UNITED STATES ATOMIC ENERGY COMMISSION

Ninth Semiannual Report

OF THE

ATOMIC ENERGY COMMISSION

January 1951

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C.

LETTER OF SUBMITTAL

WASHINGTON, D. C.
31 January 1951

SIRS: We have the honor to submit herewith the Ninth Semiannual Report of the United States Atomic Energy Commission, as required by the Atomic Energy Act of 1946.

Respectfully,

UNITED STATES ATOMIC ENERGY COMMISSION.
T. KEITH GLENNAN.
THOMAS E. MURRAY.
SUMNER T. PIKE.
H. D. SMYTH.
GORDON DEAN, *Chairman.*

The Honorable
The President of the Senate.

The Honorable
The Speaker of the House of Representatives.

CONTENTS

APPENDICES

FOREWORD

The AEC has been occupied with two principal activities during 1950. It has carried out the operation of all existing production and development facilities at full capacity. It has placed considerable emphasis on the completion of plans for new plant construction and expanded operations in order adequately to serve the Nation's interests in the years immediately ahead.

The President's appointment of Mr. T. Keith Glennan rounded out the Atomic Energy Commission to its full complement. Mr. Carroll L. Wilson resigned as General Manager, effective August 15. Mr. Marion W. Boyer was appointed to succeed him and entered on the work November 1.

This Ninth Semiannual Report to the Congress gives a summary of the year's program operations insofar as they can be reported within the limits of national security. It provides as well a brief review of the methods which the Commission follows in contracting with industries, research institutions, and with universities and colleges for the carrying on of the many phases of the national atomic energy program. It is believed that this résumé will provide a convenient reference for members of Congress and their constituents who may have need to know about the general principles governing the letting of contracts. This program, probably more than any other in the United States Government today, is carried on through contracts with private industry rather than by direct Government operation. The enlistment of a large and growing cross section of industry in the provision of business methods and scientific and engineering competence is one of the prime aims of the Commission. It is hoped that the brief outline here presented will help to widen participation of all segments of the economy in the atomic energy program.

Part One

1950 Progress and Activities in Major Atomic Energy Programs

MAJOR ATOMIC ENERGY PROGRAMS, 1950

This Ninth Semiannual Report of the Atomic Energy Commission to the Congress is made in two parts. Part One reports what can be described in an unclassified document about progress and activities in major programs of the AEC during 1950. The Joint Committee on Atomic Energy of the Congress is kept currently informed of progress and activities through classified reports and other communications and through consultations and hearings.

Part Two describes administration of the atomic energy contracts—how programs are planned, contracts are administered, and controls established and executed to assure performance and to carry out the policies and purposes of the Atomic Energy Act of 1946.

Production

The President, in a message to Congress on December 1, 1950, requested a supplemental appropriation of 1.050 billion dollars for atomic energy programs. The message said: "These funds will enable the Commission to enlarge its production capacity substantially. The new facilities will provide larger capacity for the production of fissionable materials . . . The fissionable materials thus produced can be utilized either in weapons or as fuels for power-producing atomic reactors. The program for building these additional facilities has been developed after thorough study . . ."

The Congress approved this request, appropriating 1.065 billion dollars on January 2, 1951.

This was the second supplemental request made for additional funds for atomic energy facilities for fiscal year 1951. Five months earlier, on July 7, the President forwarded a request for 260 million dollars to finance construction in addition to that already provided for in the regular supply bill for fiscal 1951. In submitting this request (later approved without change by the Congress) the President forwarded a letter from the director of the Bureau of the Budget, stating:

"This supplemental appropriation is requested to implement further your directive of Jan. 31, 1950, to the Atomic Energy Commission that it continue its work on all forms of atomic weapons, including the hydrogen or fusion bomb. This approved request is primarily for the construction of additional and more efficient plants and the necessary related facilities. These additional plants will provide materials for weapons—either the atomic bomb or the hydrogen bomb—or for fuels potentially useful for power purposes. The plants will be of advanced design and their operation will provide new knowledge that will speed the progress of the atomic energy program."

New Facilities

The Savannah River Project

On November 28, 1950, the Commission announced plans for construction on a 200,000-acre tract in Aiken and Barnwell Counties, S. C., of new facilities, to be designed, built, and operated for AEC by E. I. du Pont de Nemours & Co., wartime builders and operators of the Hanford (Wash.) Engineer Works.

Selection of the Savannah River site was made after a 4-month search covering more than 100 sites in all parts of the United States. The center of the area lies about 15 air miles south of Aiken, S. C., and about 20 miles southeast of Augusta, Ga.

The du Pont company estimated that construction of the Savannah River Plant, scheduled to start early in 1951, would take a working force of 8,000 in the first 6 months. AEC announced that, except in certain areas where immediate construction was planned, the land acquisition would not affect the 1951 crop harvest on farms in the 200,000-acre tract. The Corps of Engineers, in carrying out the land acquisition program, is to follow the procedure prescribed by Federal statute, namely, just compensation at a fair market value of the land acquired, with right of appeal to Federal courts for any owner dissatisfied with the Government's offer.

At the time of the site announcement, the Government was prepared to supply information to residents of the area and others having interest in the new plants. Inquiries on employment and housing were handled by AEC and du Pont at Augusta, inquiries on land purchase policies and property rights by the Army Corps of Engineers at Aiken, and inquiries on farm relocation by the Aiken and Barnwell Federal-State agricultural agencies.

The Kentucky Project

In a second announcement, December 15, 1950, the Commission disclosed that the President's request of December 1 included funds for a new facility to produce uranium 235 by the gaseous diffusion process employed at Oak Ridge—the plant to stand on a 5,000-acre site including the 1,400 acres now comprising the Kentucky Ordnance Works, 16 miles west of Paducah, Ky.

In setting criteria for choice of the site, AEC consulted the Department of Defense and the National Security Resources Board; and other agencies lent assistance. For reasons of speed and economy the search was confined to tracts owned wholly or partially by the Government.

Of the score or more of sites surveyed, some were found to be unavailable; the terrain at others was too rough for large-scale construction; and still others lacked accessible electric power. By September 1950, the search had narrowed down to three sites. Of these, the Kentucky Ordnance Works appeared to offer the greatest number of advantages.

The owner of the site, the Department of the Army, had declared it excess. The General Services Administration, while maintaining the buildings and machinery on a stand-by basis had sold all but 1,400

of the 5,000 acres surrounding it. In the case of 1,000 of the acres disposed of, however, reacquisition presented no difficulty; GSA had inserted in each deed of sale a clause under which the Government retained the right to repurchase at its option.

The recommendation was submitted to the Site Review Committee, earlier appointed to advise the Commission and du Pont on the site for the South Carolina project. They also unanimously approved the Kentucky site.

Electric power. A major requirement of the new gaseous diffusion plant is for electric power. The location chosen had to be such that fuel and water would be available for large new power plants. Additionally, the location had to have available—in the interim period before these large plants were in operation—substantial amounts of power from already existing sources. The Kentucky site meets both of these requirements.

In October, AEC began negotiations for provision of both its long-term and short-term power needs. TVA undertook to provide all the power needed, if necessary. Negotiations with individual private utilities failed to develop acceptable proposals. AEC next explored the possibility that a combination of private companies might supply all or part of the power required and also install such interconnecting lines as would take care of the need of "interim power."

The result of these negotiations was a proposal by a group of five utilities to construct with private funds a large power plant capable of supplying half of AEC's requirements. They also proposed to put in interconnecting lines through which any power excess to AEC's needs could be fed back into the utilities' systems and power excess to the utilities' needs would be available to AEC, especially during the interim period. The companies, organized for this purpose as Electric Energy, Inc., are: Central Illinois Public Service Co., Illinois Power Co., Kentucky Utilities Co., Middle South Utilities, Inc., and Union Electric Co. of Missouri. The agreement with Electric Energy, Inc., is currently in the form of a letter contract providing for both the construction of the power plant and the provision of feeder lines to the Paducah area.

TVA has agreed to furnish the remaining half of the power requirement and received in a supplementary appropriation the funds needed to start construction of the necessary installations and lines.

Construction. Present indications suggest that construction of the Kentucky project will involve a peak force of 10,000 on construction and an ultimate operating force of 1,600. Upon passage of the appropriation, AEC established at the site a Kentucky Area Office to report to the Oak Ridge Operations Office.

Union Carbide and Carbon Corp., contractor for the production and research facilities at Oak Ridge, Tenn., will operate the plant, and is responsible for process design and procurement of special and critical equipment and materials. F. H. McGraw & Co., Hartford, Conn., will be principal construction contractor for the plant and associated service and administrative facilities, and will install pro-

duction equipment. Three architect-engineer firms have been selected—Giffels & Vallet, Inc., Detroit, for preliminary engineering and design of the plant and inspection of construction; Sargent & Lundy, Chicago, for design and inspection of construction of power facilities; and Smith, Hinchman & Grylls, Inc., Detroit, for design and engineering for sanitary and fire water systems, sewer system, steam plant, and miscellaneous structures.

Defense priorities

The AEC, along with the Department of Defense, was one of the two agencies initially empowered by the National Production Authority to use DO (defense order) ratings to insure the delivery of critical materials and equipment required in its program. This authority to use priorities has helped at many points to maintain scheduled construction and operations. Under joint sponsorship of the AEC and the Defense Power Administration, the Tennessee Valley Authority and Electric Energy, Inc., were also authorized to use DO ratings to advance AEC work.

Production in 1950

Raw materials. Receipts of foreign ores continued at a satisfactory rate and domestic production continued to increase. New sources of supply, both foreign and domestic, have been developed and are or will be producing in the near future.

Feed materials. Production of feed materials in 1950 was maintained at planned levels—high enough to continue operations at all fissionable materials plants and to maintain stock piles. Progress on new plant capacity, described in the Seventh Semiannual Report, was satisfactory.

Fissionable materials. Construction of additional facilities at Oak Ridge and of auxiliary additions to the plutonium production facilities at Hanford, mentioned in previous reports, proceeded satisfactorily. Production from all completed facilities has been maintained at planned levels.

Military Application

There was continued progress during 1950 in the AEC program for the development of the military application phases of atomic energy.

Close coordination with the Armed Forces was maintained at all levels on the many matters of common interest such as research and development planning, weapons storage, and field training.

Preparations for additional full-scale weapons tests continued, also in close coordination with the Armed Forces. The Eniwetok Proving Ground in the Marshall Islands will continue in use. In addition, the Atomic Energy Commission has been authorized by the President to use a part of the 5,000 square-mile Las Vegas (Nev.) Bombing and Gunnery Range for experiments necessary to the atomic weapons development program.

Included in the Commission's second supplemental appropriation request for Fiscal Year 1951, recently passed by Congress, are funds for increased efforts in the fabrication of fissionable materials for use in atomic weapons and the production and research phases of the weapons program. Details of the program for atomic weapons are reported currently to the Joint Committee on Atomic Energy.

