mallinckrodt Chemical Works	1
Massachusetts Institute of Technology (Gaudin)	1
Massachusetts Institute of Technology (Kaufmann)	1
Mound Laboratory	3
National Bureau of Aeronautics	2
National Bureau of Standards	2
Naval Radiological Defense Laboratory	2
NEPA Project	2
New Brunswick Laboratory	1
New York Operations Office	5
North American Aviation, Inc.	1
Oak Ridge National Laboratory	8
Patent Advisor, Washington	1
Rand Corporation	1
Sandia Base	1
Sylvannia Electric Products, Inc.	1
Technical Information Branch, ORE	15
U. S. Public Health Service	1
UCLA Medical Research Laboratory (Warren)	1
University of California Radiation Laboratory	5
University of Rochester	2
University of Washington	1
Western Reserve University (Friedell)	2
Westinghouse	4

INFORMATION DIVISION
Radiation Laboratory
Univ. of California
Berkeley, California

NEW LOW MASS ISOTOPES OF EMANATION (ELEMENT 86)

A. Ghiorso, W. W. Meinke, and G. T. Seaborg
Department of Chemistry and Radiation Laboratory
University of California, Berkeley, California

Among the spallation products obtained from the 350-Mev proton bombardment of Th^{232} we have identified two gaseous alpha-emitters which apparently do not decay into any presently known alpha-decay chains. The half-lives observed for the decay of the alpha-activities are 23 minutes and 2.1 hours. These half-lives may be principally determined by an unknown amount of orbital electron capture. At least one alpha-emitting daughter (about 4 hours half-life) has been observed to grow from a gaseous parent, but it has not been determined whether it arises from alpha-decay or electron-capture.

Since these gaseous atoms emit alpha-particles it is assumed that they are isotopes of element 86 (emanation or radon) rather than a lighter rare gas. If they were heavy isotopes such as Em^{221} or Em^{223}, both unknown, they would decay into known alpha-decay series, the neptunium and actinium series, respectively, and so would grow known short lived alpha-emitters which would have been detected. It thus appears reasonable that they must be lighter than the known emanation isotopes.

The lightest isotope of emanation observed prior to these experiments was Em^{216}, which arises from the U^{228} alpha-decay series(1) and which should have a half-life of approximately 10 microseconds as predicted by means of the new alpha-decay systematics(2,3). The reappearance of longer half-lives, such as 23 minutes and 2.1 hours, with lower mass numbers is apparently due to the stable configuration of 126 neutrons. Thus these activities are to be assigned to the mass numbers 212 and lower (that is, Em^{212} and $Em^{<212}$). Therefore it appears that the plot of alpha-energy versus mass number for the isotopes of emanation goes through the same type of maximum and minimum as is observed for bismuth, polonium and astatine.(2)

The method used to measure the emanation alpha-activities was very simple but designed to separate the emanation from tremendous amounts of other alpha-emitters, from bismuth to protactinium. The cyclotron target consisted of thin thorium metal strips sandwiched with thin aluminum foils to act as catchers for the transmuted atoms which were able to recoil out of the surface of the thorium. These aluminum foils were then heated at a very low temperature in a vacuum system. A slow stream of argon "carried" the emanation through two cold traps at -50° C and into a final trap at -90° C where the emanation should freeze out. From this storage trap it was possible to fill a cylindrical ion chamber in which alpha-pulses could be detected. In order to prove that a gas was involved it was shown that the activity could be quantitatively transfered back and forth many times by varying the temperature of the cold trap. After an emanation sample had been allowed to decay for some hours the gas was thoroughly pumped out of the chamber and the alpha-activity left behind (presumably due to the daughters) was followed for decay. It was not possible to measure alpha-energies in these first experiments and Geiger counter measurements were clouded by the probability of xenon and krypton fission product contaminants from which no careful separation had been made.

New equipment is now being built with which it should be possible to measure alpha-energies for these emanation isotopes and their daughters and to determine the proper mass assignments.

We wish to thank James Vale and the crew of the 184-inch cyclotron for their assistance in carrying out this work.

This work was performed under the auspices of the U.S. Atomic Energy Commission.

References

(1) W. W. Meinke, A. Ghiorso, and G. T. Seaborg, Phys. Rev. 75, 314 (1949).
(2) I. Perlman, A. Ghiorso, and G. T. Seaborg, Phys. Rev. 74, 1730 (1948).
(3) I. Perlman, A. Ghiorso, and G. T. Seaborg, Phys. Rev. 75, 1096 (1949).

August 31, 1949.