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Progress Report to the Joint Committee on Atomic Energy

DECEMBER 1952 THROUGH MAY 1953

UNITED STATES ATOMIC ENERGY COMMISSION

WASHINGTON, D. C.

JUNE 22, 1953

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PROGRESS REPORT OF THE

United States Atomic Energy Commission

DECEMBER 1952 THROUGH MAY 1953

PREPARED FOR THE

JOINT COMMITTEE ON ATOMIC ENERGY

OF THE UNITED STATES CONGRESS

JUNE 22, 1953

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON

June 22, 1953

Honorable W. Sterling Cole
Chairman, Joint Committee on
Atomic Energy
Congress of the United States

Dear Mr. Cole:

Transmitted herewith, in accordance with the Joint Committee's request of July 23, 1947, is the Progress Report of the United States Atomic Energy Commission covering the period December 1952 through May 1953. In this sixteenth report are outlined the measures being taken to accomplish the Commission's major objectives, as well as changes in these program goals which have occurred since the preceding report. As in previous reports, Part III, Weapons, is submitted as a separate document.

Sincerely yours,

Gordon Dean
Chairman

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Foreword by the Commission

The events of the period covered by this Progress Report are highlighted not only by favorable developments in the weapons and fissionable-material production programs but also by recent policy decisions that promise to influence significantly other aspects of atomic energy development. Some of these outstanding events and issues of policy require special comment.

WEAPONS DEVELOPMENT

We have been especially encouraged by recent advances in the weapons development program. The weapons tests that have just been concluded at the Nevada Proving Grounds have contributed to both thermonuclear- and fission-weapon development. These tests may well prove to be the most important continental tests held thus far. Further tests were made of new approaches to such problems as initiation, hollow implosion, and boosting. But perhaps the most significant findings consisted of data which will help the Los Alamos Scientific Laboratory to proceed with greater assurance toward development and early test of deliverable thermonuclear weapons. In order to increase the probability of a successful test of such weapons, we concluded that Operation Castle should take place in early 1954.

The stockpile of fission weapons, measured by numbers, has continued to grow rapidly, as 1953 production has proceeded at a rate about as high as the record level achieved in 1952 (see Part III, Weapons). DELETED which provided a yield of 550 kilotons TNT equivalent when tested last fall at Operation Ivy, DELETED

FISSIONABLE-MATERIALS PRODUCTION

Promising developments have also occurred in the production of fissionable material. We have found it possible, as a result of higher reactor power levels that have been effected, as well as reasonable anticipation for still further increases, to project a steady-state rate of plutonium production that is one-fourth higher than was originally planned under the expansion program authorized in 1952. Alternatively, part of this additional effective reactor capacity may be used to produce larger quantities of tritium, if required for weapons, and still permit us to meet or exceed our previously projected rate of plutonium production. The added effective capacity has also permitted us to eliminate construction of the sixth reactor previously planned for Savannah River.

Construction of new fissionable-material production facilities has continued satisfactorily since the work stoppage last winter in the Dunkirk, N. Y., plant of the American Locomotive Company. Both plutonium and uranium 235 production rates have risen sharply since six months ago, mainly reflecting new facilities having come into operation. The daily rate of plutonium formation in the

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Hanford piles was 27 per cent higher in May 1953 than in November 1952. This was possible because of higher operating power levels and the achievement of six-pile operation after a series of shutdowns to install new safety equipment in the five old units. The Redox chemical separation process is functioning satisfactorily, and only a small fraction of total plutonium separation is now accounted for by the old bismuth phosphate process. Uranium 235 production is currently 50 per cent higher than six months ago, largely because the C-31 plant (Paducah) is now fully on-stream. The first unit of C-33 was placed on-stream in April.

RAW MATERIALS

The larger feed requirements of the fissionable-materials plants are being met, notwithstanding the smaller shipments of uranium concentrates received from the Belgian Congo during the past year. A substantial part of the feed now consists of depleted uranium recovered from past and current pile operations at Hanford. First shipments of uranium from South Africa have been received, and new important ore bodies have been discovered in Canada and in the Colorado Plateau. These developments reinforce our confidence that the goal established last year of procuring 12,500 tons of uranium annually will be achieved by 1960.