Construction. Construction went forward on new facilities, including those for the Los Alamos Scientific Laboratory and for the Sandia Corporation at Albuquerque, N. Mex., with emphasis on continuing replacement of temporary wartime structures at these locations. Additional housing and community facilities were provided at Los Alamos for the increasing number of persons engaged in the military application program.

Reactor Development

In advancing the development of nuclear reactors during 1950, the atomic energy enterprise:

a) Advanced construction for the Experimental Breeder Reactor at the Reactor Testing Station in Idaho. This reactor will test the feasibility of creating new nuclear fuel faster than it is consumed, and will produce a small amount of power for experimental purposes.

b) Started construction at the testing station on two other reactors—the Materials Testing Reactor and land-based Submarine Thermal Reactor.

c) Began design and construction of a chemical processing plant at the testing station.

d) Started assembly of a small pilot homogeneous reactor at Oak Ridge National Laboratory in a long-range program to develop fluidized reactors.

During 1950, the Oak Ridge School of Reactor Technology opened; AEC began the release of new information on low-power research reactors; colleges offered more nuclear engineering courses; and a small reactor was approved for one university. Information assembled during investigations of liquid metals as heat-transfer media for reactors was published as an unclassified handbook to encourage industrial development. Methods of concentrating liquid and solid radioactive wastes were improved and applied at several atomic energy installations. Stanford Research Institute, Palo Alto, Calif., undertook for AEC during 1950 a technical-economic survey to locate areas of research and development most likely to lead to applications for use of the highly radioactive fission products from reactors.

During the year, private industry expressed interest in financing the design, construction, and operation of reactors for producing both power and plutonium, and the Commission undertook to study the ways and means by which this might be accomplished.

Experimental Breeder Reactor

As the year ended, construction of the building and facilities for the Experimental Breeder Reactor was going ahead at the Reactor Testing Station in Idaho. The small turbogenerator that will be run by the reactor in heat-transfer tests and power studies was being installed. The reactor itself was being fabricated at Argonne National Laboratory which designed it. This small reactor will explore the feasibility of creating more fissionable material than is consumed. It will operate in the high-energy neutron range.

A technical staff of about 30 people from Argonne will handle start-up, testing, and operating. Engineering design was by the Austin Co., of Cleveland; major construction by Bechtel Corp., of San Francisco.

Materials Testing Reactor

During the calendar year, basic design and development work progressed at the Oak Ridge and Argonne National Laboratories on the Materials Testing Reactor. Blaw-Knox Construction Co., of Pittsburgh, is doing engineering design and Fluor Corp., of Los Angeles, the construction at the Reactor Testing Station.

Phillips Petroleum Co., of Bartlesville, Okla., was selected as MTR's operator on a cost contract which provides for considering a fixed-price contract after experience with operation.

Operating in the thermal, or slow, neutron energy range, this reactor will supply scientists with a much needed tool to test materials under intense neutron bombardment.

Submarine Thermal Reactor

Construction of facilities for a land-based prototype Submarine Thermal Reactor was started at the Testing Station by two contractors to the Westinghouse Electric Corp., selected after competitive bidding: F. H. McGraw Co., of Hartford, Conn., and M. J. Brock & Sons, of Los Angeles. Engineering design of the facilities was done by the Rust Engineering Co., of Pittsburgh. The Argonne National Laboratory and Westinghouse, which are handling the STR project jointly, advanced their work.

Although this reactor is for the Navy, it is giving impetus to the ultimate use of nuclear energy for industrial power production.

Submarine Intermediate Reactor

During the first part of the year, the Knolls Atomic Power Laboratory deferred research and development on an Intermediate Power-Breeder Reactor and directed it toward a Submarine Intermediate Reactor power plant for the Navy. This reactor will operate in a neutron energy range intermediate between thermal, or slow, neutrons and high-energy neutrons.

Fluidized Reactor Program

Oak Ridge National Laboratory began a pilot model of a fluidized reactor, designated as the Homogeneous Reactor Experiment (HRE).

The long-range planning group at ORNL reported on its studies of different types of fluidized reactors, and is continuing its work.

All other reactors built, except the Los Alamos Water Boiler, are heterogeneous, that is, the fuel and moderator are separate, and in most reactors both are solids. In a fluidized reactor, fuel and moderator are mixed in a liquid.

Aircraft Nuclear Propulsion Program

During November the AEC took over from the Air Force contract arrangements with the Fairchild Engine & Airplane Co., for a portion of the Nuclear Energy for Propulsion of Aircraft project (NEPA) at Oak Ridge, Tenn.

The Technical Advisory Board to the Oak Ridge National Laboratory, composed of nuclear and aeronautic scientists, estimated progress in nuclear and aeronautic developments and suggested lines of work.

Chemical and Metallurgical Processing

Chemical processing plant. The Bechtel Corp., of San Francisco, began constructing this year a chemical processing plant at the Reactor Testing Station. Detailed engineering design is by the Foster-Wheeler Corp., of New York City, under direction of the Oak Ridge National Laboratory.

The American Cyanamid Co. will operate the plant under a cost-type operating contract. The Oak Ridge National Laboratory will supervise the "shake-down" operation of the plant, and train Cyanamid personnel.

It is hoped that operating data will show that future plants can be built safely in populated areas where power reactors may be required.

Waste concentration. During the year progress was made in concentrating low-level radioactive wastes and in removing radioactivity from those released. Information gained through these developments may assist concentration of high level wastes.

New evaporation plants at Knolls Atomic Power Laboratory, Brookhaven National Laboratory, and Argonne National Laboratory are being tested successfully. A temporary evaporator at Oak Ridge National Laboratory made unnecessary the construction of additional expensive storage facilities.

An incinerator for concentrating combustible radioactive wastes with equipment for removing particles from the gases was improved at Mound Laboratory, Miamisburg, Ohio. Another is being modified at Knolls. Somewhat similar incinerators are being built at Argonne and designed for Los Alamos.

Sanitary Engineering

Development of an improved high-efficiency air filter was completed for AEC by Arthur D. Little, Inc., of Cambridge, Mass., and the filter was offered for manufacture by industrial concerns for commercial use.

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The Weather Bureau and the Geological Survey supplied information essential for designing the chemical processing plant at the Reactor Testing Station. The Geological Survey reported on the Valle Grande area in New Mexico, a potential source of water for Los Alamos. Arrangements were completed for a comprehensive survey of Columbia River in cooperation with the Public Health Service to study the effect of dams near the Hanford plants.

Harvard University undertook, under AEC contract, investigation of the distribution of radioactive materials introduced into water supply reservoirs and a conduit. The Massachusetts Institute of Technology was testing the effectiveness of conventional water supply treatment for radioactive decontamination. A research and development program was set up at the Oak Ridge National Laboratory with the Department of Defense and the Public Health Service on decontaminating water supplies, a first step being to test effectiveness of a Corps of Engineers diatomaceous earth filtration unit in removing radioactivity.

Harvard University also undertook AEC research and development work on air cleaning partly in cooperation with Los Alamos Scientific Laboratory. The University of Illinois continued basic research on fine particles in air (aerosols).

Brookhaven National Laboratory began in 1950 research on the fixation of radioactivity on natural soils to gather new knowledge for developing improved methods of ultimate disposal of radioactive wastes. Johns Hopkins University completed work on the take-up of certain radioactive isotops by slimes found in plumbing systems, while New York University completed studies of the effect of radioactive phosphorus on biochemical oxidation characteristics of domestic sewage.

Facilities at Reactor Installations

Reactor Testing Station. At the Reactor Testing Station in southeastern Idaho construction, other than that already reported, included development of the Central Facilities Area, which makes use of the cluster of buildings formerly headquarters for the Arco Naval Proving Grounds.

Argonne National Laboratory. At the end of the calendar year 1950 the 61-million-dollar program of constructing major facilities at the Argonne National Laboratory was about four-fifths completed. The CP–3 heavy water research reactor had been remodeled and equipped with new fuel elements which enable it to operate at higher power and with more intense neutron flux.

Knolls Atomic Power Laboratory. Facilities at Knolls Atomic Power Laboratory are being improved by construction of a new building for the Preliminary Pile Assembly and a Radioactive Materials Laboratory.

About the middle of the year the Knolls Preliminary Pile Assembly completed a period of operation of more than 2 years during which it was brought to criticality some 2,000 times in 11 different assemblies. Valuable data about the nuclei of reactor structural materials and fuels were obtained.

Training for Reactor Engineering

During the spring, a School of Reactor Technology was established at Oak Ridge National Laboratory to provide training needed by engineers for work in the AEC's reactor development program.

An interim course, starting in March, enrolled 18 men from AEC contractors and the military services for full-time studies over a period of a year. In September, the school started the first regular class with 43 students—23 men from contractors and the military services, and 20 recent college graduates temporarily employed by Oak Ridge National Laboratory who had been selected from 350 applicants from colleges and universities throughout the country.

Industrial Interest in Dual-Purpose Reactors

During 1950 the Commission received several inquiries looking toward the designing and constructing of nuclear reactors with private capital and their operation and use by industry. While these inquiries were in general very preliminary proposals, they are a significant development in the field of industrial interest in atomic energy.

These expressions on the part of industrial investors represent a step toward realization of the objectives of the Atomic Energy Act of 1946. Industrial interest in nuclear reactors has been stimulated by AEC's technical information program, its training activities in the nuclear field and the experience of industrial firms in doing developmental work under AEC contract. At the same time, it appears from discussions with the industrial representatives and from the proposals themselves, that they stem from the desire of the companies to stay abreast of technological developments and to enter more fully in atomic energy industrial operations.

The Commission welcomed the proposals and is studying the problems involved. It is highly desirable to have industry enter the field of nuclear reactor development, design, construction, and operation on a basis in which incentives for aggressive and rapid technical and business development are present. The problems include the limited manpower, materials, and laboratory facilities and the relative urgency of defense projects.

Physical Research

The Division of Research allocated over 23 million dollars to the support of basic research for the year 1950–51, two-thirds devoted to basic research in AEC laboratories and one-third to contracts with universities and private research institutions. In the latter category, 2.7 million went into contracts administered through a joint program with the Office of Naval Research. Other research supported under the physical research program—applied research and development—was allotted 8.1 million.

The Brookhaven National Laboratory's nuclear reactor went into operation in August; work progressed on a number of new particle accelerators being constructed—as the year ended the Brookhaven "cosmotron" was nearing completion; the "bevatron" of the University of California Radiation Laboratory, Berkeley, was about 45 percent complete. An improved linear accelerator is being designed and con-

structed for the Commission jointly by the UCRL and the California Research & Development Corp.

In October, the AEC approved a proposal of the Consolidated University of North Carolina to build a small research reactor with its own funds. In November, the AEC announced that it had declassified information, formerly restricted data, about three low-power reactors that could be used for research and for training.

