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Progress Report to the Joint Committee on Atomic Energy

JUNE THROUGH NOVEMBER 1951

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UNITED STATES ATOMIC ENERGY COMMISSION

US DOE ARCHIVES

326 U.S. ATOMIC ENERGY
COMMISSION

WASHINGTON, D. C.

DECEMBER 21, 1951

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To the Joint Committee

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PROGRESS REPORT OF THE

United States Atomic Energy Commission
DOE ARCHIVES

JUNE THROUGH NOVEMBER 1951

PREPARED FOR THE

JOINT COMMITTEE ON ATOMIC ENERGY
OF THE UNITED STATES CONGRESS

DECEMBER 21, 1951

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

December 21, 1951

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Honorable Brien McMahon
Chairman, Joint Committee on
Atomic Energy
Senate Office Building
Washington 25, D. C.

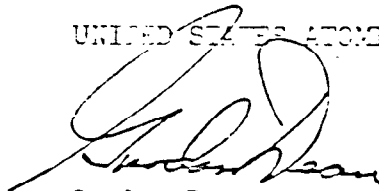
Dear Senator McMahon:

Transmitted herewith in accordance with the request of the Joint Committee, dated July 23, 1947, is the Progress Report of the United States Atomic Energy Commission covering the six-months' period June through November 1951. As in the last report, Part III and Appendix F of the Report are being submitted as separate documents.

This is the Commission's thirteenth progress report outlining the measures being taken to accomplish major objectives. These were set forth initially, covering approximately a five-year period, in the Program Goals Report, November 15, 1947. Since then the Committee has been furnished restatements of program objectives in succeeding periodic progress reports.

Sincerely yours,

UNITED STATES ATOMIC ENERGY COMMISSION



Gordon Dean
Chairman

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FOREWORD BY THE COMMISSION

This Progress Report, covering the period June - November 1951, is necessarily confined to the Commission's presently authorized atomic energy program. A joint study of the extent to which atomic energy facilities might be further expanded is now being completed for submission to the Joint Committee by the Department of Defense and the Commission. Corresponding joint studies are also proceeding in the National Security Council preparatory to a Presidential decision on the recommendations of the participating agencies.

Because of the possibility that an expansion program of some magnitude will be authorized by the President and the Congress, we have taken certain advance planning steps, within the present availability of funds, which will assure rapid and orderly execution when and if an expansion program is authorized. The principal positive steps taken are as follows:

1. Two site surveys were begun, one by Stone & Webster for a gaseous diffusion plant, and the other by the Corps of Engineers for a new reactor location.

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2. Additional work under the Union Carbide and Carbon Corporation contract was authorized, utilizing funds already available, to permit Carbide to start work on establishing the scope of new gaseous diffusion facilities, developing design criteria and preliminary design on process plant and equipment, and planning for procurement and manufacture of specialized equipment.

3. The estimated requirements of critical materials, equipment, electric power, and manpower were transmitted to the Munitions Board and the Office of Defense Mobilization to indicate the possible impact of an expansion program and the necessity for the highest priority treatment.

Notwithstanding the long-run importance of expansion plans now being studied by the Executive Agencies, it must be recognized that the effect of any further overall expansion in plant capacity will not be forthcoming as additional fissionable materials and weapons until after 1955. Because the 4-year period immediately ahead is so critical in the nation's defense, it is of the utmost importance that the present expansion of facilities be carried forward with the greatest speed, that existing plant and resources be utilized most efficiently, and that improved techniques and scientific advances continue to be introduced promptly into weapons, fissionable material, and raw material production.

During the last 6 months certain developments have occurred which provide some assurance of meeting the goals of present programs, and permit planning for a substantial further expansion. Raw material procurement goals in 1956 have been increased 25 percent over the minimum target

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we established last spring. Both Canadian and South African prospects have improved since our previous progress report. The Fedox plant at Hanford is essentially complete and is expected to be operating at capacity this spring, thus returning for enrichment in the gaseous diffusion facilities the depleted material which formerly had gone into underground waste storage. This will represent the culmination of years of the most difficult research and development and will link in combined operation the production of plutonium at Hanford and Savannah River and the production of uranium 235 at Oak Ridge and Paducah. The last unit of the K-31 addition at Oak Ridge was placed in full operation early in December, 2 months earlier than anticipated.

