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QUARTERLY PROGRESS REPORT (U)

to the JOINT COMMITTEE on ATOMIC ENERGY

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RESTRICTED DATA

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January - March 1958

UNITED STATES ATOMIC ENERGY COMMISSION

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Part VIII

Biology and Medicine

PROJECT SUNSHINE [redacted]

To disseminate the most up-to-date knowledge of fallout and radiation effects, Commissioner Libby presented a review and analysis of available data in a speech delivered on March 27 before the Swiss Academy of Medical Sciences Symposium on Radioactive Fallout.*

Monitoring and sampling programs to study the distribution of radioactive fallout continued during the January-March quarter, as did research on the biological hazards of fallout. The results of analysis of some of the samples collected are given below.

Stratospheric Monitoring

The preliminary results of analysis for strontium 90 of some of the stratospheric samples collected during the period November 1956 through November 1957 are summarized in Table 1. Progress was made in tests of filter efficiency but it was still not possible to inter-

Table 1 — Average Concentrations of Strontium 90 in Stratospheric Samples Collected November 1956 through November 1957*
Based on Data Available through April 14, 1958

(Strontium 90 content expressed in disintegrations per minute per 1,000 cubic feet of air, reduced to standard conditions)

	Minneapolis, Minn.		San Angelo, Tex.		Panama Canal Zone France Air Force Base		Southern Hemisphere	
Altitude (feet)	Average strontium 90 content	Number of samples	Average strontium 90 content	Number of samples	Average strontium 90 content	Number of samples	Average strontium 90 content	Number of samples
90,000	45 ± 24†	3	15 ± 12	8	<3	1	22 ± 19	7
80,000	23 ± 15	7	28 ± 13	8	28 ± 19	3	34 ± 14	10
65,000	45 ± 37	12	62 ± 31	7	88 ± 72	3	30 ± 12	8
50,000	19 ± 8	6	6 ± 4	6	-	0	3 ± 2	2‡

* Analyses have not been completed on all samples collected during this period. The program calls for one sample a month from each altitude at each location. In some instances the sample was not recovered.

† Range shows one standard deviation above and below average. Standard deviations shown include both errors of measurement and variations in strontium 90 content from month to month.

‡ These samples were collected within the troposphere (below the stratosphere). The 50,000-foot sampling level is usually below the stratosphere at this location.

* Copies of Commissioner Libby's talk entitled "Radioactive Fallout" were provided to the Joint Committee. The document includes tabulations of recent data and bibliographical references to recent contributions to the subject.

pret these data in terms of strontium 90 concentrations in the stratosphere. Moreover, there are considerable variations in the data from one sample to another, which have not yet been accounted for on meteorological grounds.

Foreign Food Collection

The results of analysis for strontium and calcium of the food samples from the Philippine Islands, Turkey, and Libya collected by nutrition teams of the Interdepartmental Committee on Nutrition for National Defense are given in Table 2.

Table 2—Summary of Foreign Food Analyses

Location date (foods collected)	Weight of ash of sample in grams	Weight of calcium in sample in grams	Total strontium 90 in disintegrations per minute per sample	Strontium units (micromicrocuries per gram of calcium)
		(Range of values)*		
Ankara, Turkey				
April–June 1957 (wheat, wheat products, beans, milk products)	0.6 to 25	0.07 to 0.65	less than 0.4 to 5.0	1 to 5
Philippine Islands				
February–March 1957 (legumes, cereals, vegetables, fruit, meat, fish, eggs, coconut, rice, evaporated milk)	0.06 to 0.9	0.004 to 0.06	less than 0.4 to 0.8	4 to 12
Libya				
June–July 1957 (meat, fish, bread, vegetables, cereal, evaporated milk)		less than about 0.10	1.0 to 6.5	†

*The limits of the ranges of values given do not correspond to the same sample in each case.

† Data inadequate to convert to strontium units. The minimum range of values would be 5–29 strontium units (calcium content assumed to be 0.10, the maximum value given); if the calcium content is lower, the range would be higher.

The following values for United States foods may be used for comparison with the values given in Table 2:

1. Determinations by Dr. J. L. Kulp, Lamont Geological Observatory, Columbia University.*

Vegetables average 9.4 strontium units, with a range of 1–29 strontium units, coast to coast.

Cereals average 13.5 strontium units, with a range of 4–23 strontium units.

Milk, liquid and powdered, averaged 6 strontium units in 1957, with a range of 3–10 strontium units.

*Taken from the manuscript, "Current Strontium 90 Level in United States Diet."