Oak Ridge Institute of Nuclear Studies agreed in 1950 to take over administration of the AEC's entire fellowship program for the academic year 1951–52.

During the year the discovery of two new transuranic elements was announced, fission of elements near the middle of the atomic table—copper, bromine, silver—was accomplished in particle accelerators, and the existence of an electrically neutral meson was confirmed. This and other research work is reported in later sections.

Brookhaven Reactor Operated

Modification of the Brookhaven National Laboratory research reactor was completed on August 11, 1950, and by August 22 the reactor had been loaded to criticality. Several months of tests will precede routine operation at its designed power level. Operators are studying the effect on the behavior of the pile of a variety of factors such as atmospheric pressures, temperature, the specific pattern in which uranium is loaded into the reactor, and the temperature of the reactor.

During testing, a few physics experiments can be carried out. Full operation of the reactor as a research tool was scheduled about the first of the year.

The Particle Accelerator Program

These important tools for studying nuclear forces and structure will produce elementary particles of several types with energies ranging from 300 million electron volts (Mev) to several billion electron volts (Bev). The AEC supported during the year, both directly and through a joint program with the Office of Naval Research, a large program for constructing and operating several powerful particle accelerators.

The most powerful of these, the bevatron at University of California Radiation Laboratory, will produce protons with energies between 6 and 7 billion electron volts. Construction is scheduled to be finished in December 1953. A similar machine, a "cosmotron" nearing completion at Brookhaven National Laboratory, is designed to produce protons with energies of about 2.5 Bev.

Two other very powerful machines under construction in 1950 will produce electrons with energies of 1 billion electron volts. A synchrotron, being constructed at California Institute of Technology, is to be completed by 1953, and an electron linear accelerator, being supported jointly by AEC and ONR at Stanford University, is scheduled for completion in 1952. Low-energy electrons are being produced in the Stanford machine now.

The first of several proton accelerators operating in the 250 to 500 Mev range to be constructed since the war was completed at Colum-

bia University in May. It is designed to produce 450 Mev protons. Similar machines are nearing completion at the University of Chicago and the Carnegie Institute of Technology, and a slightly smaller one was completed at the University of Rochester in late 1948. These four accelerators have been jointly financed by the AEC and the ONR. The joint program is sponsoring in addition five other accelerators to produce 300 Mev electrons.

Research Reactors Outside the Commission

During 1950, a significant advance was made in the effort to make the unique research techniques developed by the Atomic Energy Commission available to the general public to the maximum extent consistent with the national security.

Declassifying research reactors. In November the AEC released to the public certain information on low-power research reactors which had hitherto been classified as restricted data.

The information authorized for release will speed the training of nuclear-reactor engineers and technicians and hasten atomic energy development, particularly for peacetime applications. It describes what must be known in order to assemble and operate a low-power research reactor, an important use for which will be for teaching advanced courses in reactor physics. For example, it will be possible for instructors to use specific data obtained from actual experiments instead of discussing reactor technology in general and theoretical terms. On the other hand the information now releasable does not endanger the national security since low-power research reactors cannot produce atomic weapons or power.

University building reactor. In anticipation of the declassification of information on low-power research reactors, the Consolidated University of North Carolina completed design of a 5-kilowatt water-boiler type reactor to be located on the campus of North Carolina State College at Raleigh, N. C. The reactor itself, exclusive of building and facilities, will cost about $150,000, all financed by the university. The Commission approved the loan of a maximum of 1 kilogram of U 235 required as fuel for the reactor, contingent upon final approval of safety and security safeguards. The reactor will be completely unclassified, but the uranium fuel will be carefully guarded.

Possible hazards connected with the reactor have been carefully evaluated in the light of actual experience with the similar reactor at Los Alamos, which has operated safely for several years.

A curriculum in reactor engineering has been established at the State College, and the reactor will be used for unclassified research. The university will be able to produce radioisotopes for use within the Greater University of North Carolina and for other institutions in the area. The Commission also received an inquiry from the University of California concerning the possibility that the institution might build a research reactor.

Low-cost reactor study. The AEC contracted with the North American Aviation Co., Inc., to design a more versatile low-power research reactor to be made available for private use. The cost of such a reactor is estimated to be about 1 million dollars, and its power and neutron flux would be considerably greater than in the Water Boiler; hence such a machine would have greater usefulness for research.

Fellowship Program

The Oak Ridge Institute of Nuclear Studies agreed late this year to administer the entire fellowship program for academic year 1951–52 on a national basis, subject to the negotiation of an appropriate contract. The program will continue at the following levels in 1951:

New appointments in predoctoral physical sciences	150
New appointments in predoctoral biological sciences	100
New appointments in postdoctoral physical sciences	30
New appointments in postdoctoral biological sciences (including medicine and agriculture)	45

The Oak Ridge Institute of Nuclear Studies will also consider requests for reappointment received from fellows participating in the present regional program. The National Research Council will continue to assess the scientific qualifications of applicants and to advise the Oak Ridge Institute of Nuclear Studies on administering the program.

Results in Research

Discovery of new elements. During 1950 the University of California Radiation Laboratory, Berkeley, announced the discovery of two new transuranic elements. These elements, number 97 and 98, extend the series of known elements by two, making the list now comprise six beyond uranium, number 92, the heaviest element known before the United States atomic energy project began.

The isotope of element 97, berkelium, was prepared by bombardment of americium 291 with 35 Mev helium ions in the 60-inch cyclotron. Its mass number is 243. Its radioactive decay proceeds predominately by electron capture with a half-life of 4.8 hours.

The other element, No. 98, named californium by its discoverers, has a mass of 244. It was made by alpha bombardment of curium in the 60-inch cyclotron and purification in an ion-exchange column. The new element emits alpha particles with an energy of 7.2 Mev and has a half-life of 45 minutes.

Acceleration of carbon nuclei in cyclotron. During the past 4 years efforts have been made at the University of California Radiation Laboratory to accelerate in the cyclotron heavy ions with masses of 10 to 19 such as boron, carbon, nitrogen, oxygen, and fluorine, so that they can be used for bombarding other nuclei. Previously, the heaviest bombarding particle has been helium 4—the alpha particle.

One object of such a program is to make possible the production of transuranic elements in quantity, since by bombarding heavy targets such as uranium with large ions containing several nucleons the much heavier transuranic elements americium, curium, berkelium, and cali-

fornium might be formed by a single transmutation rather than by the slow process of successive absorption of several neutrons. The difficulty in such experiments has been to obtain substantial beams of the accelerated ions.

Recently, detectable beams of carbon 12 and carbon 13 have been accelerated to energies of over 100 Mev in the 60-inch cyclotron. Gold 197, bombarded with carbon nuclei, produced astatine 205 in measurable quantities, an increase in mass of 8 units, while bombardments of aluminum 27 produced chlorine 34.

Fission of copper 63. About a year ago it was discovered at UCRL that chlorine 38 is found among the products of high-energy proton bombardments of copper 63, and the mechanism of formation was concluded to be fission rather than spallation.

Since that time, studies have been made of similar reactions in other elements of intermediate atomic number, including bromine, silver, and gallium. Bombardments were carried out at increasing energies, and in all cases "fission" products were formed at bombardment energies below those at which the same products theoretically could be produced by spallation reactions. It appears that when the bombardment is sufficiently energetic, large fragments which are essentially fission products may be emitted by elements of all atomic numbers. The size of the fragments seems to vary continuously (depending on bombardment energy) from those which accompany what is termed for convenience "spallation" (neutrons, protons, deuterons, alpha-particles, etc.), through intermediate sizes (for example, lithium 8, etc.), up to sizes such that the nucleus is split essentially into several pieces of comparable weight such as chlorine 38 and sodium 24 from splitting of copper 63.

Meson research. The most fruitful attack on the problem of nuclear forces at the present time appears to be the study of the properties of mesons. The existence of these particles was postulated in 1935 by Hideki Yukawa, a Japanese physicist, in deriving a theory of nuclear forces; his theory gained support when similar particles were actually discovered in cosmic radiations. After completion of the 184-inch cyclotron it was possible to produce these particles in the laboratory and this greatly assisted the study of their properties.

Mesons of two distinct masses were found in 1947 as the result of a series of researches in England. The heavier ones, of about 280 electron masses, disintegrate into lighter ones of about 210 electron masses, each of which in turn disintegrates into an electron and a gamma ray. These particles may be positive or negative, yielding either positive or negative electrons at the final result of the disintegration. During the last 6 months, the UCRL group has confirmed experimentally the existence of a predicted neutral heavy meson which disintegrates into 2 gamma rays. Determinations have been made of the masses, lifetimes, and mechanisms of formation and absorption of mesons, but a vast amount of work remains to be done before a comprehensive explanation of nuclear phenomena can be achieved.

Biology and Medicine

TheAEC financed biological and medical research during 1950 at a rate of 22.1 million dollars a year, not including the outlay for new buildings and equipment. Approximately 85 percent of this work was in the unclassified area. Of the 22.1 million, 1.4 million dollars went for research in cancer, 6.6 million for other medical research, 9.5 million for biological research, 3.6 million for biophysics research, 1 million for special training and fellowships.

Fifteen million of the total went for research work in AEC laboratories, production and other centers. The 5-million total for contract research, 35 percent above the previous year, was spent under some 250 research contracts with 76 universities and colleges and 20 hospitals, research laboratories, and other private institutions where 1,000 scientists and technicians worked on problems related to atomic energy. The Atomic Bomb Casualty Commission, working in Japan, received 1.7 million.

New Buildings and Equipment

To provide special laboratories and equipment for studies in the life sciences, the AEC has undertaken a 25-million-dollar construction program, and about half of this building program was completed by December 31, 1950. The remainder is scheduled within the next 18 months. New construction includes:

University of Rochester. AEC Training Building, estimated total cost 1.3 million dollars; completed and in use.

Hanford Biology Laboratory, 1.3 million; nearing completion.

Argonne Cancer Hospital, University of Chicago campus, 4.3 million; construction began in June 1950.

Argonne National Laboratory, biology building, 5.4 million; construction contract signed in November 1950.

Los Alamos Scientific Laboratory, biology and medicine research building, 2 million; design completed, construction to begin next year.

Brookhaven National Laboratory, biology and medical laboratories, 2.5 million; new building and remodeling old army camp structures, approximately half completed.

Oak Ridge: various improvements and modifications of existing facilities $700,000—including $400,000 for a cancer research wing at Oak Ridge Hospital, which is completed and in use.

University of California Hospital at San Francisco, animal laboratory and a laboratory with a 70 Mev synchrotron to study effects of high-energy radiation in cancer and other medical research, $700,000, including $267,000 for the synchrotron; construction about one-third complete.

Atomic Bomb Casualty Commission laboratories and staff housing at Hiroshima and Nagasaki, 2 million; in final stages of construction.

Training Activities

In addition to the general fellowships, the AEC offers special 1-year technical fellowships to train science graduates as health physicists (radiological safety men) for atomic energy plants and laboratories.

