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UNITED STATES ATOMIC ENERGY COMMISSION

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QUARTERLY PROGRESS REPORT

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TO THE JOINT COMMITTEE
ON ATOMIC ENERGY

July--September 1956

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Part VII

Biology and Medicine

Radioactive Fallout Studies (Project SUNSHINE) UNCLASSIFIED

Information continues to be accumulated on the worldwide fallout of radioactive strontium, its accumulation in the soil, its incorporation into the food chain, and its deposition into the human body, principally in the skeleton. Representatives of the United States, United Kingdom, and Canada, meeting informally on October 18 and 19, found themselves in substantial agreement on methods of measurement and, in those cases where observations are comparable, on results obtained.

As the broader outlines of the fallout problem become better defined, an increasing proportion of the total research effort is required for reducing the degree of uncertainty which still remains in present knowledge of the distribution of fallout and the physical and chemical behavior of strontium. Some of the uncertainties arise from physical and geographical factors such as the vastness of the earth, the relative inaccessibility of both the stratosphere and many geographical areas, and difficulties of estimating fallout into the ocean. Some depend upon the technical difficulties in obtaining and measuring samples. Other uncertainties are the result of lack of information on many details of nature upon which the questions involved in SUNSHINE serve to focus attention, perhaps for the first time.

Estimates of the results of detonations of nuclear weapons to date, in terms of both the present and future distribution of strontium 90 in nature and in man, must be considered as tentative and to require additional measurements. In the opinion of Commissioner Libby and the staff, estimates made by persons actively engaged in the SUNSHINE program are believed to be generally somewhat conservative or "on the safe side."

In a recent address before the American Association for the Advancement of Science, Washington, D. C., October 12, Commissioner Willard F. Libby has estimated that "a total of about 22 millicuries per square mile of strontium 90 is to be found in the soils of the mid-western United States," and that the concentration is about three quarters of this value in similar latitudes in the rest of the world. "The stratospheric deposition would be expected to continue at the expected rate which at the present is about 1.2 millicuries per year, so that some 15 years from now . . . a maximum additional total stratospheric fallout of about 6 millicuries per square mile will have occurred. In the meantime, the present 22 millicuries per square mile would have been reduced to 15 by radioactive decay, just about compensating for the stratospheric deposition." From available data relating human uptake to content of the soil, he estimates that "at the moment we would expect that the body burden for children born now in America eventually would amount to between 0.004 MPC units [4 micromicrocuries per gram] . . . and possibly a figure two or three times higher."

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In an address before the Washington Academy of Sciences, Washington, D. C., November 15, Merrill Eisenbud, Director of the Atomic Energy Commission Health and Safety Laboratory, New York, stated that his estimates of the deposition of strontium 90 in soils are in good agreement with those of Commissioner Libby. On the basis of current concentrations of strontium 90 in milk in the New York area, Eisenbud estimated that 8 micromicrocuries of strontium 90 per gram of calcium becomes the upper limit of the foreseeable strontium burden in the skeletons of the population of that area, and that 25 micromicrocuries of strontium 90 per gram of calcium is the highest foreseeable skeletal burden anywhere in the United States from weapon tests already conducted. Eisenbud qualified the estimate with the statement, "This estimate is likely to be reduced as new information about the uptake of strontium 90 eliminates some of the uncertainties which have prompted the use of highly conservative assumptions." (End of UNCLASSIFIED section.)

Radiological Marine Biology Survey ~~CONFIDENTIAL~~

A survey to determine the amount of radioactivity in the waters around Bikini and Eniwetok Atolls was made during the period June 11-21, 1956, from on board the USS *Walton* (DE 361). The 3,300-mile cruise covered a grid of 53 sampling stations about 45 miles apart, lying between 10° 15' and 14° North Latitude and between 159° and 166° East Longitude, within the restricted zone established for Operation REDWING.

Radioactive materials were found in the plankton samples from every station. The highest plankton counts, 1,100,000 disintegrations per minute per gram (d/m/g) wet weight, were obtained near Bikini Atoll, and the lowest, 1,300 d/m/g, in the northwestern part of the survey area. The average value of 71,000 d/m/g for plankton was about 7,000 times the average value for surface water.

Water samples were collected at the surface and at depths of 25, 50, 75, and 100 meters. The average radioactivity of water was 10,000 disintegrations per minute per liter (d/m/l) at the surface and 3,900 d/m/l at 100 meters. A scintillation probe was used to record continuously the radioactivity of the surface water. This method has interesting possibilities if problems of contamination, vibration, and static electricity can be overcome. The survey successfully demonstrated the usefulness of the various methods in evaluating the amount and distribution of radioactivity in the sea.