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In contrast, key segments of the present expansion program have proceeded less favorably, as the combined result of work stoppages, delays in deliveries of materials and equipment, and inadequate and competing priorities. Construction completion dates have had to be set back sharply for several highly important projects (see Appendix B). For example, completion of the Dana heavy water production plants, which were 77 percent complete against a scheduled 89 percent at the end of November, has been set back 3 months to April, 1952. At the Savannah River Plant, the du Pont Company has predicted that if the present unsatisfactory delivery experience is continued there will be a 9-months' delay in the project, with the startup of the first reactor being set back from the former target of October, 1952, to as late perhaps as June, 1953.

Difficulties too have arisen in the production of plutonium and certain nonnuclear weapon components. The continued occurrence of ruptured slugs in the Hanford reactors caused additional pile outage time and prevented attainment of the increased rates of plutonium synthesis previously projected. Problems with the radar fuze device designed for the Mark 6 have delayed the operational date of this weapon. Notwithstanding these setbacks, the production of both fissionable materials is now at its highest point, and the stockpile of nuclear and nonnuclear weapon assemblies is substantially higher than a year ago. Fissionable material and weapon production in 1951 have met the levels authorized by the President under the Atomic Energy Act at the beginning of the year.

Two full-scale test operations were successfully conducted at the Nevada Test Site in October and November. Operation BUSTER involved five detonations for weapon development purposes and included the satisfactory proof-testing of the [REDACTED] DELETED [REDACTED]. Operation JANGLE consisted of one surface shot and one underground shot to investigate the effects of atomic explosions under these conditions.

Research and development provided new guidance and laid the groundwork for further advances. In view of the potential usefulness in weapons of uranium 233 for fission weapons and lithium 6 for certain thermonuclear approaches, steps are being taken to furnish these materials in some quantity. In the reactor development program the completion of the Experimental Breeder Reactor and the Homogeneous Reactor Experiment

will shortly provide some of the experimental data required for determining the feasibility of breeding and of fluidized reactors, respectively. Broad contributions to further understanding, in both the basic and applied sense, were made by the physical research and biology and medicine programs, as outlined in the body of the Report.

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

December 21, 1951

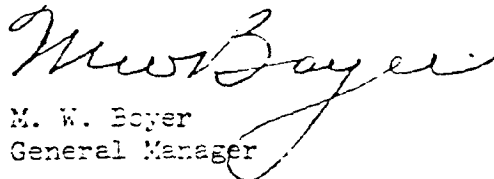
Mr. Gordon Dean
Chairman, United States
Atomic Energy Commission
Washington 25, D. C.

My dear Mr. Dean:

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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 June through November 1951.

Respectfully submitted,


M. W. Boyer
General Manager

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* Transmitted separately.

PART VI

BIOLOGY AND MEDICINE

(UNCLASSIFIED)

The biology and medicine program is primarily concerned with evaluating the extent of radiation and other atomic energy hazards, prescribing adequate protective measures for atomic energy operations and personnel, and providing related information to other Government agencies responsible for civilian and military defense. Recent weapon tests have presented special problems and opportunities in this respect, which are discussed below.

Related activities of a continuing nature are also discussed which include protection of workers in Commission installations, the development of radiation instruments for both monitoring and research uses, the study of the effects of radiation on other mammals, and provision of facilities for the application of atomic energy techniques to the study and treatment of cancer. Basic research in the application of atomic energy to the life sciences continues as the long-range activity. A comprehensive discussion of current research in plant sciences will be included in the forthcoming Semiannual Report to the Congress. (End of UNCLASSIFIED section.)

Weapon Test Activities ~~()~~

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During the summer and fall, the Commission's biology and medicine staff contributed to the planning for the BUSTER-JANGLE series of weapon tests held in Nevada in October and November. In addition, in cooperation with the New York Operations Office, a program for measuring the radioactive fall-out over the United States from the detonations was planned and executed. Several related research projects were also sponsored.

Operation RANGER, carried out in January and February, 1951, had demonstrated that the Nevada site could be used safely for aboveground shots such as those planned for BUSTER, provided that the energy release is not too great and weather conditions are favorable. The surface and underground shots contemplated for JANGLE, however, presented new and more serious problems of radiological safety.

The AEC officials primarily responsible for recommendations to the Commission as to the feasibility of the tests met in May at Los Alamos and again in July at Washington with representatives of the Armed Services, the Geological Survey, and the Los Alamos and Sandia Laboratories and with leading AEC scientific consultants to evaluate the potential contamination and establish criteria for safety. General agreement was reached that both the surface and underground shots could be conducted without undue radiological hazard, but that the results of the surface shot should be closely studied to determine that the underground shot could be carried out with reasonable safety.