Forty health physics fellows were in training in 1950: 20 in the Vanderbilt University-Oak Ridge unit, 20 at University of Rochester supplemented by practical experience at AEC installations.

During the last 6 months, the AEC inaugurated a limited fellowship program for industrial physicians to receive 1 year of postgraduate academic work followed by 1 year's training on the job. Two fellows were appointed for 1950–51 and four fellowships will be offered in 1951–52.

During the calendar year, Oak Ridge Institute of Nuclear Studies gave its 4-week course in the safe handling and use of radioisotopes to 194 scientists and technicians.

Research on Radiation Exposures

Research pointing toward a clearer knowledge of safe and unsafe exposures to various radioactive materials went forward during 1950 at major AEC centers and under AEC contracts with universities.

Toxicity Studies, Uranium and Plutonium

Research on uranium has answered most of the important questions about its toxic and radioactive effects on people. AEC curtailed this research and put greater effort into studies on plutonium during 1950. Three years' work at present levels should bring knowledge about plutonium to the level of knowledge about uranium.

Partial evidence suggests that plutonium may be less toxic than first evidence indicated. Since no cases of plutonium poisoning existed, permissible limits on plutonium were set largely from experience with radium. It now appears that the data on radium may have been inconclusive, and that a number of persons believed to have suffered radium poisoning (notably a group of luminous dial painters in New Jersey) may actually have been poisoned by a combination of radium and mesothorium, another radioactive element. To the extent that this proves to be true, the human system can withstand more pure radium than had been assumed, consequently present plutonium tolerances, based on radium tolerances, may have been set lower than necessary. If studies should show plutonium to be less toxic than previously estimated, work with plutonium in laboratories and plants could be simplified with substantial economies both in building facilities and in operating them.

Remeasuring radium damage. An AEC-financed research project at Massachusetts Institute of Technology is reinvestigating reported cases of radium poisoning, and making new determinations of biological effects. MIT has developed a particularly sensitive scintillation counter which makes it possible to detect smaller tracer-scale doses of radioactive elements in medicine. Another useful detection instrument developed in this project is a small liquid-filled ionization chamber, about 30 times as sensitive as an air-filled chamber, which measures radiation effects equivalent to those in living tissue.

Direct studies on plutonium. Thorough studies—notably at Argonne National Laboratory—have been made on the effects of plutonium in

mice and lower organisms. Translating data from such organisms and small animals to human beings is difficult, however, and AEC is financing studies through a contract with the University of Utah to determine the effects of plutonium on dogs. Various aspects of plutonium toxicity are being investigated at Argonne, Los Alamos Scientific Laboratory, the University of Rochester, and elsewhere.

Other Toxicity Studies

Large-scale studies of the toxicity of neutrons started at Argonne and Brookhaven. Using mice for experimental animals, Oak Ridge National Laboratory continued an investigation into the pathology of slow or low-energy neutrons, their effects on longevity, and as agents causing cancers and cataracts.

Relating effects to exposure. The Radiological Research Laboratory at Columbia University is seeking to correlate definite levels of exposure to radiation with specific biological effects. This correlation requires measuring exposure in terms of energy absorbed per gram of tissue and effort has concentrated on developing apparatus and techniques to do this.

Special ionization chambers were developed which make it possible to determine the total ionization dose delivered to tissue by fast and slow neutrons when other kinds of radiation are also present. The ionization chambers have walls consisting of water, gelatine, and other ingredients that are equivalent to living tissue, and contain tissue-equivalent gas. A special electrically conductive plastic with the same proportions of hydrogen and nitrogen found in tissue made it possible to build ionization chambers which are simple to operate and which are accurate enough for routine measurements of neutron exposures.

The Columbia group is also studying cataracts of the eye induced by radiation. A number of physicists working with cyclotrons developed cataracts, and cataracts also have appeared with more than normal frequency in survivors at Hiroshima and Nagasaki. In the Columbia study smaller exposures at intervals appeared less dangerous than a single exposure to the same total dose.

Permissible Exposures Within Program

Effective December 11, 1950, the AEC established the maximum permissible level for chronic exposure of the total body to penetrating radiation (beta, gamma, X-rays) as 0.3 roentgen [1] per week to the blood-forming organs (assumed to be at an average depth of 5 centimeters in soft tissue). An additional exposure of 0.2 *r* per week of "soft" components of radiation is considered permissible, as these are absorbed in the outer layers of tissue. In exposures limited to the hands and forearms, the maximum permissible exposure was set at 1.5 *r* per week.

For operating purposes, however, it was decided that exposure levels may be considered in terms of the average taken over a longer period

[1] The roentgen is a measure of the ionizing effect of radiation, the effect which is injurious to living things.

of time, not to exceed 3 months, provided a single week's exposure does not exceed twice the permissible level of 0.3 *r* per week of penetrating radiation (or twice the level of 0.5 *r* under the conditions described above), and provided the average weekly exposure over 3 months does not exceed the maximum permissible limit.

The AEC has also prescribed for use in its own program permissible concentrations for 10 radioactive isotopes in drinking water, in air, and fixed in the human body: radium, plutonium, natural uranium, uranium isotopes 233, 234, and 235, iodine 131, tritium, strontium 90, sodium 24, and phosphorus 32. These values were established after conferences within the program and with Canada and the United Kingdom.

Emergency Limits of Exposure for AEC

The AEC, late in 1950, set limits on permissible exposure to radiation of atomic energy personnel who may be called upon in emergency to cope with radiological disasters in war or peace. Emergency limits believed safe for contamination of food or drinking water were established. These standards were developed during the year on the basis of research, experience, and the consensus of expert judgment.

The permissible limit for AEC emergency radiation monitoring teams, who normally would be exposed to some radiation in the course of regular duties, was placed at 10 roentgen. The permissible emergency exposure for persons not exposed to radiation in the normal course of their occupations was set at 25 *r*.

Tentative limits were calculated for the permissible contamination of water and food under disaster conditions, based on an assumption that fission products or plutonium, about the most toxic of substances, caused the radioactivity. On this basis, water could be drunk without grave risk for 10 days immediately after a disaster if its beta and gamma radioactivity did not exceed 90 microcuries [2] per liter, or if the alpha activity did not exceed 5 microcuries.

Values one-third as high as the above were calculated that are applicable if contaminated water were to be consumed over a period of 30 days. Studies are under way at the University of Rochester to determine a simple method for monitors to test suspected water with ordinary radiation detection instruments.

Research on Atomic Explosion Injuries and Treatment

Blast, Burns, Radiation

Studies were under way in 1950 on three types of injury which may be caused by an atomic explosion—direct blast injury, flash burns, and radiation injury.

The Atomic Energy Project at the University of California in Los Angeles developed apparatus for simulating explosive blasts, in which air in a vessel is pumped up to a predetermined pressure and suddenly the pressure is released by shattering a membrane. The resulting pressure wave strikes small animals; usually mice are used. Re-

[2] A curie is a measurement of radioactivity, assumed equal to that originating in a gram of pure radium. A microcurie is one-millionth of a curie.

producible blast experiments of predetermined force are now possible and they give reliable data on the effects of blast on animal tissues. Observations indicate that the effects are complex, and methods of physiological protection or of medical treatment so far are unknown. Since blast waves arise in every kind of explosion, these studies have implications extending beyond the field of atomic energy.

The University of Rochester recently developed a laboratory method of producing flash burns, a major cause of injury in atomic explosions, and is conducting research on methods of treating such burns. The effectiveness of ACTH and other agents in combating burns is being tested.

White Cell Separation

Under sponsorship of the American National Red Cross, scientists at Harvard University undertook to develop methods of separating plasma from blood so as to build up a plasma stockpile for use in disasters. With AEC financing, Harvard worked out a successful method of separating white blood cells and platelets from blood processed at Red Cross blood centers. White cells separated in this manner remain alive for about 2 weeks.

White cells can now be transfused without other components of blood, and may prove to be of value in combating the infection that follows acute radiation injury, leukemia, and certain other disease conditions. Several AEC laboratories and investigators will obtain supplies of white blood cells for such researches.

Studies of Protection and Treatment

During the past year, AEC-financed research continued to study methods of minimizing radiation injuries or assisting recovery from their effects. Evidence continues to accumulate that animals whose tissues are deficient in oxygen at the time of exposure have better chances of survival. Under laboratory conditions, an animal can be deprived of oxygen by replacing its air supply with nitrogen at the moment of exposure. The sulphur-containing amino acid, cysteine, given just before radiation also increases the chances of survival. Shielding the spleen approximately doubles the animal's resistance. Investigators at Argonne National Laboratory have discovered that the sulfyhydryl group of enzymes are especially sensitive to radiation injury, and that administering specific chemicals which protect these agents increases the survival rate in laboratory animals.

Means are not yet in sight for applying these findings to the protection of people, but knowledge gained by the study of animals suggests that it may be possible to develop methods which will enable human beings to survive radiation exposure which otherwise would prove fatal.

Continued research has demonstrated that antibiotic drugs—such as aureomycin, streptomycin, and penicillin—are effective in pulling experimental animals through the period of reduced resistance to infection that attends acute radiation sickness.

The Atomic Energy Project at University of California in Los Angeles carried out basic studies on the effects of radiation and treat-

ment of radiation injuries. Experiments dealt, for example, with the responses of blood vessels to various drugs after exposure to radiation, the effects of radiation on the ability of the intestines to absorb vitamins and amino acids, and the processes by which such metals as plutonium become deposited in bone, and how they can be dislodged.

Irradiating Part of a Cell

AEC-financed investigators at the University of Chicago will bombard microscopically small fractions of single living cells with high-energy radiation, so as to learn more about how radiation produces biological damage. This is done with a microbeam of protons only one one-twenty-five-thousandth of an inch in diameter produced in a 2 Mev Van de Graaff generator and passed through a perforated shield. Highly precise equipment has been designed to enable the experimenter to focus this needle of radiation on a selected part of a cell. Special means have been developed to culture the material under study as single cells or one-layer-deep films of cells. The Van de Graaff, recently completed by a commercial manufacturer, performed well in tests, and late in 1950 was being installed at the University of Chicago.

Atomic Bomb Casualty Commission

The Atomic Bomb Casualty Commission, financed by AEC and administered by the National Research Council, is continuing its studies of survivors at Hiroshima and Nagasaki. The purposes are to determine (*a*) the development of delayed radiation injury, alterations in the immunity of the exposed population to disease, any changes in fertility that may develop and change in growth rates, if any, among children; and (*b*) the genetic changes, if any, in children of the survivors.

New patients given complete medical examinations numbered 13 last January, exceeded 30 in June, and will be increased to about 100 a few months hence with the completion of the new research facilities under construction at Hiroshima. All known survivors who were within 1,000 meters of the points directly below the two explosions have been examined for radiation cataracts; complete medical examinations of this group in Hiroshima are in progress. About 650 newborn children in Hiroshima and 750 in Nagasaki are being examined each month to determine any increase in the incidence of hereditary abnormalities. The ABCC studies, especially the search for genetic effects, are a long-range undertaking.