POWER REACTORS

Turning to the events in reactor development, we would call special attention to major policy issues remaining to be settled. We have recently presented to the Joint Committee a statement of our policy on the development of economical power from nuclear reactors, looking toward greater contributions by groups outside the Commission. Proposed interim legislation based on this statement of policy has been drafted and submitted to the Bureau of the Budget. The Joint Committee has been currently informed of budgetary actions affecting plans for constructing pilot-model power reactors. As to military power reactors, another milestone was passed in March 1953, when the Submarine Thermal Reactor was completed and brought to criticality at the Reactor Testing Station. Meanwhile, the Experimental Breeder Reactor is continuing to provide data on breeding, the technical accomplishment of which was highlighted in the preceding Progress Report.

EXCHANGE OF INFORMATION

We are proceeding with special arrangements, in accordance with the provisions of the amendment to Section 10 of the Act, to permit the exchange of information with Canada needed to secure technical data on the proposed use of flat-plate fuel elements in AEC production reactors. Meanwhile, the broad problem of what this nation's policy should be toward future atomic energy relations, and the exchange of technical information, with the United Kingdom and Canada has been a matter of continuing study by the Commission. As one aspect of this continuing study, members of the Commission's staff visited the United Kingdom to examine personnel security practices and problems. An exchange visit by British personnel is now under way. Although all personnel employed on the British project have been cleared for access to British classified atomic energy information in accordance with their standards, our representatives report that the newly instituted procedure of a full background investigation comparable to ours will require between two and three years to complete for all personnel currently at work on the British project. (End of [redacted] section)

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON

June 17, 1953

Mr. Gordon Dean
Chairman, United States
Atomic Energy Commission

My dear Mr. Dean:

I submit herewith, in response to the Commission's request, a report of progress in the activities of the U. S. Atomic Energy Commission during the period December 1952 through May 1953.

Respectfully submitted,

M. W. Boyer
General Manager

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*Transmitted as separate document.

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PART VI

Biology and Medicine

(UNCLASSIFIED)

The Commission's biology and medicine research program is focused primarily on studies of the nature of radiation sensitivity of various organisms and particularly on radiation sickness in man. The specific aims of this research are (1) to adopt and continuously verify permissible levels of radiation and (2) to study the effects of overexposure and develop methods of treatment. These aims complement the over-all objectives of the biology and medicine program: (1) to develop means of protecting people from the harmful effects of radiation; (2) to develop new beneficial uses for radiation in the treatment of disease; and (3) to investigate possible effects of radiation on crop yields and on development of new varieties of plants.

Most of this research is conducted in the Commission's laboratories and at private institutions throughout the nation. Another important source of research data is weapons tests, which verify laboratory results and produce new information which cannot be obtained in the laboratory. The recent test series has revealed important facts about the effects of blast on structures and vehicles and is also expected to increase our understanding of the medical and psychological effects of atomic detonations. (End of UNCLASSIFIED section)

WEAPON TEST ACTIVITIES

Fall-out Data on Operation Ivy ([redacted])

The world wide monitoring network described in the preceding Progress Report has produced a large amount of data on fall-out from Operation Ivy, which was conducted at Eniwetok in November 1952. Evaluation of these measurements showed that only very low radioactivity was present in the Pacific Islands. Outside Eniwetok Atoll the highest reading was approximately 1.5 milliroentgens per hour of gamma radiation 60 hr after the first detonation. Air-sampling units set up at a number of islands were not activated since fall-out did not reach the minimum measurable value of 0.5 milliroentgens per hour. In the United States, observations disclosed air activity 500 times above normal at Hanford, Wash., but this value declined quickly. The amount constituted no health hazard. (End of [redacted] section)

Operations Upshot-Knothole (UNCLASSIFIED)

Fall-out Data. A number of detonations in Operations Upshot-Knothole, the recent spring tests at the Nevada Proving Grounds, have produced significantly greater fall-out than those of previous

series. These relatively heavy fall-outs resulted from tower shots of higher energy yield than those in previous continental tests. (See Part III, Weapons.)

