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QUARTERLY PROGRESS REPORT

to the
JOINT
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on ATOMIC
ENERGY

Excerpt

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July - September 1959

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Part VI

Biology and Medicine

MEDICAL SURVEY OF RONGELAP PEOPLE, MARCH 1959 (UNCLASSIFIED)

Whole-body gamma radiation measurements were made during the sixth annual medical survey of the Rongelap people, which was carried out in March. Examination of these people for internal levels of radioisotopes revealed low levels (one to two percent of maximum permissible levels) of cesium 137 and zinc 65. These levels were not appreciably greater than levels found in the previous year, indicating that the body burden of these isotopes in the people has about reached equilibrium with their slightly contaminated environment. Radiochemical urinalyses for strontium 90 have not been completed. No additional medical surveys are planned until approximately the spring of 1961, subject to review and approval by the Trust Territory of the Pacific.

ECOLOGY STUDIES AT RONGELAP ATOLL

This program was begun in March 1958. Expeditions to the atoll were made in March and August, 1958, and in February, March, and September, 1959. However, at the request of the Trust Territory of the Pacific, the next study has been postponed until 1961. Meanwhile, samples and data already collected will be analyzed, and laboratory experiments with large soil samples will be conducted by the University of Washington.

Atypical plants have been observed on some of the islands of the atoll but whether these are the result of radiation exposure is still in question. Since radiation effects upon biota are too elusive to be followed profitably in the field, the emphasis has been upon mineral transport through the biota, which requires evaluation of the stable isotopes as well as the radioisotopes. Efforts during the first year were concentrated on land forms. In September extensive sampling of the lagoon bottom and plankton was accomplished. Some of the points that stand out most clearly thus far are as follows:

In general, cesium 137 and strontium 90 are the principal radioisotopes (half life of about 28 years) found in the land organisms, while discrimination against these fission products is noted in marine organisms which selectively absorb the nonfission produced relatively short lived radioisotopes, such as zinc 65, cobalt 60, manganese 54, and iron 55 (half lives ranging from 260 days to 2.9 years).

Gamma dose rates have declined as expected from theoretical decay curves for mixed fission products. The average and maximum values at Rongelap Island in September 1959 were 0.03 milliroentgen per hour (mr/hr) and 0.04 mr/hr. However, the

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highest average and maximum values were found at Naen Island and were 0.18 mr/hr and 0.25 mr/hr.

The general levels of radioactivity in the biota continue to decline more rapidly than would be expected from physical decay alone with the exception of the levels of strontium 90 in coconut crabs. These latter levels also continued to decline, but at a rate which was not as striking as otherwise noted.

Extensive sampling of soils shows clearly that the radioisotopes are still concentrated in the top inch or less. In lagoon sediments they are found more uniformly mixed to a depth of several inches.

Collection of rain water which has percolated through undisturbed soil shows that cesium 137, rhodium 106-ruthenium 106, zirconium 95-niobium 95, antimony 125, and cesium 144 are being leached from the soil in very small but as yet undetermined amounts.

Cesium 137 is the principal long-lived fission product taken up by the plants. The cesium 137 levels are higher in older leaves than in younger leaves.

There is a general potassium deficiency which increases cesium 137 uptake by the plants. Uptake of cesium 137 varies in all types of soil and biological samples by as much as a factor of five even within a limited area.

Evaluation of calcium levels in the soil in terms of levels of available calcium is very difficult. It is clear that although these are highly calcareous soils, available calcium represents a small fraction of the total calcium. This is important relative to strontium 90 uptake.