Cancer Research

The program to bring the unique facilities of atomic energy to bear in cancer research is carefully limited so as to supplement and assist the national program of cancer studies under many different auspices.

Oak Ridge Program

The 30-bed Oak Ridge Cancer Hospital was completed and the first patients were admitted in April 1950. This hospital is devoted exclu-

sively to experimental treatment of patients with certain short-lived radioisotopes produced in the Oak Ridge nuclear reactor. Patients are selected by medical schools in the South.

Longer-lived radioisotopes for work with cancer are distributed free except for shipping charges to qualified researchers and hospitals. This free distribution for cancer work amounted to 3,250 shipments during 1950, or 52 percent of the AEC's total of 6,200 domestic shipments to all isotope users.

Arrangements were made for senior residents of southern medical schools to get 3 months of special training in the Oak Ridge Cancer Hospital. The Oak Ridge cancer program in 1950 included the following activities:

a) Exploring the possibility of using radioactive gallium in the treatment of bone cancers in animals, later in human beings. Extensive studies of gallium toxicity and behavior as a drug have been completed.

b) To explore the properties of radioactive ruthenium in the treatment of surface tumors. This isotope is a short-lived but powerful source of beta particles which can deliver intense radiation to surface tissues without damaging deeper-lying tissues.

c) To explore the possibility of using radioactive manganese, another powerful beta source, in treatment of thyroid tumors. The purpose is to compare the performance of this isotope with that of radioactive iodine.

d) To develop with the Postgraduate School of Medicine, University of Texas, and the M. D. Anderson Hospital for Cancer Research, a method of telecobalt therapy for treating deep-seated cancers with gamma rays from radioactive cobalt. Radiation from 1,000 curies of radioactive cobalt will be passed through a narrow window aligned over the site of the cancer. One thousand curies, generated at comparatively modest cost by irradiating ordinary cobalt in a nuclear reactor, is equivalent in radioactive power to two-thirds of the world's known supply of refined radium.

Work at Other Laboratories

Brookhaven. Ten beds were set aside in the hospital at Brookhaven National Laboratory for experimental work in cancer. The hospital has studied a few patients suffering from thyroid cancers.

One task at Brookhaven is to design a safe portable apparatus for separating iodine 132, which loses half its radioactivity in 2.4 hours, from tellerium 132, a fission product of nuclear reactors which decays into iodine 132. Brookhaven also will seek methods for separating calcium, iron, and astatine in a state of high radioactivity.

Argonne. A third AEC-financed facility for the experimental treatment of cancer, the Argonne Cancer Hospital, is under construction on the University of Chicago campus.

Using particle accelerator. The medical program for the University of California at Berkeley includes treatment of selected cancer, polycy-

themia, and leukemia patients. Research is concentrated on improving methods for making radioactive agents deposit selectively in cancerous sites within the body. Radiation beams from the 184-inch cyclotron of the Radiation Laboratory were used in experimental treatment of tumors in animals. University of California is doing limited cancer research in San Francisco, pending the completion of a 70 Mev synchrotron which will provide beams of X-rays and beta particles for more extensive work.

Radium localization. Extensive studies were made at the University of Kansas of the metabolism and distribution of radium in various tissues, especially bone. It has been known for years that a small amount of radium may cause cancer. Calculations showed that this amount, if uniformly distributed through the skeleton, should not produce in any place enough alpha radiation to cause cancer. The Kansas project revealed that miscrosopic concentrations of radium occur in the bones and yield an alpha-particle intensity which probably would be lethal to the tissue in these microscopic sites.

Cancer research under AEC contracts is going forward at Meharry Medical College at Nashville, Tenn., the University of Minnesota, Ohio State University, and other institutions. Each of these projects is concerned with the unique application of a particular radioisotope to cancer diagnosis and treatment.

Medical Research

The AEC supports medical research in Government-owned laboratories and in a number of medical schools, hospitals, and research institutions across the country. The purpose of this sponsorship is to safeguard the health of atomic energy workers, to seek methods to reduce the human injury that attends atomic bombing or radiological disaster, and, more broadly, to find fruitful ways to use the unique tools of atomic energy in the diagnosis and treatment of disease.

A number of children from 1 to 6 years old suffering from the disease nephrosis have been admitted to the Brookhaven hospital for study with the special facilities available there. Observations will be made on the metabolism of proteins and fatty substances known as lipids that are formed in the body.

Another inquiry under way at Brookhaven was on the effect of internal radiations on formation of new protein. A nonradioactive isotope of nitrogen (N 35) will be used to "tag" the new protein so as to determine its distribution in organs, tissues, and blood. Brookhaven scientists also investigated the effects of radiation from isotopes and from neutrons, the susceptibility of animals to infections from bacteria and viruses, the development of immunity, and other related questions.

Programs of medical research were under way at Oak Ridge, Argonne, Rochester, and other atomic energy installations, and under AEC contracts in more than 60 medical schools, hospitals, and other institutions.

Agricultural Research

The range of research studies of interest to agriculture include the use of radiotracers to study proper fertilizer placement in crop planting, basic research on the genetics of mold, the speed of transmission of plant nutrients from the roots to the leaves of a plant, effects of radiation on plant growth and on the heredity of plants and animals, and the fundamental life processes—photosynthesis, the functions of vitamins and amino acids, and the role of trace mineral elements required by both plants and animals.

Radioactive effects. Brookhaven National Laboratory continued its investigation of the effect of heavy radiation on crop plants. Experiments gave no indication that radiation could improve growth rate or yield, but in large doses caused marked damage to both. The experiments may ultimately give information on the mechanisms in plants that control growth and yields, on genetic mutation rates, and on the resistance of plants to infections.

Fertilizers. In a cooperative program between the Department of Agriculture and the AEC, facilities for producing various tagged fertilizers have been built, and research and development work necessary for their safe and extensive use has been carried out. Experiments with these fertilizers showed how widely different crops vary in their ability to use different compounds of phosphorus and other fertilizer material from the soil. Investigations included studies on chlorotic plants—that is, plants that become yellow and stunted during growth primarily because of deficiency in trace elements.

The AEC is supporting a number of basic researches on plants and radiation to seek to extend man's knowledge of living processes in plants. It has been verified with radioactive tracers that oak trees frequently graft to one another at the roots. This may account for the spread of the oak wilt disease.

Radioactive weed killers have been prepared and are being used to determine the site and mode of action of these economically important chemicals. Radioisotopes are being extensively used to study the mechanisms by which plants absorb nutrient materials in their roots, transport them through the plant structures, and deposit them in various parts of the plant. At the University of Missouri, for example, it was found that radiophosphorus tends to be concentrated most heavily in the newer leaves of the squash plant. At the State College of Washington the movements of eight different mineral elements in the bean and other plants are being investigated.

At South Dakota State College, radioactive selenium is being used in studies of selenium poisoning of cattle from plants grown on selenium-containing soils. Selenium poisoning is a serious economic problem in some parts of this northwestern region.

Biosynthesis of milk constituents and metabolism of ruminant animals, such as cattle, is being investigated at the University of California by means of compounds tagged with radioactive carbon. The results are in agreement with the general concept that in the ruminant

stomach the plant material is broken down by microorganisms to short-chain fatty acids, primarily acetic acid, and that the acetic acid is then used directly in the synthesis of milk. The AEC is supporting a research project at the University of Tennessee that is investigating many phases of mineral metabolism in farm animals—cattle, sheep, swine, chickens. Facilities for this work within the Government reservation at Oak Ridge have been completed, and work is actively in progress.

Genetic Studies

Genetics is a major field of AEC-financed research in biology, with special emphasis on the genetic effects of radiation.

Effects of oxygen concentration. At Oak Ridge, Yale University, Washington State and elsewhere, geneticists are examining the effects of oxygen concentration upon the frequency of radiation-induced chromosome aberrations in plants, mutations in the fruitfly, and the killing of bacteria. Studies showed that concentration of oxygen in the cell makes less difference as the ionization density of the radiation increases. Relations of temperature to frequency of radiation-induced chromosome aberrations was also under investigation.

Studies with mice. Two years ago the AEC commenced a large-scale genetic study involving thousands of mice. The necessary strains and numbers of mice have been developed and scientific data are beginning to be obtained.

Studies showed that abnormalities result from exposing mouse embryos to X-rays, and that types of abnormalities are influenced by the size of the X-ray dose and the stage of development in the embryo at the time of exposure. Evidence collected in the last few months showed that exposures as low as 25 to 50 roentgens may have genetic effects upon some physical characteristics in mice.

The high frequency of partial sterility in mice after radiation (apparently a result of chromosome aberrations) has been confirmed at Oak Ridge. Studies of the affected cells are in progress to determine the cause.

A pilot experiment indicated that it is feasible to carry through the projected large-scale study of radiation-induced mutations of specific genes in mice, and that the mouse is at least as sensitive as the fruitfly to genetic damage from radiation, and may be 10 times more sensitive. Methods for artificial insemination of mice have been perfected, a procedure that will permit direct radiation of spermatozoa with heavier doses than can be tolerated by the testes.

Biological Research

Each major AEC laboratory has a varied program of fundamental studies in biology.

Brookhaven, for example, is carrying out investigations in two broad fields: the effects of radiation, and studies of metabolism in plants and

920317—51——3

animals with the use of radioactive isotopes as tracers. Immature eggs (oocytes) of amphibians will be used in tests for the effects of beta and gamma radiation on cells.

Studies of intermediate steps in metabolism with radiophosphorus as the tracer are being continued at Brookhaven; it has already been determined that the formation of high-energy phosphate bonds, which are important in metabolism, differs in normal and diabetic cells. The incorporation of radioactive iron into blood plasma and red blood cells may lead to information on the fate of the blood during radiation sickness. A study in photosynthesis, the chain of processes by which plants convert carbon dioxide into plant tissue, will search for intermediate products between carbon dioxide and the end-product sugars.

Major biological studies at Oak Ridge National Laboratory included the effects of radiations on germ cells and on the rate of cell division; mutations of fungi and bacteria; tracer studies on metabolism; biochemistry of nuclei acids; and studies of mice including pathology and physiology and genetic and developmental effects of radiation. The University of California Atomic Energy Project at Los Angeles studied the effects of radiation on various enzyme-sybstrate systems, metabolism of fats and fatty acids, and the mechanisms of radiation effects. Los Alamos Scientific Laboratory concentrated on the toxicology of transuranic elements and other materials encountered in the weapons research program. The Hanford plant maintained a broad program of biological research and surveys to make sure that its operations were not contaminating the environment. Scientists at the University of California's Radiation Laboratory pursued a number of studies in tracer biochemistry and organic chemistry, radiobiology, and physical biochemistry, making use of particle accelerators and radioactive tracers. Argonne National Laboratory conducted an extensive program of classified research in biology.