In a few cases where such action seemed advisable, AEC warned residents of nearby communities of the approaching radioactive cloud. The fall-out was not hazardous, but, in keeping with AEC policy to limit exposures to radiation, the populations were requested to remain indoors for 2 or 3 hr during the time of actual fall-out. The highest possible radiation doses of gamma rays based on measurements of survey teams in communities were calculated as follows:

Location	Approximate population	Potential gamma dose, roentgens	
		13 weeks	Lifetime
Riverside Cabins, Nev.	14	9.0	13.0
Bunkerville, Nev.	200–300	5.2	8.2
Hurricane, Utah	1500	5.0	7.7
Rockville, Utah	300	4.2	5.8
Santa Clara, Utah	300	3.8	5.3
Springdale, Utah,	200	3.6	5.0
St. George, Utah	4500	3.5	4.9
Lincoln Mine, Nev.	200	3.0	3.8

These doses are based on the extreme assumptions that (1) people remain in the locality continuously, (2) none of the activity is lost through weathering, and (3) there is no attenuation due to intervening walls, floors, etc. These calculations therefore represent the extreme case, and the actual doses were undoubtedly much less. Data obtained on the effects of weathering and from film badges placed in several communities indicated that actual values were about half those shown in the tabulation. This fact would indicate that the highest radiation dose did not significantly exceed the standard of 3.9 roentgens for a 13-week period recommended by the Ad Hoc Committee consisting of authorities in the fields of medicine and roentgenology. The value of 3.9 roentgens is conservative since about 25 roentgens are required to produce observable changes, which are neither dangerous nor permanent, in the blood structure. In fact, about 100 roentgens, delivered in a short time, are required before the onset of radiation sickness.

The measured air and water concentrations were all within safe limits. The maximum permissible concentration in air is 1 microcurie per cubic meter, averaged over 24 hr. Since the highest reading obtained, 1.29 microcuries per cubic meter at St. George, Utah, existed for only a single 24-hr period, it may be concluded that the concentration level did not represent a hazard to health. The highest water concentration, 0.000087 microcuries per cubic centimeter in the Virginia River Irrigation Canal, was well within safe limits.

The only anomalous fall-out recorded in distant parts of the nation occurred on the second day after the seventh detonation in the Troy-Albany, N. Y., area during a heavy rain. It was found after final evaluation of the data that the 13 weeks' integrated dose did not exceed 0.1 roentgen.

Collection of Fall-out Data. During the recent spring tests in Nevada, special attention was given to procedures for assembling, evaluating, and interpreting fall-out data collected by the various test monitoring groups. Special steps were taken to furnish this information promptly to

public health officers and state officials so that possible questions arising from erroneous public speculations could be answered without delay. With the cooperation of the U. S. Weather Bureau, trajectory maps were prepared to record the actual movement of the main portion of fall-out from the detonations. The U. S. Public Health Service assisted in the important work of interpreting for the public the health aspects of fall-out. In addition, scientists at 10 Commission installations throughout the country were designated as authoritative sources to whom local public health officials could refer for fall-out information. (End of UNCLASSIFIED section)

Radiological Telemetering Program (CONFIDENTIAL). The detection and measurement of the nature and quantity of fall-out during test operations are costly in terms of manpower and equipment. To reduce the large requirements for highly trained technical personnel in the monitoring system, the Commission has developed a type of radio network which permits the automatic transmission of radiological and meteorological data, without the need for personnel at remote locations. For the current tests a prototype network of three stations was constructed in an area 10 to 30 miles downwind from the target area. Excellent reception was obtained up to 25 miles from the control point and on occasion at distances up to 70 miles away. These results indicate that with relay stations it is possible to cover distances of 200 to 500 miles as effectively with the telemetering system as with the present mobile team method, which involves the hazards of exposing personnel to fall-out. (End of [redacted] section)

Civil Effects Tests (CONFIDENTIAL). Plans for civil effects tests for Upshot-Knothole, as described in the preceding Progress Report, provided for three months' activity at Nevada Proving Grounds by some 185 physicians, physicists, biologists, geneticists, architects, and other specialists. Basic data from these studies are now being evaluated. Some significant results already determined are as follows:

1. Structures — The typical frame house located 3500 ft from ground zero was 90 to 95 per cent destroyed although the basement area was not greatly damaged. A similar house at 7500 ft was badly damaged but remained standing.