As a basis for later measurement of the lingering radioactivity resulting from these operations, a background survey was made of naturally occurring radioactivity in soils and plants throughout the entire test area. At the sites of the underground and surface shots, analysis of soil samples taken by the Beltsville Soil Laboratory at various depths down to 22 feet disclosed about 10 times the concentration of calcium, sodium, and potassium normally found in arable soils. Planning therefore included the expectation that induced radioactivity resulting from neutron capture by these elements would be greater than in other soils.

Exposure of test personnel. A total integrated gamma dose of 3.9 roentgens over any period of 13 consecutive weeks which included the test period was established for BUSTER-JANGLE test personnel. This level was based on the established standard of 0.3 roentgens per week for AEC project personnel. Only an emergency was considered justification for deliberate exposure beyond 3.9 roentgens. This level was exceeded in the cases of only two persons, the highest exposure being 5.0 roentgens.

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Monitoring activities within 200 miles. The Test Director's radiation safety unit was assisted by monitors from the Armed Forces, the Public Health Service, the Federal Civil Defense Administration, and several AEC laboratories; in addition, seven staff members and AEC fellows in radiological physics from the University of Rochester assisted in evaluating dust phenomena during JANGLE. Eight mobile teams covered the area within a 200-mile radius and others were assigned to nearby communities. As expected, radiation levels in populated areas during BUSTER rarely attained values in excess of one-tenth milliroentgen per hour, or about five times natural background. In a few instances levels up to about 10 milliroentgens per hour were observed which decayed to negligible values within a day or two. Precise timing of the JANGLE detonations in relation to weather conditions resulted in fall-out on populated areas not significantly different from BUSTER. For both series, the cumulative exposure which residents received fell far short of the level agreed upon as the signal for carrying out evacuation plans.

Nation-wide monitoring activities. The New York Operations Office coordinated the procedures to measure the radioactivity resulting from the BUSTER-JANGLE series in the atmosphere, rain, and snow throughout the United States.

This office earlier in the year had supervised a sampling network to measure radioactive fall-out in this country resulting from Operation GREENHOUSE at Eniwetok. Radioactivity had been measured at many places throughout the United States with the help of AEC laboratories and contractors and the National Association of Photographic Manufacturers. The highest level of fall-out recorded was at Rochester, New York, where on one day the maximum activity was 5×10^{-10} curies per square foot and of no hazard to health.

For the BUSTER-JANGLE tests, the New York Operations Office furnished complete equipment to 50 Weather Bureau stations, each of which

made several collections daily and forwarded the samples for uniform processing to the New York Laboratory, the Argonne, Brookhaven, and Oak Ridge National Laboratories, Hanford, the University of Rochester, or the University of California at Los Angeles. The Air Force tracked radioactive clouds across the country and made detailed atmospheric observations along the 85th meridian from Florida into Ontario. All data were brought together in New York to analyze the relationship between fall-out and weather conditions and to study the nature of radioactive dispersion in the atmosphere. Interpretations were made more difficult, particularly in October, by the presence in the atmosphere of other radioactivity originating in Russia.

At no locale in the United States was the observed level of radiation high enough to be significant in terms of human and animal health. The fall-out from the Nevada tests was sufficient, however, to trouble the photographic industry, which found it necessary temporarily to suspend certain operations. (End of ~~section~~ section.)

FCDA participation. (~~SECRET~~). The Federal Civil Defense Administration was invited to participate in the BUSTER-JANGLE operations to test bomb shelters of a backyard-type, which might be installed by home owners. Twenty-nine shelters of three basic types were exposed to shots BAKER, CHARLIE, DOG, and EASY. FCDA representatives also served as monitors and took an active part in other radiological safety activities.

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AEC personnel shelter test. A prototype communal shelter, to accommodate about 50 persons, was exposed to the same four shots to determine its suitability for use by AEC and contractor personnel at key installations such as Hanford. With a view to simplicity, economy, and maximum salvage value, the structure tested was built of 90-inch culvert pipe, half of it reinforced concrete and half corrugated iron, and covered with 3 to 4 feet of earth. Its location was 800 feet from ground zero in the first three of these shots and a greater distance from shot EASY. Shots CHARLIE and DOG each exposed it to blast, radiation, and thermal effects of greater severity than would be sustained at ground zero from a 20-kiloton explosion detonated at a height of 2,000 feet. Observable damage was slight to moderate. Although recorded measurements are still being studied to judge the probable effects on occupants, the resistance of the structure to blast confirmed the theoretical design estimates of the effects of overpressures on the structure. (End of ~~section~~ section.)