In addition to studies in its own laboratories, the AEC financed some 85 biological investigations in nearly 60 universities and other institutions. The University of Chicago is working on the biosynthesis of radioactive drug compounds; the Connecticut Agricultural Experiment Station on the treatment of plant diseases with nuclear radiation; the University of Delaware on the effects of radiation on the growth of corn seedlings; the Bureau of Plant Industry, United States Department of Agriculture, on soil management and crop production; the University of Georgia on genetic studies of carbon dioxide fixation; Iowa State College on the effects of radiation on the longevity of mice; the University of Pittsburgh on radiation studies of viruses; Rutgers University on the accumulation of radioisotopes in shellfish; the University of Wisconsin on the long-term effects of intermittent radiation on dogs; and Yale University on the mechanism whereby radiation causes genetic effects.

Distribution and Use of Radioisotopes

During the year 1950 the isotope distribution program, one of the AEC's major activities for peaceful uses of atomic energy, continued to increase. More than 6,000 shipments of radioactive isotopes were made from the production facilities at Oak Ridge National Labora-

tory during 1950. This year's total amounts to more than 40 percent of the 15,000 shipments in all made since the program was initiated in 1946.

In 1947, 241 departments in 160 institutions were using isotopes; 2 years later when the AEC issued its report, "Isotopes—A Three-Year Summary of U. S. Distribution," there were 549 departments in 305 institutions. As of December 1950, AEC-supplied isotopes were in use in 939 departments of 485 institutions in 47 States and Territories of the United States and in 175 institutions in 29 nations abroad.

Growth in isotope distribution and utilization stems mainly from an increase in the number of scientists and technical personnel experienced in using radioactive materials, aided by construction and operation of a new radioisotope processing area.[3] The new processing facilities made it possible to offer to isotope users a wider range of radiomaterials at reduced costs. The increase in number of persons who know how to use radioisotopes safely is shown by the 142 new institutions and 287 new departments allocated these materials in 1950.

Uses of Radioisotopes

As tracer atoms, radioisotopes have become a standard research tool in many laboratories. Radioisotopes also are used increasingly as sources of ionizing radiation, as for instance, beta-ray applicators for treating certain pathological conditions such as lesions of the eye, beta-ray thickness gages, and radiocobalt for radiographic testing with a number of investigators indicating plans for using multi-curie sources of radiocobalt as substitutes for 1- and 2-million-volt X-ray machines in therapy. Numerous new radioisotope applications were proposed, many as outgrowths of research programs already in progress. Examples of such applications are reported in the following sections.

Medical Applications

An increasing number of reports indicate that radiophosphorus for treating polycythemia vera, a disease in which the number of red blood cells increases enormously, and radioiodine for treating overactivity of the thyroid gland, are being accepted as treatments. One such report was based on a survey of 500 cases.

A development recently reported is the use of a radiocobalt-nylon thread as radiation source for certain treatments. It was found that warm nylon tubing may be stretched to a small diameter with good tensile strength, thus forming a thread suitable for sewing into position with ordinary surgical techniques. Radioactive cobalt wire may then be inserted through this small nylon tubing to make a very versatile radiation source for treating tumors accessible for application on body surfaces or in body openings.

Several groups of investigators reported on using radioactive iodine to treat certain cases of intractable heart disease. In some patients with normally functioning thyroid glands but suffering from angina pectoris, a heart condition marked by recurring chest pains, with

[3] Described and pictured in Eighth Semiannual Report, Superintendent of Documents, Washington 25, D. C., 55 cents.

suffocation and fainting brought on by effort or excitement, comparatively small doses of radioactive iodine reduced the thyroid function and caused varying degrees of relief in 60 percent of the patients treated.

The use of radiodiiodofluorescein, a dye containing radioactive iodine and emitting gamma rays, in detecting and locating brain tumors was extended in 1950. The method is based on the fact that when this radioactive dye is injected intravenously into a patient, the radioactive dye is taken up more rapidly by most types of tumor tissue than by normal brain tissue. This particular diagnostic technique is currently in use in over a dozen hospitals and clinics throughout the country. Recently the range and versatility of the diagnosis was greatly enhanced by the development of the so-called crystal or scintillation counter, the most sensitive radiation detector developed to date.

Agricultural Applications

Radioisotopes have been used as tracer atoms in investigating many fundamental and intricate problems in the fields of fertilizers, plant growth, animal husbandry, horticulture, entomology, and cattle raising. The use of tracer atoms in fertilizers continued to be developed as a valuable test of soil fertility as well as of the efficiency of fertilizer application.

One unique application tried for the first time in recent months is the use of radioactive carbon in studying mealybug wilt of pineapple plants. The radioisotope is being used to study substances in the salivary secretions of mealybugs, to study the translocation of these secretions in resistant and susceptible strains of pineapple plants, and to determine if there is any correlation between the onset of wilt and the time of translocation of salivary secretions to the roots. The pineapple plants will be allowed to photosynthesize in an atmosphere of radioactive carbon dioxide and then the mealybugs made radioactive by feeding on the leaves of the radioactive pineapple plant. Once the bugs have been made radioactive they will be allowed to feed on nonradioactive pineapple plants which will be analyzed at various intervals until the onset of wilt.

An older radioisotope investigation which progressed during the year is the use of radioactive iodine in studying plant growth regulators. Radioiodine has been used to study the absorption and translocation or movemnet of about 15 types of plant growth regulating compounds. The movement of as little as three-millionths of a gram of the radioactive growth regulator can be accurately followed.

Industrial Applications

During the year radioisotope tracer programs were initiated in more than a score of industrial research laboratories. Although numerous new industrial problems were tackled for the first time with radioisotopes, some of the most interesting developments in 1950 resulted from research programs started in earlier years.

One group culminated a series of laboratory tracer studies on wear and friction by road-testing the wear of radioactive piston rings in an automobile under various driving conditions. As a result, the

company conducting the tests has now offered for retail sale a new lubricating oil.

Another application resulting from extensive laboratory and small-scale tests is the routine use of radioiostopes in an oil products pipeline to run from Salt Lake City, Utah, to Pasco, Wash. The pipeline is now in operation to Boise, Idaho, and when completed will cover a distance of 566 miles. A wide variety of products is pumped through the line, including several different types and grades of gasoline, Diesel oil, and stove oil. Radioactive antimony is used to mark the boundary between the various products.

Each time the Salt Lake pump station changes the product being pumped through the line, a small amount of the tracer material is injected into the line between the products. As the junction or interface between the two products moves along the line, the tracer flows with it. With aid of radiation instruments operators know when one product has passed the cut-off valves and when it is time to switch the new stream of gasoline or oil to the proper tank.

A new industrial application is the use of radioactive strontium in studying the movement of preservatives in telephone poles. Pole replacement in the United States costs 200 million dollars a year.

By using the radioisotope as part of the material used to impregnate the pole, investigators can accurately determine the amount of penetration by letting the impregnated radioactive material take its own picture on a photographic film. Other methods can be used to determine the total amount of preservative in a piece of timber, but the radioisotope technique shows also the exact location of the preservative.

Distribution of Isotopes, Oak Ridge, Tenn.

DOMESTIC	NUMBER OF SHIPMENTS					
	Aug. 2, 1946, to June 30, 1947	July 1, 1947, to June 30, 1948	July 1, 1948, to June 30, 1949	July 1, 1949, to June 30, 1950	July 1, 1950, to Nov. 30, 1950	Total to Nov. 30, 1950
Shipments classified by broad field of utilization:						
Radioactive Isotopes:						
Medical Therapy	407	884	1,564	2,594	1,258	6,707
Animal Physiology	280	712	890	1,150	496	3,528
Physics	82	175	271	376	190	1,082
Chemistry	74	188	254	223	122	873
Plant Physiology	49	107	195	282	105	738
Industrial Research	42	68	135	217	113	575
Bacteriology	11	53	79	64	49	256
Other		4	187	392	247	830
Total	945	2,191	3,575	5,298	2,580	14,589
Stable Isotopes:						
Physics	27	175	245	298	68	813
Chemistry	12	69	68	92	46	287
Animal Physiology	16	35	33	34	19	137
Industrial Research		21	4	6	1	32
Plant Physiology		5	9	2	1	17
Bacteriology		2	4		1	7
Other			6	2		8
Total	55	307	369	434	136	1,301
Shipments classified by kind of Isotope:						
Radioactive Isotopes:						
Iodine 131	276	741	1,213	1,994	961	5,185
Phosphorus 32	260	747	1,221	1,582	692	4,502
Carbon 14	88	134	148	216	123	709
Sodium 24	32	113	152	303	100	700
Sulfur 35	31	35	89	115	48	318
Gold 198, 199	63	23	39	79	81	285
Calcium 45	22	40	55	75	36	228
Iron 55, 59	26	34	48	57	30	195
Cobalt 60	24	22	55	82	69	252
Potassium 42	23	24	53	95	54	249
Strontium 89, 90	7	15	17	36	17	92
Other (61)	93	263	485	664	369	1,874
Total	945	2,191	3,575	5,298	2,580	14,589
Stable Isotopes:						
Deuterium oxide (heavy water)	31	115	116	96	53	411
Deuterium (hydrogen 2)	22	97	79	103	30	331
Boron 10 and 11	2	35	32	37	8	114
Helium				7		7
Oxygen 18		23	17	17	10	67
Electromagnetic concentrated		37	125	174	35	371
Total	55	307	369	434	136	1,301

Distribution of Isotopes—Continued

DOMESTIC	TOTAL NUMBER OF SHIPMENTS TO NOV. 30, 1950	
	Radioactive	Stable
Shipments classified by State and Territory:		
Alabama	37	1
Arizona	2	----------
Arkansas	63	----------
California	1,372	88
Colorado	75	2
Connecticut	256	49
Delaware	32	7
Florida	77	4
Georgia	192	----------
Illinois	1,165	200
Indiana	225	39
Iowa	122	6
Kansas	43	2
Kentucky	68	----------
Louisiana	220	6
Maine	2	----------
Maryland	999	39
Massachusetts	1,565	140
Michigan	499	35
Minnesota	481	29
Mississippi	9	----------
Missouri	444	16
Montana	1	5
Nebraska	97	----------
New Hampshire	4	----------
New Jersey	201	43
New Mexico	26	----------
New York	1,906	141
North Carolina	226	13
Ohio	970	126
Oklahoma	32	8
Oregon	142	6
Pennsylvania	861	111
Rhode Island	7	1
South Carolina	46	----------
South Dakota	3	----------
Tennessee	432	14
Texas	629	37
Utah	82	2
Virginia	111	6
Washington	124	7
West Virginia	1	1
Wisconsin	385	50
Wyoming	2	----------
District of Columbia	342	67
Hawaii	11	----------
Total	14,589	1,301