2. Determinations by the Health and Safety Laboratory, New York Operations Office.

Perry, New York
Powdered milk, January–August 1957: 3–4.7 strontium units

New York City
Liquid milk, January–August 1957: 3–6.5 strontium units

Mandan, North Dakota
Powdered buttermilk, January–July 1957: 4–17 strontium units (May 1956: 17 strontium units)

Ithaca, New York
Cabbage, July 24, 1957: 23 strontium units

Beans, July 29, 1957: 6 strontium units

MEDICAL SURVEY OF RONGELAP AND UTIRIK PEOPLE, MARCH 1957

The final report on the medical survey of the Marshallese made in March 1957, three years after their exposure to radioactive fallout, has been completed.* Examinations were carried out at Majuro in the Marshall Islands on 82 people of Rongelap who had been exposed to the heaviest fallout (doses estimated at about 175 roentgens) and on a comparison group of unexposed Rongelap people, matched for age and sex. In addition, 144 people of Utirik Island were examined from a Navy LST. The Utirik Islanders were exposed to the least fallout (doses estimated at about 14 roentgens) of any of the exposed people of the Marshall Islands.

The medical survey of the Rongelap people showed them to be in generally good health. The following summarizes the findings:

1. Acute and subacute effects

   a. Penetrating radiation

      (1) Diseases. In general, the incidence of disease, infectious and noninfectious, was about the same in exposed and unexposed groups. No symptoms were present that could be related to radiation effects. Several interesting findings were noted in both the irradiated and unirradiated groups:

         (a) The incidence of congenital anomalies was high,
         (b) Arteriosclerotic and hypertensive heart disease appeared to be as frequent as in Americans,
         (c) Peptic ulcer and psychic disturbances were rare,
         (d) The incidence of dental caries was very high,
         (e) Intestinal parasitism was widespread.

      (2) Nutrition. Nutrition appeared to be as good in the exposed as in the unexposed groups.

*Report in preparation for publication.

(3) Growth and development. In the exposed Rongelap children from about 4 through 9 years of age there was a slight lag in bone maturation (based on X-ray studies of the left wrist), and these children were slightly shorter and weighed slightly less than unexposed children of the same age.

(4) *In utero* effects, pregnancy, fertility. Pregnancies in the exposed group are believed to have been in the normal range for the Marshallese with regard to number, course, and termination. No abnormalities were observed in the babies irradiated *in utero*.

(5) Psychic effects. Little or no effect on the psyche related to their radiation exposure or displacement has been observed in the Rongelap people.

(6) Hematological effects. Lymphocytes and platelets (mean population counts) in the exposed groups continue to lag in complete recovery as compared with the unexposed people. The low values found may be related to widespread parasitism and chronic infections (skin, caries). These diseases may also be a factor in the elevated total serum proteins (average of about 8.0 grams) with high gamma globulin fraction noted in most of the Marshallese.

b. Beta lesions

There remained in the exposed Rongelapese 15 residual beta lesions, which showed varying degrees of mild atrophy, scarring, and pigment aberration. No chronic radiation dermatitis was noted.

An increase in incidence of certain conjunctival and corneal abnormalities was noted in the exposed groups.

c. Internal radiation

There were no acute or subacute effects from internal deposition of fallout isotopes because the body burden of radionuclides was low.

2. Late effects

a. Penetrating radiation

(1) Premature aging, shortening of life span. One death (at the time of this survey) or 1.5 percent incidence in the exposed Rongelap people compares favorably with 5 deaths of 3.0 percent mortality in the Utirik people. In general, the exposed people did not appear older or to have aged faster than the unexposed Marshallese.

(2) Degenerative diseases. No increase in degenerative diseases was noted in the irradiated people as compared with the unexposed populations.

(3) Carcinogenesis, leukemia. No cancer or leukemia was seen. Examination of blood smears failed to reveal any consistent decrease in alkaline phosphatase activity of neutrophiles or increase in basophiles, indicative of early leukemia.

(4) Ophthalmological effects. No loss of visual acuity or appearance of opacity of the lens was seen that could be related to radiation effect.

(5) Genetic effects. No anomalies have been noted in the 13 babies born of irradiated parents since exposure. One possible exception might be the stillborn child of a woman in the original group of irradiated Rongelapese examined. It is not known whether the mother was irradiated before conception or early in pregnancy.*

b. Beta lesions

Gross and microscopic studies of residual skin lesions revealed no changes in the skin indicative of premalignant or malignant change.

c. Internal radiation

Radiochemical analyses of urine samples and whole-body gamma spectroscopy for cesium 137 revealed levels of this isotope several times higher than found in Americans, but far below accepted "tolerance" levels. Because of subsequent worldwide fallout, residue of the original exposure was difficult to differentiate from later absorption. Strontium 90 levels as of March 1957 were far below "tolerance" levels. The body burden of isotopes had dwindled rapidly over the 3 years since exposure and was not considered to present any long-term hazard.

The levels of contamination on Rongelap Atoll were reduced sufficiently to allow safe habitation, and the Rongelap people were moved back to their home island in June 1957.

Future examinations of the Marshallese will include studies of (1) subacute radiation effects, (2) long-term effects of radiation on the human being, and (3) careful ecological radiation studies of the people, particularly studies of the soil-food-human chain for the radioisotopes still present on the island.