Project GABRIEL ~~SECRET~~

Project GABRIEL is a study begun several years ago to determine the long-range toxic effects which might result from the detonation of a large number of atomic bombs. This question is being reexamined in the light of recent bomb tests by the following ad hoc committee, whose membership suggests the broad scope of the inquiry:

- Dr. Lauriston S. Taylor, physicist, National Bureau of Standards
(Chairman of committee)
- Dr. Nicholas M. Smith, Jr., theoretical physicist, Operations
Research Office, Johns Hopkins University, contractor for U. S.
Army
- Dr. Edward Teller, theoretical physicist, Los Alamos Scientific
Laboratory, and University of Chicago Institute of Nuclear
Studies
- Dr. Joseph Kaplan, geophysicist, University of California at Los
Angeles
- Dr. Leo Marinelli, radiologist, Argonne National Laboratory
- Col. Benjamin Holzman, meteorologist, U. S. Air Force
- Dr. Sterling Hendricks, soil scientist, U. S. Department of
Agriculture
- Dr. William Urry, physicist, U. S. Air Force, AFOAT-1
- Dr. Donald Rock, mathematician, U. S. Air Force, AFOAT-1
- Dr. Sverre Pettersen, meteorologist, U. S. Air Force, Air Weather
Service
- Dr. Shields Warren, Director of Biology and Medicine, U. S. Atomic
Energy Commission

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The committee has been assisted by members of the Commission's staff.

At a 2-day meeting in late November the committee reviewed tenta-
tive findings on long-range effects and went on to consider short-range
effects as well. A report of the committee's deliberations is being pre-
pared for the information of the Commission. (End of ~~section.~~)

Radiation Protection for Atomic Energy Workers (~~section~~)

The Commission's policy with respect to providing radiation pro-
tection to atomic energy workers is based on all accumulated evidence,
both historical and experimental. For certain kinds of radiation, the
permissible levels to which workers may be exposed have been increased.
On the other hand, there are indications that exposure to neutrons, to
take one example, is more hazardous than had earlier been assumed. Re-
laxation of engineering design standards for radiation protection in AEC
installations is not warranted at this time.^{1/} (End of ~~section~~
tion.)

Design criteria for protective construction (UNCLASSIFIED). Per-
sonnel protective features of existing Commission plants have been stud-
ied and design criteria for new plants are being formulated which will be
related to vulnerability to enemy attack.

Planning for emergency facilities. Canadian reports of the explo-
sion a year ago in the Chalk River chemical processing plant have prompted
certain design changes in first-aid facilities planned for Sandia and

^{1/} The basis for this conclusion was set forth in greater detail in a
statement furnished the Joint Committee on June 19, 1951.

Argonne, to permit safe and expeditious handling of patients exposed to radiation without contaminating hospital facilities, in the event a similar accident should occur. (End of UNCLASSIFIED section.)

Investigations of Radiation Effects ()

Body protection. Scientists at Argonne National Laboratory have pursued their discovery, described in the preceding report, that in administering near-lethal and lethal doses of radiation to mice, the shielding of the spleen with lead greatly increases the probability of survival. The substance supplied by the shielded spleen appears to stimulate irradiation-damaged bone marrow to resume production of red blood cells. Accumulating evidence suggests that this stimulating factor, also found in normal bone marrow and embryonic tissue, is not specific to each species of mammal, and therefore may offer a promising approach to the treatment of whole body radiation injury, in which restoration of red blood cells is so important.

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At the University of Rochester additional dog facilities have been completed for use in studying the therapy of whole body radiation illness. In preliminary work blood transfusions and antibiotics, singly and in combination, have been administered to a small number of animals.

Investigations by the University of California at Los Angeles reveal that certain pleomorphic bacilli predominate in the small intestine of surviving heavily irradiated rats. These bacteria apparently exert an antagonistic effect against other organisms which tend to invade the radiation-damaged small intestine. When grown in the laboratory, these bacilli were found to produce antibiotic substances which are harmful to a number of organisms not affected by currently available antibiotics. This observation may be of significance in the treatment of whole body radiation injury.

