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By authority of the U.S. Atomic Energy Commission
Per Lindsley H. Noble BW Date January 31, 1950
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U. S. ATOMIC ENERGY COMMISSION

Washington, D. C.

QUARTERLY PROGRESS REPORT

October-December 1949

REPORT TO THE

JOINT COMMITTEE ON ATOMIC ENERGY (U)

January 30, 1950

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pages 2-50

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PART VI

BIOLOGY AND MEDICINE [redacted]

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Special aspects of the Commission's program of biology and medicine have been singled out recently for intensive work during the next year:

1. Civil defense planning activities.

2. Research on radioactive waste disposal.

3. Studies to establish permissible levels of exposure.

4. Studies of radiation injury and long-term effects of radiation.

5. Training health physicists in radiation protection.

Recent developments in each of these fields will be described.

Civil Defense Planning

The Commission's role. In November the Commission reaffirmed its responsibility for providing civil defense planning agencies and the public with data concerning the effects of atomic weapons. The Division of Biology and Medicine was designated to coordinate the Commission's civil defense activities and serve as liaison with the National Security Resources Board (NSRB), the National Security Council, the General Services Administration, and other interested agencies.

Steps are being taken to proceed immediately with a positive program in this field, including the preparation of a paper for doctors on the treatment of persons exposed to radiation; the completion of a paper for the engineering and construction industry, "Atomic Bombs vs. Buildings"; the preparation of a manual for operating and maintaining monitoring instruments; and the preparation of a paper on decontamination. A statement on "The City of Washington and an Atomic Bomb Attack" was furnished the National Security Resources Board and the National Security Council.[1]

Training courses. The AEC initiated plans for two types of civil defense training courses during the quarter. One is to train radiological monitoring instructors, and the other course is to train instructors in the medical aspects of atomic warfare. The groups thus trained in

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1/ This statement was transmitted to the Joint Committee, November 17, 1949.

[redacted]

turn will establish in their home institutions and localities similar courses for the instruction of others who ultimately will compose local civil defense organizations. The responsibility of the AEC in this undertaking will be limited to the original teacher-training level, and will not extend to subsequent courses given, except that training materials, advice, and consultation will be furnished as necessary.

Final arrangements for the radiological monitor training course were made early in January.[1] The course is planned to be of 5-weeks' duration and will be given at Brookhaven National Laboratory, Oak Ridge, and University of California (Los Angeles) in the near future. Participants will be selected by invitation of the National Security Resources Board to the States. The qualifications required of individuals for attendance will be jointly agreed upon by the NSRB and AEC, with the latter reserving the right of final selection.

Monitoring teams. Plans discussed in Chicago, October 12, 1949, for establishing and operating emergency radiation monitoring teams were further developed.[2] Each major AEC installation will have one or more teams composed of trained personnel available to monitor on-site incidents involving the release of radiation. These teams will also be available for off-site service if a radiation disaster should occur.

The consideration being given to the publication of certain unclassified portions of the Weapons Effect Handbook was mentioned in the preceding quarterly report. "Medical Aspects of Atomic Weapons," the first of these advance reports, dated December 22, 1949, was submitted to the NSRB for dissemination to the States.[3] This report was prepared jointly by the Department of Defense and the AEC. The second report of the series will concern blast effects of atomic explosions on structures and protective construction.

Radioactive Waste Disposal

So that the discharge of radioactive waste may be held to safe levels as production activities increase, the Commission must develop suitable waste handling and disposal techniques, carefully design and locate new production facilities, and sponsor research to accomplish the easier and more economical handling and final disposal of radioactive wastes, still maintaining protection of the public.[4]

1/ The physician training course was described in a letter of December 23, 1949, from the General Manager to the Executive Director, Joint Committee.

2/ The Joint Committee was initially advised of the purpose and operation of these teams by letter, March 24, 1949.

3/ The report was transmitted to the Joint Committee, December 28, 1949.

4/ Copies of a public report by the Atomic Energy Commission, "Handling Radioactive Wastes in the Atomic Energy Program," were transmitted to the Joint Committee, December 7, 1949.

This work also includes determining the levels below which radioactivity is harmless to man or his environment, and measuring radioactivity in and around working areas to make certain that these permissible levels are not exceeded.

The amount of radioactivity in discharged wastes that can be considered allowable from the biological and human standpoint must be determined. New data are needed to give added assurance that present disposal techniques are acceptable or to indicate changes advisable from the standpoint of public health or economy of Commission operations. Commission studies in this field now include:

1. Research on utilization of radioactive isotopes by plants and animals. Low levels of radioactivity in water or soils become a hazard to humans and higher animals to the extent that this activity is taken up and concentrated by plants and lower animal forms which, in turn, serve as food for higher animals or man.

2. Research on monitoring methods. Work is still necessary to develop routine methods of radioactivity detection suitable for measurements of low intensity radiation in water, air, and food.

3. Research on normal radioactivity in man and nature. Data on the radioactivity normally present in rocks, soils, natural waters, plants, animal life, and the human body are needed as a basis for considering disposal techniques.

Research proposals approved by the AEC during the quarter in these and other related fields are listed in Appendix D.

Permissible Levels of Exposure

The operation of production plants in the atomic energy program of necessity discharges some radioactive waste products into the environment. The complete elimination of radioactivity from the environment is not necessary. Throughout its existence the human race has been subjected to radiation by cosmic rays and natural radioactivity in soil, rocks, and water. Living organisms have some resistance to damage by radiation, and the problem is to determine the level of this resistance. Exposure to certain amounts of radiation is known to harm man. However, the imposition of unjustifiably rigorous standards for permissible exposure would result in excessive operating costs and lowered operating efficiency. Research is therefore under way to determine as accurately as possible the optimum level of protection which must be given to populations located in the vicinity of atomic energy plants.