The above values for plankton and water are of the same order of magnitude as similar samples from Rongelap lagoon during Operation CASTLE. The only fish collected on this survey were three flying fish in which the radioactivity of the liver sample was about 0.1 that of the plankton, and the muscle 0.05 that of the liver.

The second and final open survey operated from on board the USS *Marsh* (DE 699) between Kwajalein, Eniwetok, and Guam. The 4,000-mile cruise was expected to be completed about October 1, 1956. (End of ~~CONFIDENTIAL~~ section.)

Aerial Monitoring—Operation REDWING ~~CONFIDENTIAL~~

The use of fast moving aircraft to delineate fallout patterns was successfully accomplished during Operation REDWING in support of Task Force fallout studies. P-2V aircraft equipped with the aerial monitoring equipment designed by the Health and Safety Laboratory of the New York Operations Office mapped tens of thousands of square miles of open ocean after each of the large detonations. Equipment employed during REDWING is presently being considered by the Federal Civil Defense Administration to meet state requests that aerial radiation detection instruments be supplied on a matching fund basis as part of the national civil defense program.

Publication of "Medical Effects of the Atomic Bomb in Japan"

"Medical Effects of the Atomic Bomb in Japan," edited by Dr. Ashley W. Oughterson and Dr. Shields Warren, has been published in the National Nuclear Energy Series, Manhattan Project Technical Section, Division VIII, Volume 8. This publication, based on the investigations of the Joint Committee for the Investigation of the Effects of the Atomic Bomb in Japan, which was sent to Japan in 1945 immediately following the Hiroshima-Nagasaki bombings, is the authoritative treatise on the subject.

Training Program

About 90 scientists from approximately 50 educational institutions worked at Brookhaven National Laboratory this summer under the Commission's program for participation by university faculty members in research programs at national laboratories. Fourteen scientists came from other countries. About 20 graduate students were brought to the Laboratory by these visiting scientists to work as their research assistants. The experience provided assists faculty members in their presentation of scientific courses, and in addition may lead to initiation of university research projects directly or indirectly related to atomic energy programs.

There have been about 45 foreign scientists from 20 nations working at Brookhaven for continuous periods of two months to more than a year.

Summer courses for both graduate and undergraduate students were also provided at Brookhaven. The 90 students participating were chosen from 400 applicants, of whom 105 were offered appointments.

Radiobiology Training for High School Science Teachers

Summer courses in general radiobiology, emphasizing the utilization of radioisotopes, were initiated for high school teachers. The plans for this training were developed in cooperation with the National Science Foundation, which reimbursed certain expenses of the participants. The courses were given at the University of New Mexico, Duke University, and Harvard University, and were received enthusiastically by the teachers who participated. It is planned next year to include three additional universities, the University of California at Los Angeles, the University of Pennsylvania, and possibly the University of Tennessee. If the success of the plan continues, courses might be offered in the following year at as many as 20 additional universities.

Participants who completed the course this summer were presented with demonstration kits, which will be supplemented by other materials and teaching aids to be used in conjunction with their high school science courses. The universities which gave the courses will undertake during the coming year to determine how effective the training has been in stimulating the incorporation of atomic energy subject matter in high school science courses.

Cesium Radiation Source

A cesium 137 radiation source of 2,045 curies was delivered recently to the University of Michigan for use in medical therapy. It will be used by the university under a contract executed three years ago covering a comparative evaluation of X-ray, cobalt 60, and cesium 137 sources in clinical teletherapy.

This source is only the second cesium 137 source ever produced for medical therapy. The first is a source of about 1,500 curies in use at the Oak Ridge Institute of Nuclear Studies.

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BIOLOGY AND MEDICINE

At the present cost of \$14 per curie for cesium 137, the newly installed unit has a total cost of about \$29,000.

Cesium 137 is one of the most important of the relatively long-lived gamma-emitting radioisotopes, with a half-life of approximately 35 years. In addition to its medical value, this isotope has many applications in industry. The demand is expected to reach many millions of curies, as the techniques for extracting cesium 137 from reactor wastes are improved and reduced in cost.

The Michigan source consists of powder pressed at 20,000 pounds per square inch into two pellets and placed in a stainless steel container, double sealed to produce a leak-proof capsule. The source measures 3.2 centimeters in diameter and 3.56 centimeters in length, and its specific activity is 24 curies per gram of cesium 137.

During the past year the Michigan group has been treating patients with conventional X ray and with a 1,903-curie cobalt source, the largest high-specific-activity cobalt source in this country. Acquisition of the cesium source completes the university's planned installation of high-energy sources for use in radiation therapy at this project. (End of ~~section.~~)

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