RADIATION ACCIDENT AT Y-12 PLANT, OAK RIDGE

Extensive studies and observations were made on the five men who were exposed to dangerous levels of whole-body radiation in the accident which occurred at Y-12 on June 16, 1958. These men, who were exposed to neutron and gamma radiation, were treated at the Medical Division of the Oak Ridge Institute of Nuclear Studies. Although there was good spontaneous recovery from the initial radiation effects, the men showed evidence of profound depression of bone-marrow activity, particularly during the fourth and sixth weeks. They are now in good physical condition, and most of the laboratory tests indicate recovery from radiation injury. The men have all returned to work. Because of the circumstances of the accident, it was possible to establish with good accuracy the radiation dosage, and because of the absence of blast, burns, or uneven dosage of radiation it was possible to assess quite accurately the whole-body radiation effects produced. A publication has been presented of the initial clinical and laboratory findings.*

Amino Acid Measurements

Of particular interest in the changes that were followed was a detailed study of the excretion of certain amino acids, the building blocks of protein in the body. There is some suggestion that the levels of beta aminoisobutyric acid excretion are correlated sufficiently well with dosage of radiation to give useful measurements of exposure.

*"The Acute Radiation Syndrome, a Medical Report on the Y-12 Accident June 16, 1958," ORINS-25.

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Bone Marrow Studies

Bone marrow studies were made at Brookhaven National Laboratory Medical Department. Five of the exposed persons developed symptoms characteristic of the "hemotologic" type of acute radiation syndrome. Three individuals did not show significant clinical signs or symptoms.

The mitotic index (rate at which cells divide) was determined by examination of the bone marrow of all eight individuals. The cells were labelled with tritiated thymidine and studied by autoradiography. Within four days the mitotic index dropped from normal levels (about 9 mitotic figures per 1,000 nucleated bone marrow cells) to less than 1 per 1,000. The decrease seemed to be dose dependent, and thus might serve as a biologic dosimeter. Abnormal mitoses and severe morphologic changes in the cytoplasm and nucleus of blood cell precursors were seen in the first marrow smear performed 12 hours after the accident. Tritiated thymidine was incorporated into myeloid and erythroid precursors indicating the presence of DNA synthesis in remaining cells continuing after four days. The mitotic activity of the marrow of the heavily exposed individuals reached minimal values within about 14 days and was back to normal after 28 days. These findings indicate the possible value of bone marrow examinations after a nuclear accident, both as an aid in estimating the effective dose received and for therapeutic considerations, since blood cell changes as seen in the peripheral blood reflect only indirectly the effects on blood cell formation.

DOSIMETRY OF RADIATION ACCIDENTS

The Oak Ridge National Laboratory is fabricating several hundred improved dosimeter units of their own development, which are capable of measuring both gamma and neutron dose resulting from radiation accidents. These units consist of threshold detectors and chemical dosimeters for the measurement of neutron and gamma radiation dose respectively. The AEC is making these units available to those groups within which the possibility of accidental criticality excursions exists.

PROJECT CHARIOT ENVIRONMENTAL STUDIES

Field parties to conduct planned environmental studies reached the site of the proposed harbor excavation in Alaska (Project CHARIOT) in June. Activities were stepped up during July and August and decreased in September to what will be only intermittent operations throughout the remainder of the year.

Project participation has now been extended to seven groups, each concentrating in areas of their special competency. The University of Alaska is conducting investigations of the flora, small land mammals, sea-cliff birds, human ecology, and exploratory archeology.* Dr. Don Charles Foote is investigating human geography. The Arctic Health Research Center and U. S. Public Health Service are making studies of avian species other than the cliff-dwellers, fresh water algae, and marine mammals. Hanford Laboratories (General Electric Company) is conducting studies to analyze the effects of an atomic detonation on the structure and balance of the ecosystems (the living organism in combination with its environment) of fresh waters and their shorelines, and to study the transference of specific radioisotopes from the detonations through the ecosystems. The University of Washington and the U. S. Fish and

*Artifacts were excavated very close to the project site this summer and are being examined now in an effort to date them.

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Wildlife Service are cooperating in an ecological and oceanographic survey of marine areas adjacent to the site of Project CHARIOT.

In addition, the University of California at Los Angeles will participate in the program to provide radiological assessment and determination of biological availability of the resultant fallout debris. Pre-shot sampling which was to have been included in this project was postponed to a future date because of the rapidly changing radioactive background in the region of the CHARIOT site as the result of fallout from nuclear weapons testing.