External radiation. Living organisms can repair a small amount of radiation damage as fast as it occurs. Determining the level of this "tolerance dose" for man and animals is under study.

Early research on the subject was largely confined to short-lived species of animals such as rats and mice and to brief experiments of a year or two at most. Considerable uncertainty exists, however, in extrapolating the results of these experiments when calculating the effect of long-duration, low-intensity exposures on man. These data must be supplemented therefore by lifetime chronic exposure studies on relatively long-lived species such as the dog, and by a more critical survey of the fragmentary data available on man in the records of radiologists. The mouse genetic program recently established at Oak Ridge may be important in establishing the effects of the low level exposure on large segments of human population.

Internal emitters. Radioactivity accumulates in the human body following prolonged exposure to certain radioactive isotopes in air, water, or food, inasmuch as these isotopes are selectively absorbed by various organs of the body. Depending upon the rates of absorption and excretion, the energy of the radioactivity, and the sensitivity of the organs to radiation damage, it is possible to arrive at a figure for the permissible concentrations of the radioactive elements in air and water consumed by human populations. All the values of the biological reactions required for the calculations (such as rate of absorption, sensitivity, etc.) are not known accurately, and the calculated results must be qualified with arbitrary "safety factors" which may or may not be fully justified. Research programs to obtain better data are in effect at the Los Alamos Scientific Laboratory and at Argonne National Laboratory, and it is planned to encourage the initiation of research projects in this field at other AEC facilities and at private institutions during the next year.

Radiation Injury and Long-Term Effects

Radiation cataract studies. The appearance of incipient cataracts among a few nuclear physicists (off the project) who had been exposed to cyclotron-produced radiation led to the Commission's request last year that the Division of Medical Sciences of the National Research Council make a thorough study of the problem. The Committee on Radiation Cataracts of the National Research Council, established for the purpose, assisted in studying the cases of radiation cataracts, recommended a sound research program, and screened research proposals for their scientific merit. As a result of their recommendations, approval was given during the quarter to research projects on radiation cataracts at four universities - Harvard, Massachusetts Institute of Technology, University of Chicago, and State University of Iowa. These are listed in further detail in Appendix D. Other proposals are under consideration, and related studies are being made at Oak Ridge National Laboratory and Argonne national Laboratory.

At the suggestion of the Committee on Ophthalmology of the National Research Council, the Atomic Bomb Casualty Commission (with funds provided by the U. S. Atomic Energy Commission) sponsored a survey to determine what, if any, late ocular effects have resulted from the atomic

bombings in Japan. This survey, led by Dr. David G. Cogan of Harvard Medical School, has revealed ten cases of cataracts which are believed to have been caused by the atomic bombs. All cases were within 550 to 950 meters of the hypocenter at the time of explosion. The frequency of atom bomb cataracts now, or to be expected in the future, cannot be stated at present due to the selective methods used in discovering these ten cases.

Long-time effects of radiation. In order to learn about the genetic effects of chronic exposure to radiation, the Commission is supporting investigations of the rate of accumulation of harmful genes in experimental populations of Drosophila (fruit fly) exposed to varying dosages of X-rays. Progress has been made in these studies even though they were initiated only recently. In addition, a proposal has been approved to make extensive studies of the effects of both acute and chronic radiation upon longevity and fertility in mice, as well as an accompanying study of the genetic effects. The Commission will gain information needed for its own problems and will also make substantial contributions to basic knowledge of population genetics.

Health Physics Training

The monitoring of radiation exposure to insure that permissible levels are not exceeded is a function of health physics. There are approximately 375 professional health physicists in AEC plants and laboratories and in various other clinical and experimental stations. As atomic energy production and the use of isotopes increase in importance, the need for competent health physics service will also increase.

Until recently training courses were administered by the National Research Council. At Oak Ridge National Laboratory and at the University of Rochester the Commission has provided health physicists with training of a more comprehensive nature than is possible with on-the-job training. The last group of 13 students completed the regular courses in September and, of these, 8 were placed in health physics positions and 5 have returned to school for further training. The new group begun in October includes 21 students at Oak Ridge and Rochester, 2 at the University of Minnesota, and 1 at the California Institute of Technology. The last 3 will take advanced work in radiation biophysics.

Plans are under way to administer the 1950-51 training program through the University of Rochester and the Oak Ridge Institute of Nuclear Studies.

Construction of Facilities

Construction of four important facilities for the biology and medicine program were brought to substantial completion during the quarter. These included the Rochester Training Building ($1,089,000) on the campus of the University of Rochester; Phase I of the Biology Laboratory ($500,000) at Brookhaven; the Experimental Animal Farm ($307,000) and

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the Personnel Meters and Records Building ($190,000), both at Hanford.

Important installations under construction at the end of the quarter were the Biology Laboratory Building ($1,063,000), 47 percent complete, at Hanford; and the cancer wing of the Oak Ridge Hospital ($235,000), 70 percent complete. Bids for construction of the Argonne Cancer Research Hospital, the design of which was completed during the quarter, will be requested when the operating and land-lease agreements are executed by the University of Chicago and the Commission. (End of [redacted] section.)

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Progress Report to the Joint Committee on Atomic Energy

JUNE THROUGH NOVEMBER 1953 (U)

Part III - Weapons

By authority of the [redacted]
Per Francis J. McCarthy Date January 6, 1954

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AEC letter 3/2/65

UNITED STATES ATOMIC ENERGY COMMISSION

WASHINGTON, D. C.

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