FOREIGN	TOTAL NUMBER OF SHIPMENTS TO NOV. 30, 1950	
	Radioactive	Stable
Shipments classified by country:		
Argentina	50	----------
Australia	96	----------
Belgium	91	----------
Brazil	50	----------
Canada	51	----------
Chile	22	----------
Colombia	4	----------
Cuba	4	----------
Denmark	115	----------
Egypt	1	----------
Finland	5	----------
France	31	----------
Iceland	2	----------
India	1	----------
Italy	5	----------
Japan	24	----------
Lebanon	3	----------
Mexico	2	----------
Netherlands	42	----------
New Zealand	9	----------
Norway	36	----------
Peru	7	----------
Spain	4	----------
Sweden	136	----------
Switzerland	36	----------
Trieste	2	----------
Turkey	4	----------
Union of South Africa	27	----------
United Kingdom	107	----------
Bermuda	15	----------
British West Africa	1	----------
England	91	----------
Uruguay	8	----------
Total	975	----------
Shipments classified by kind of isotope:		
Phosphorus 32	436	----------
Iodine 131	220	----------
Carbon 14	106	----------
Sulfur 35	54	----------
Iron 55, 59	44	----------
Cobalt 60	50	----------
Calcium 45	22	----------
Strontium 89, 90	8	----------
Other	35	----------
Total	975	----------

AEC and Civil Defense

The role of the AEC in civil defense—except for its operating responsibility to have emergency plans, teams, and measures in readiness against catastrophes at atomic energy centers—is that of a scientific and technical consultant to the agency empowered to administer Federal activities in civil defense. Much of the research described contributes to this work. Specific activities in support of civil defense included:

a) A training course for instructors in radiological monitoring was completed under joint sponsorship of the AEC and the National Security Resources Board. Eighty-three persons representing 39 States, Alaska, Hawaii, Puerto Rico, and the District of Columbia received this training at Brookhaven, Oak Ridge, Illinois Institute of Technology, University of California at Los Angeles, and Reed College. Physicians and osteopaths numbering 157 and representing 31 States, Alaska, Hawaii, Puerto Rico, and the District of Columbia, plus observers from the United Kingdom and Canada, received 1-week instructor-training courses in the medical aspects of atomic warfare at Argonne National Laboratory and at the following universities: Rochester, Western Reserve, Johns Hopkins, Alabama, Utah, and California at Los Angeles. At the NSRB's request, AEC arranged for a 1-week course for nurses in the medical aspects of atomic warfare at the University of Rochester Atomic Energy Project beginning in November, and 70 nurses attended.

b) Eighteen emergency radiation monitoring teams were organized in five areas and are undergoing training.

c) *The Effects of Atomic Weapons*, a handbook produced under joint sponsorship of the AEC and the Department of Defense, was published on August 12, 1950. *Medical Effects of Atomic Weapons*, a pamphlet prepared by the AEC and published by the NSRB in 1949, was revised and reprinted in August. The AEC collaborated with the NSRB in certain portions of the first volume of the NSRB's *U. S. Civil Defense* (NSRB Doc. 128); contributed material for subsequent volumes, and gave advisory assistance on the texts of the NSRB pamphlet *Survival Under Atomic Attack*. Similar assistance was given the preparation of *Fire Aspects of Bombing Attacks* and the *Civil Defense Health Services Manual*.

d) The AEC participated in civil defense test exercises sponsored by the NSRB and the local governments of Washington, Seattle, and Chicago.

e) Five AEC staff members, at the request of the NSRB, were appointed to serve on the NSRB's Interdepartmental Committee on Radiation Monitoring, concerned with all aspects of policy, organization, and radiation instrumentation for the national program of radiological defense, including training by State and local governments in monitoring procedures and techniques.

Finance

AEC began the 1950 fiscal year with 12 months' experience with a cost-based performance budget. The 1950 budget was not presented to the Congress in this form, but was recast in terms of the costs of the various planned activities and was administered on that basis. As a result, an annual cycle for the orderly preparation and review of budget estimates, in terms of what each activity costs is developing. A recently developed procedure for executing the AEC budget provides for preparing an annual financial plan that is adjusted quarterly to conform with decisions made on each program. Figures based on the financial plan are reported throughout AEC in monthly comparisons of costs, with budget estimates, enabling officials responsible for the programs to measure current performance against projected plans.

Using a Cost Budget

Costs of AEC programs, subprograms and categories, have been reported monthly since September 1949. However, until April 1950, these budget and reporting classifications did not define the costs sufficiently well to permit uniform reporting by all offices. Activity classifications within each program and subprogram now have been reviewed and revised. Monthly reports compare actual costs with the budget estimates for each current quarter and show whether various activities are costing more or less than the financial plan forecast. This comparison of the rate at which money is being spent with the estimated costs for a given period helps both to evaluate progress in programs and to control costs.

Progress was made during the year in developing and improving the financial statements by all AEC offices which must be on a uniform basis so that they can be more easily and accurately analyzed and consolidated.

Property Management

During the year, AEC started testing at the Oak Ridge Operations Office a plan for better utilization and disposal methods for property and equipment consistent with the policy of placing maximum managerial responsibility on its contractors. Any significant quantities of excess property are circularized among all prospective users, contractors are authorized to dispose of excess property which does not have to be circularized, and certain low-value items are eliminated from lists of excess property.

The introduction of industrial-type accounting and cost budgeting high-lighted the amounts of materials and supplies on hand at AEC installations. Detailed studies during the fiscal year 1950 showed that substantial quantities of obsolete and excess materials and supplies were in inventories, and effort was directed toward disposing of obsolete materials and reducing inventories to the minimum for efficient operations. By June 30, 1950, although the scope of operations had increased, the atomic energy industry had reduced its total inventory from slightly over 97 million dollars to approximately 82 million.

Reducing the number of motor vehicles and, in some cases, providing more suitable vehicles, reduced operating and maintenance costs 2.6 million dollars, 40 percent below those for fiscal year 1949.

Transportation Savings

During the year AEC improved methods for making reduced transportation rates on Government property available to contractors whose costs the Government reimburses. A recent arrangement permits negotiated savings in rates to be applied to AEC property that is moved under commercial bills of lading, as well as that shipped under Government bills of lading.

Auditing

During the year general policies and standards were established for auditing accounts of contractors whose financial records are integrated with the AEC system. Internal controls were strengthened. Continuing inspections of business activities were instituted and are now part of the internal auditing program.

The Comptroller General has authorized the General Accounting Office, Corporation Audits Division to conduct the independent audit of AEC, and they have recently started the audit.

Security

Measures to protect the atomic energy enterprise's property from sabotage and to maintain the security of its secret information were strengthened during 1950.

Antisabotage Studies

In order to assess the vulnerability to sabotage and to institute all practical countermeasures, special antisabotage studies have been conducted at the most vital plants and laboratories. The studies have covered all sensitive points at which serious damage could be effected by determined persons who might gain access despite the safeguards which have been set up.

FBI liaison agents have been familiarized with technical aspects of vital operations and materials to assist them in evaluating and investigating any evidence of possible subversive activity.

Air Protection

By Executive Order 10127, signed by the President on May 22, 1950, the boundaries of the prohibited airspace over Hanford were extended beyond those previously established in 1948. A danger area, formerly established over the Naval Proving Ground at Arco, Idaho, was reactivated at the AEC's request to control flights by aircraft over its Reactor Testing Station under construction in that area.

Air defense zones which include Commission sites at Los Alamos, N. Mex.; Oak Ridge, Tenn.; and Hanford, Wash.; were established by the CAA-USAF Joint Air Defense Planning Board during the

year. These zones extend in a radius of some 150 miles from the prohibited inner areas over each of these installations. Operators of aircraft must either file flight plans before entering these outer or "buffer" zones or be subject to identification in flight by Air Force fighter planes.

Close liaison is maintained between AEC and the Department of Defense. As reported in the Eighth Semiannual Report, a military garrison was established at Hanford early in 1950.

Personnel Investigations

Under the terms of the Atomic Energy Act, which calls for prior FBI investigation and AEC evaluation of FBI findings on the loyalty, character, and associations of persons given access to restricted information and restricted areas, about 200,000 persons have been investigated between January 1947 and the end of 1950. The figure includes both persons being considered for employment or close association with the program and the entire staff taken over from the wartime Manhattan Engineer District. In some 2,300 of the 200,000 cases, AEC instituted further review to determine whether clearance should be granted; approximately 700 were granted clearance after additional investigation, interview, or formal hearing, and the remaining 1,600 either resigned or terminated employment before a final determination by the AEC of their eligibility for clearance, or were denied clearance.

Extension of right to hearings. The right to appeal adverse recommendations, originally available only to persons already in the program, such as those taken over from the MED, was opened on September 19, 1950, to applicants for AEC employment and to AEC contractors and licensees where access to restricted data is required.

When an FBI report causes clearance to be withheld, the affected person is given an opportunity to be heard and to have his case reviewed by a board at the place where he has applied for employment. This board makes a recommendation to the local manager, who, in turn, makes a recommendation to the AEC General Manager. If the local manager has made an adverse recommendation, the person may appeal to the Commission's Personnel Security Review Board, which reexamines the entire record, including any brief he may choose to file. The Review Board then makes a recommendation to the General Manager, who makes the final determination for the Commission to grant or withhold clearance (see Appendix 4).

Part Two

AEC Contract Policy and Operations

(PUBLIC LAW 585—79TH CONGRESS)

(CHAPTER 724—2D SESSION)

(S. 1717)

AN ACT

For the development and control of atomic energy

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

DECLARATION OF POLICY

SECTION 1. (a) Findings and Declaration.—Research and experimentation in the field of nuclear chain reaction have attained the stage at which the release of atomic energy on a large scale is practical. The significance of the atomic bomb for military purposes is evident. The effect of the use of atomic energy for civilian purposes upon the social, economic, and political structures of today cannot now be determined. It is a field in which unknown factors are involved. Therefore, any legislation will necessarily be subject to revision from time to time. It is reasonable to anticipate, however, that tapping this new source of energy will cause profound changes in our present way of life. Accordingly, it is hereby declared to be the policy of the people of the United States that, subject at all times to the paramount objective of assuring the common defense and security, the development and utilization of atomic energy shall, so far as practicable, be directed toward improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace.

(b) PURPOSE OF ACT.—It is the purpose of this Act to effectuate the policies set out in section 1 (a) by providing, among others, for the following major programs relating to atomic energy:

(1) A program of assisting and fostering private research and development to encourage maximum scientific progress;

(2) A program for the control of scientific and technical information which will permit the dissemination of such information to enourage scientific progress, and for the sharing on a reciprocal basis of information concerning the practical industrial application of atomic energy as soon as effective and enforceable safeguards against its use for destructive purposes can be devised;

(3) A program of federally conducted research and development to assure the Government of adequate scientific and technical accomplishment;

(4) A program for Government control of the production, ownership, and use of fissionable material to assure the common defense and security and to insure the broadest possible exploitation of the fields; and

(5) A program of administration which will be consistent with the foregoing policies and with international arrangements made by the United States, and which will enable the Congress to be currently informed so as to take further legislative action as may hereafter be appropriate.