Radium Toxicity

Radium symposium. A symposium was held in New York on June 13 and 14 to study radium and radon toxicology. The measurement of radium and radon in the human body received primary attention. It was concluded that on the basis of present knowledge, maximum permissible levels for these substances should not be increased.

Argonne Study. The Argonne National Laboratory has issued a preliminary report on its study of 26 persons who were given radium intravenously some 20 years ago as "treatment" for a variety of conditions. About 100 such individuals have been located, all of whom will be studied. The resulting data will be a basis for more definitive estimates of the toxicity of plutonium and other alpha-emitting heavy elements used in the atomic energy program. (End of section.)

Cancer (UNCLASSIFIED)

New facilities. The Argonne Cancer Hospital was 66 percent complete on November 30 and is expected to be completed in April, 1952.

At the San Francisco Hospital of the University of California Medical School, the 70 Mev synchrotron has been installed in the AEC-financed cancer research facility. When final testing is complete it will be used to study and treat cancer in human patients and in experimental animals.

Photosynthesis

The chemical transformations involved in photosynthesis^{1/} are being investigated by several AEC contractors. The University of California at Berkeley, by use of radioactive carbon 14 in the carbon dioxide of the atmosphere in which plants are growing and by very accurate control of the light, has traced the reactions through a number of steps. **DOE ARCHIVES**

Evidence to date indicates that all plants go through the same initial chemical steps and only later make specialized products. Basic knowledge obtained from this and other studies may eventually permit the synthesis of plant substances to be greatly accelerated. It may develop that specialized products of different algae, minute one-celled plants, can some day be produced on a greatly enlarged scale for use as food or fuel by growing the algae in nutrient solutions under precisely controlled conditions. (End of UNCLASSIFIED section.)

Radiation Detection and Measurement Instrumentation (~~SECRET~~)

Instruments for monitoring use. Project 5.1 of Operation GREENHOUSE covered tests of instruments for military, civil defense, and AEC monitoring use. Although many instruments performed well, continued work is required on the design of lighter weight instruments which will operate reliably under conditions of high humidity, wide temperature changes, and rugged field usage. Also, because residual radiation encountered in the field from an atomic burst consists largely of the low-energy radiation resulting from multiple gamma ray scatterings, more emphasis will be placed on developing and redesigning instruments which will measure soft radiation with the same degree of accuracy as gamma radiation of higher energies can now be measured. (End of ~~SECRET~~ section.)

Instrument loans for civil defense training (UNCLASSIFIED). Since about a year ago the Commission has been lending radiation monitoring instruments and radioactive isotopes to qualified state and local civil defense organizations for training. In all, loans have been made to 22 state organizations and 9 cities. (End of UNCLASSIFIED section.)

^{1/} A report on the extent of Commission support for photosynthesis research was furnished the Joint Committee on November 26, 1951. Progress in this work will be described in greater detail in the forthcoming Eleventh Semiannual Report to the Congress.

Electronic tube developments ~~(UNCLASSIFIED)~~. The contract with the Radio Corporation of America for development of special purpose electronic tubes has been extended. Although the prototype tubes so far developed do not fully meet Commission requirements, significant progress has been made during the year in developing two types of photomultiplier tubes and a pulse height selector cathode ray tube. These tubes will achieve increased sensitivity, and will be able to amplify about a billion times the original photo electronic response to the radiation being measured. These improvements will make possible experiments and physical measurements on nuclear properties which have heretofore been very difficult to perform. (End of ~~RESTRICTED~~ section.)

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Air radon measurements (UNCLASSIFIED). In cooperation with the U. S. Public Health Service, AEC is measuring radon contamination of the air in Colorado-Utah uranium mines. Samples taken at the mines formerly had to be sent to one of three distant laboratories equipped to analyze them. The use of a recently developed portable unit permits analysis of air radon samples within the mine itself within 30 minutes. (End of UNCLASSIFIED section.)

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PARTIAL DOCUMENT RECORD SHEET

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Pages ~~Part I (Pgs. 1-12), Part II (Pgs. 13-24), Part III (Pgs. 25)~~

Enclosures ~~Part IV (Pgs. 26-34), Part V (Pgs. 35-41)~~

Attachments ~~APPENDICES (Pgs. 49-83)~~

Other _____

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W. Teach
signature

10/2/85
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