2. Shelters — Eight FCDA underground "back-yard" shelters appeared capable of withstanding blast overpressures of at least 20 pounds per square inch and of providing reasonable protection from radiation.

3. Vehicles — General damage to the structure and mechanism of test vehicles was noted. The possible use of vehicles as personnel shelters is being studied.

4. Blast and displacement — The 15 dogs placed in two communal shelters 1400 ft from ground zero all survived the detonation and recovered within a few hours. Radiation and thermal effects on the dogs were found to be negligible. Although some degree of local hemorrhage was found in heart valves and lungs, the most severe of these lesions would not have been lethal. Tests with dummies simulating the human body suggested that the tossing about of occupants and objects would have been the greatest hazard in these shelters.

5. Biomedical studies — Results of genetic studies using fly populations, plant materials, and a small number of mice will be determined after a longer period of examination. (End of [redacted] section)

Project Gabriel [redacted]

On several occasions the Commission has examined the general question of how many atomic weapons can be detonated without hazardous long-range and short-range radiation effects on man, animals, and crops. When the expansion program was considered in 1951, it was tentatively concluded that the proposed stockpile would not contain a number of weapons approaching this danger

limit. The Rand Corporation was selected in 1952 to examine one aspect of this conclusion more thoroughly. To date, Rand has calculated a preliminary sample estimate of the range of distribution of radioactive fall-out which would occur from a 1- to 10-kiloton detonation. One important consideration is the relatively large amount of radioactive debris which may be brought down by rain from low-level bomb clouds. In some cases a more serious radiation hazard may be created by weapons of low yield than by those of higher yield, because the radioactive bomb cloud produced by the latter is carried to higher altitudes than are normally reached by weather disturbances.

After the basic principles for one detonation have been established, the problem will be to determine possible statistical distributions of rain-out resulting from a number of bombs detonated in patterns which vary in time and space. A problem of this magnitude will require additonal studies by independent groups like Rand. A consultant group to advise the Commission's staff has recently been established to expedite this work and to ensure that all phases of the problem are properly considered. (End of S[redacted] section)

RESEARCH ACTIVITIES (UNCLASSIFIED)

Since July 1952 the Commission has renewed 240 projects and approved 78 new contracts for research in cancer, medicine, biology, and biophysics in universities, hospitals, and private laboratories throughout the nation. The greater part, about two-thirds, of the Commission's research in biology and medicine is conducted at about a dozen AEC installations. Newest of these is the 58-bed Argonne Cancer Research Hospital, which was dedicated in March 1953.

Effects of Radiation

The Commission supports a number of projects designed to study the effects of radiation on animals. Data obtained are useful in determining the probable effects of radiation on humans. (End of UNCLASSIFIED section)

Massive-dose Studies (CONFIDENTIAL) The effects of radiation are such that in the absence of other types of injury men and animals can exercise their normal faculties for some period after receiving what constitutes several times a lethal dose. Because of implications for both offensive and defensive tactics, the Air Force is especially interested in determining how long and to what extent men could retain their normal abilities after receiving a massive dose from atomic projectiles at altitudes of 40,000 ft or higher. To determine these limits, the Los Alamos Scientific Laboratory has irradiated rats, mice, and monkeys with a barium lanthanum source of 10,000 to 30,000 curies. In one experiment monkeys temporarily lost coordination and became nauseated following exposure. Eventually, but after different intervals, all refused to perform completely certain learned tasks. The experiments showed that the incapacitating dose for monkeys lies between 10,000 and 30,000 roentgens. There is no significant change in the relative biological effectiveness of gamma rays when dose rates are varied from 6000 to 9000 roentgens per minute. (End of CONFIDENTIAL section)

Detection and Treatment of Brain Tumors (UNCLASSIFIED)

Massachusetts General Hospital in Boston is developing instruments and techniques to aid in the external localization of brain tumors. Radioactive isotopes administered intravenously to animals in which tumors have been induced concentrate in cancerous and normal tissues in varying

ratios. A slightly higher concentration in the tumor mass enables the investigators by coincidence counting with newly developed instruments to locate the tumor mass within the head.