CONFERENCE ON BIOLOGICAL EFFECTS OF COSMIC RAYS

A conference on the biological effects of cosmic rays was held at the Donner Laboratory of the University of California, January 21-22. The AEC's growing interest in this subject stems from the possible similarity of damage from cosmic radiation to damage from other types of radiation. The conference reviewed the present state of knowledge about the nature of cosmic radiation, acknowledged the dearth of data on biological effects, and discussed the kinds of data needed. A research program in which the AEC might have an interest would be aimed at elucidating biological indicators of the damage resulting from the very dense ionization of rapidly decelerating heavy particles. Also of interest would be studies to determine whether the dense tracks produce unexpectedly severe effects, especially in the central nervous system. Biological studies of the somatic and genetic effects of decelerating heavy particles could be adequately pursued under laboratory conditions, using available accelerators. Another important aspect of any effects studies undertaken would be the dosimetry of cosmic rays at extremely high altitudes. Measurements taken thus far at very high altitudes and corrected to the zero pressure that occurs at the top of the atmosphere indicate low dosages of approximately 25 millireps per day at the top of the atmosphere.

BACKGROUND RADIATION STUDIES

Heightened interest in the radiation received by man from natural radioactivity has been stimulated by the assumption of many geneticists that there is a linear relationship between

* Reported in "Some Effects of Ionizing Radiation on Human Beings," U. S. Atomic Energy Commission, July 1956.

radiation dose and the incidence of genetic mutations. Although this relationship has not been demonstrated at the low dose rates prevailing in nature, the possibility of such a relationship has led to the suggestion that geographical variations in the frequency of spontaneous mutations may be correlated ultimately with differences in the natural radiation dose to populations.

The July-September 1957 quarterly report described the preliminary results of a study of natural background radiation performed in August by a team from the Health and Safety Laboratory of the New York Operations Office. A report dated March 11 entitled "External Environmental Radiation Measurements in the United States" (HASL-25) presents the data and the team's analysis.

In order to establish the approximate range of population exposures to cosmic and terrestrial gamma radiation, an effort was made to attain results which would be representative of the unperturbed natural background and which would be influenced as little as possible by the occasional substantial variations in the observed natural radiation levels produced by localized sources. Such sources might be ore bodies, granite buildings, brick paving, fallout, etc.

The measurements were made with a specially designed ionization chamber over a period of 17 days during the course of a round trip by automobile from New York City to Utah. Readings were recorded from 154 locations in 19 states.

To account for the cosmic ray contribution at the higher altitude locations in the mountain states, measurements were later made at corresponding altitudes along the east coast during airplane and airship flights. In general, the terrestrial contribution to natural background radiation was found to be about 60 to 90 millirads per year. The cosmic ray contribution was found to range from about 30 millirads at sea level to about 90 millirads at Denver, Colorado, where the elevation is about 5,000 feet above sea level.

ACTIVITIES IN ATOMS FOR PEACE PROGRAM

Mobile Radioisotope Training Laboratory

Preliminary plans have been drawn up for two mobile radioisotope training laboratories for presentation to the International Atomic Energy Agency. Each mobile laboratory would consist of two units, a laboratory and a counting room, contained in a trailer. The two trailer laboratories, accommodating a total of 12 students in each laboratory session, would cost an estimated $85,000. It is felt that a course can be presented that would be essentially the same as the basic course given by the Oak Ridge Institute of Nuclear Studies except for the omission of an activation experiment.

It is planned to include the two mobile laboratories in the United States technical exhibit at the International Conference at Geneva in September 1958. The laboratories would be presented to the International Atomic Energy Agency at the General Conference to be held in Vienna shortly after the close of the Geneva Conference.

Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica

Under the AEC program for the support of agricultural research and radioisotopes training at the Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, a 200-curie gamma irradiation source supplied by Brookhaven National Laboratory has been installed in a gamma field constructed at the institute.

Work continued in preparation for the course in radioisotope techniques to be offered for the first time in the fall of 1958. A humidity-controlled room for counting equipment and a

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laboratory for handling radioisotopes have been constructed, and some equipment has been set up. It is expected that between 8 and 15 students will take the first radioisotope course.

Plans for expansion of the institute call for the construction of a new plant science building with facilities for radioisotope work and classrooms for teaching.

EDUCATION AND TRAINING

Training Equipment Grants

On March 7, 1958, the AEC announced the award of 31 additional grants totaling $373,599 to 30 colleges and universities to provide assistance in equipping their laboratories for training in nuclear applications in the life sciences. Grants in this group were for assistance in the fields of medicine (12), biology and agriculture (17), and health physics (2).

Since the first awards were made under this program in October 1957, 52 training equipment grants have been made to 46 educational institutions for a total of $713,597. Amounts requested range from $1,900 to $112,000; the awards granted range from $1,381 to $30,000 and average about $13,500. The next review of requests for such assistance was scheduled for May 1958. (End of U[redacted]D section.)

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