Phase II of Project CHARIOT, of which this summer's activities were a part, covers the period of June 1959 to approximately May 1960. If Project CHARIOT is continued, Phase III (continuation and extension of Phase II studies) will commence in June 1960.

When Project CHARIOT, Phase II, was approved by the Commission on May 22, 1959, it was also determined that by January 1, 1960, there would be a recommendation relative to whether the project should proceed or be indefinitely suspended. The recommendation is to be based on the results of the summer surveys and other factors applicable at that time.

RADIATION SHIELDING STUDIES OF OAK RIDGE HOUSES

A series of measurements of shielding characteristics of typical Oak Ridge homes against simulated fallout radiation was made in July. These measurements were an extension of similar measurements at the Nevada Test Site in May 1958. Specific objectives included the determination of the effects of irregular terrain and the shielding generally afforded by the furnishings. The technique involved a point source which was pumped hydraulically through about 2,000 feet of flexible plastic tubing. In each experiment, the tubing was positioned over and around the house being used in such a way as to simulate a fallout pattern. The integrated exposure from radiation at points in the house was measured with ionization chambers and the readings were compared with those made three feet above a flat area covered by the same radiation source. Results of the studies will be released shortly.

FALLOUT LEVELS IN THE UNITED STATES

On September 8 the AEC released the first quarterly statement on fallout, in accordance with the Chairman's announcement of May 5, 1959.* This statement provided the latest information received by the AEC on (1) surface air radioactivity levels, (2) strontium 90 levels in U. S. milk, (3) production of carbon 14 in nuclear explosions, and (4) strontium 90 removal from milk. An appendix to the statement dealt with areas where relatively high fallout had occurred.

ORGANIZATIONAL CHANGES IN AEC

Several components of the Division of Biology and Medicine were transferred to the new Office of Health and Safety. These included the Office of the Assistant Director for Radiation Protection, Health Protection Branch, and Radiation Effects of Weapons Branch.

A Fallout Studies Branch was established in the Division of Biology and Medicine to study the mechanisms of production and transport of radioactive debris through the atmosphere, soil,

*The second quarterly statement was issued October 9 to coincide with the issuance of HASL-69, the latest quarterly strontium report by the AEC's Health and Safety Laboratory, New York.

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plants, and other food products, and ultimate deposition in man. Sources of such radioactive debris may be nuclear weapons detonations, aeronautical and space propulsion systems, or possible nuclear accidents involving release of fission products and fissionable materials along with induced activity.

EDUCATION AND TRAINING

Equipment Grants

Requests from 45 colleges and universities amounting to \$948,860 for assistance in purchase of educational equipment were reviewed and evaluated in September. Thirty-seven requests in the amount of \$434,601 were being processed for award.

Summer Institutes in Radiation Biology

During the month of July, representatives of the AEC visited the radiation biology institutes for the purpose of evaluating individual university performance in the teaching of various courses, and for general evaluation of the program. There was every evidence of the excellent contribution being made during the summer of 1959 through the conduct of these 17 institutes for high school science teachers, and two institutes for biology teachers from small colleges.

This program has been supported for the past four summers under joint sponsorship with the National Science Foundation. The Foundation supports the teacher participants, and the AEC supports the universities conducting the institutes.

Approximately 35 requests were received from colleges proposing the conduct of training institutes in radiation biology for high school and/or college teachers in the summer of 1960. These are being studied, and announcements will be made in November.

The manual, "Teaching with Radioisotopes," prepared by Harvard University under contract with the AEC was distributed in July 1959. It is intended for use by the teachers who have attended radiation biology institutes, and much of its material was contributed by these teachers.

Two shipments of radioisotopes will be supplied during this academic year to the teachers who participated in institutes during the past four summers. These radioisotopes are limited to quantities which do not require a specific license.

During the first week of September, a seminar was held with directors of radiation biology institutes sponsored by the AEC to discuss course content, instrumentation, accomplishments to date, and future plans. (End of UNCLASSIFIED section.)

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