The Northwestern University Medical School in Chicago has been developing applications of ionizing radiation in the possible treatment of brain tumors. Small pieces of gelfoam impregnated with radioactive colloidal gold or chromic phosphate were implanted in the brain tissues of 50 healthy adult cats. A small zone of dead tissue soon surrounded the site of implantation. However, later examination disclosed that the dead tissue was replaced by regenerating tissue. The experiments suggest a possible therapeutic application of radioactive gold or chromic phosphate to ensure the complete eradication of diseased tissue following surgery.

Somatic Mutation Studies

A number of agricultural experiment stations in the eastern states have sent trees and shrubs to Brookhaven National Laboratory for planting in the experimental field surrounding a cobalt 60 source. Trees or shrubs ranging from seedlings to mature flowering plants have been set out in the field at various distances from the gamma source. Mutations induced by radioactivity may be expected to appear in buds of trees or plants of any age. Later, cuttings can be transferred as scions to other nonirradiated plants at the home agricultural stations. Mutations similarly induced in seeds may become evident after a much longer period of growth and testing. It is hoped that the project will result in new and valuable varieties of trees and plants which can be made available to the public.

Argonne Cancer Research Hospital

The recently completed Argonne Cancer Research Hospital operated under contract by the University of Chicago was formally dedicated on Mar. 14, 1953. The building was constructed and equipped at a cost of $4,200,000 and was ready for occupancy in December 1952. This 58-bed hospital is the largest facility ever built specifically for the application of atomic energy in the study, diagnosis, and treatment of cancer.

Complete laboratory facilities, supplemented by a variety of radiation sources available in the Chicago area, will be used for both research and clinical studies in the diagnosis and treatment of experimental cancers and whole-body radiation injury. Facilities of the hospital will be employed by the staffs of Argonne National Laboratory and its 32 participating universities and research institutions in the Midwest.

Eniwetok Biological Laboratory

The Commission is considering the establishment of a small biological station at Eniwetok which would continue the work heretofore conducted by the University of Washington in measuring the uptake of fission products by plants, fish, and other marine life in the Pacific. The facilities would be made available to other Government agencies and to a few university biologists. Construction and maintenance costs for a small laboratory accommodating eight biologists would be held to a minimum by using existing facilities. (End of UNCLASSIFIED section)

Exposure of Uranium Miners to Radiation

When the U. S. Public Health Service conducted a survey of some 60 uranium mines on the Colorado Plateau in 1950, it was found that concentrations of radon and its radioactive products

in the mine atmospheres were far higher than recommended standards. Under an agreement with the Commission, the Public Health Service in the summer of 1952 surveyed 157 mines, representing about 90 per cent of those operating on the Plateau. Results showed that in 78 per cent of these mines, employing 84 per cent of the miners, atmospheric concentrations of radioactive products of radon were higher than the standard of 100 microcuries per liter adopted by the Public Health Service. In 1953, investigations will be continued to find effective methods for reducing this concentration. (End of [redacted] section)

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PARTIAL DOCUMENT RECORD SHEET

Parts of this document were judged irrelevant to the CIC collection effort and were not copied:

Pages Part I (pgs. 11-24), Part II (pgs. 25-38), Part III (pgs. 39-40)

~~Enclosures~~ Part IV (pgs. 41-50) Part V (pgs. 51-56)

~~Attachments~~ Appendix A (pgs. 63-81)

Other _____

DOE ARCHIVES

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W Leach
signature

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date