I

CONTRACT OPERATION

The national policy under which atomic energy work is carried on and the major programs that comprise it are set forth in the Atomic Energy Act of 1946 (sec. 1, see opposite page). This Act established the framework of the programs and their administration, and designated the Atomic Energy Commission to carry them forward. The major programs are research and development in private and Government-owned institutions to promote progress in atomic energy; production, use, and Government control of fissionable materials, which, under the President's direction, includes the production of atomic weapons; control and dissemination of scientific and technical information; and a program of administration consistent with the policies established by the Act. The enterprise is owned by the people of the United States and its operation is directed toward the paramount objective of assuring the common defense and security, and, beyond that, toward obtaining for the people the many constructive benefits that atomic energy offers.

The Atomic Energy Commission took over a large part of the present plant from the Manhattan Engineer District, its wartime operator. Since the transfer in January 1947, the program has been growing. New administrative devices, new methods of directing and controlling the enterprise, still are evolving.

Probably the Commission's most important administrative decision has been to continue the MED's practice of contracting with industrial concerns and academic institutions to perform the actual operations. Under the terms of the Act, this course is explicitly permitted. The unanimous report of the special Senate committee that drafted the Act, stated:

> Wherever possible, the committee endeavors to reconcile Government monopoly of the production of fissionable material with our traditional free enterprise system. Thus, the bill permits management contracts for the operation of Government-owned plants so as to gain the full advantage of the skill and experience of American industry.

Under contract, industrial organizations, universities, and research institutions run the production plants, operate atomic energy laboratories, carry out research and development work, and do other special tasks.

In 1947, the atomic energy facilities entrusted to the Commission were being operated capably under contracts. The impairment and even stoppage of production that might have resulted from termination of these contracts and a shift to operations manned by Government employees, possibly without the benefit of the experienced private management engaged in the work, were risks too grave to be accepted. Since that time, upon several occasions, the Commission has studied the possibility of direct Government operation when undertaking new

projects. In each case it has appeared that the project would be advanced most rapidly and efficiently by an experienced industrial concern. The unique capacity of American industry to develop new, better, and more economical ways of doing things is one of the greatest advantages that our Nation has in atomic energy development.

Another important advantage is gained through contractor operation: it lays the groundwork for eventual termination of Government monopoly and the integration of atomic energy development with the competitive private enterprise system. Industrial participation in atomic energy is a two-way street: the national program draws upon the managerial skills of industry, and industry acquires specialized technical knowledge in the field of atomic energy which—under present necessities of information control—is obtainable in no other way.

The Commission is aware that its operation through contractors is giving some industrial concerns access to atomic energy information that is not available to others. It follows the policy, therefore, of bringing additional concerns into the program whenever possible. A fair share of contracts and subcontracts are placed with small business concerns as a matter of policy. AEC is carrying on a program to bring about wide distribution of the declassifiable information developed in the program. Previous reports have described the work of special advisory committees appointed by the Commission, and of professional societies, in searching out such information and making it available throughout the industrial world. Steps are currently being taken to release information about low-power nuclear reactors, useful for research, and to permit construction of such reactors by nongovernmental institutions.

Private operation of atomic energy enterprises on a risk-and-profit basis, although small today in comparison with the size of the program, is significant in the manufacture of compounds containing radioisotopes; the manufacture of instruments for detecting radiation; the mining, milling, and processing of uranium ores; and the preparing of uranium for use in production plants. A number of proposals involving wider industrial participation on a venture basis have recently been advanced, and the Commission is considering them (see page 11).

The following portion of this Ninth Report describes the types of contracts the AEC uses, the way in which contractors are selected, and the methods employed to assure efficient and economical performance under the contracts.

The diversity of the Commission's work necessarily calls for a wide variety of contractual arrangements, for example, such contracts as operation of a Government-owned production facility, and routine procurement of more or less standard supplies. The following summary of these policies must be in broad terms. The effort has been to present a general coherent explanation, based on the major categories of contracts. Certain policy refinements, special arrangements, and exceptions have, of course, been omitted or not developed in detail.

II

TYPES OF AEC CONTRACTS, THEIR USES AND EXECUTION

Atomic Energy Commission contracts are of two main types: (*a*) fixed-price, such as those under which AEC pays a lump sum for a construction job, or a unit price for processing uranium ores into feed materials for production plants; and (*b*) cost-reimbursement contracts such as those under which AEC pays the costs of operating a plant or laboratory or of developing a reactor, and may or may not pay also an agreed-upon fee. Contracts are let by three different procedures:

a) To the lowest responsible bidder after formal advertisement and request for bids in open competition.

b) To the lowest responsible bidder among qualified firms invited to bid on an undertaking.

c) To a concern selected by established criteria under terms negotiated between the concern and AEC.

AEC Procurement Policy Guide

AEC operated at first under policies and procedures established by the Manhattan Engineer District, and many of the contracts—particularly those for operation of major production and laboratory installations—are essentially unchanged today. In December 1950, the AEC formulated and confirmed the general principles of its contract operation and issued them as the AEC Procurement Policy Guide, which covers procurement of services, supplies, materials, and equipment by AEC and by its cost contractors.

In accordance with Federal policy, the guide sets up a general policy of open competitive bidding at lump-sum or unit-price quotations, with award of contracts to lowest responsible bidders. It also states that a fair proportion of orders shall be placed with small business concerns.

Advertising of requirements and public solicitation of bids are not always possible. Certain considerations may make it necessary to rely on the exemptions provided in the Atomic Energy Act [1] and other laws to let contracts without advertising. This may be necessary, for example, because of security, urgency of work, or complex design which must be worked out during the term of the contract. When this

[1] Specific exemptions are granted in the Act. For example, Section 4 (c) (2) states, "Any contract made under the provisions of this paragraph may be made without regard to the provisions of section 3709 of the Revised Statutes (U. S. C., title 41, sec. 5) upon certification by the Commission that such action is necessary in the interest of the common defense and security, or upon a showing that advertising is not reasonably practicable, and partial and advance payments may be made under such contracts."

is necessary, the guide stipulates that AEC officials must take other steps to promote competition, and every contract made without advertising must be supported by a written explanation of the conditions which caused the advertising requirement to be waived.

The Procurement Policy Guide, as required by public policy, prohibits cost contracts in which the contractor receives a percentage of costs as a fee. Fees in contracts under which the contractor is paid a fixed fee above costs must be fair and reasonable, and are subject to such directives as the General Manager may issue. Subject to particular contract terms and necessary exemptions the Guide seeks to establish the policy that holders of cost-reimbursement contracts shall obtain supplies and services "in the manner most advantageous to the Government—price, quality, and other factors considered;" that they shall obtain their requirements from Government sources when doing so will effect a saving, the AEC reserving the right to make purchases for their use; that advance notice of proposed purchases from sources controlled by the contractor be given to AEC in order to permit it to judge whether the arrangements will be advantageous to the Government and to prescribe other methods if desirable; and that in procuring from private sources their methods shall be "designed to assure such full and free competition as is consistent with securing the required supplies or services." Subject to the above qualifications these contractors are required to file with the AEC detailed explanations of their procurement policies.[2]

Applying the Policy

Within this policy framework, AEC selects for each undertaking—whether it calls for supporting university research in the structure of the atom's nucleus or building a production plant—the particular combination of contract and procedure best calculated to meet the needs of the situation and to accomplish the task efficiently and economically. The operator of a feed material plant may be paid at a fixed negotiated price per unit of production; the contractor who operates a Government-owned plant to produce fissionable material may be reimbursed for costs incurred; a construction contractor may be paid a lump sum that covers the entire job. One construction job may be let to the lowest responsible bidder after full advertising; for another job, it may be necessary to select the bidder from a list invited to submit proposals. In designing a reactor, or in building a complex new production plant to meet urgent time schedules, AEC may have to use a contract calling for reimbursement of the contractor's costs by the Government, and payment of a fee negotiated with a qualified firm after its selection from a list of firms screened against established criteria.

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[2] Application of these requirements is not mandatory with respect to a research or development contract to be performed at a place not owned or leased by the Government if the quantity of procurement contemplated under the contract is not deemed by the AEC contracting officer to be substantial. The exception serves to relieve universities and other nonprofit institutions receiving minor sums from AEC for research or development work from the close supervision which is appropriate for larger contracts and other types of contractors but would be unduly cumbersome and contrary to custom in small-scale university and similar research.

The Procurement Policy Guide does not give detailed procedures or instructions, except to the extent necessary to establish basic policies. However, for each general category of contract, and for the ways in which the contracts are let, the AEC has established procedures. Many of the procedures have been collected in manual form; other manuals are being prepared.[3] Standard contract forms, allowing adaptations as necessary, have been prescribed for lump-sum and cost-reimbursement construction contracts. A construction contract manual for this type of work, issued in January 1949 and amended as needed, lays down policies and methods. A manual prescribing contract policies for development work on reactors and similar projects is in preparation. General stipulations used in contracts for basic research are being put together in a manual. Specific procedures are in use for obtaining bids, and also for screening prospective contractors and negotiating with them for cost or unit-price contracts.

Each contract defines the task to be performed and spells out the contractor's and AEC's commitments and working relationship. In lump-sum contracts, certain provisions are standard for Government undertakings with private industry—for example, those involving construction require adherence to current Department of Labor determination of minimum pay for laborers and mechanics under the Davis-Bacon Act. Contracts under which the AEC reimburses costs generally contain clauses on purchase of supplies and materials, subcontracting, patents, statutory regulations, advance of funds, security, accounting, auditing, protection of health and safety, and risks chargeable to the Government—all adapted to that contract undertaking.

Unit-Price Contracts

In purchasing supplies, materials, equipment, and other items, the AEC uses a type of fixed-price contract called unit price. Under these contracts, for example, AEC agrees with certain processors of uranium ores to take up a specified quantity of uranium concentrates at a stipulated price. It agrees to pay a negotiated price per unit to companies who process the raw uranium into feed materials. In many of its lump-sum construction contracts, AEC provides for unit-price work, such as a firm price per foot of pipe to be laid to connect a new building with existing utility mains. This type of contract may also be used for such operations as mapping or drilling to assist exploration for uranium: so much per square mile of mapping, so much per foot of drilling.

Unit-price contracts may be either negotiated, as in the production of feed materials, or let after advertising under full competitive conditions as in the case of drilling and mapping operations. In the latter case, geological and engineering surveys provide detailed specifications as a basis for bids. During the last 3 years, during which some 650,000 feet of drilling was financed by AEC, 21 different companies were awarded contracts after public advertising and bid invitations to some 100 drilling operators.

[3] The Procurement Policy Guide is scheduled for publication in the *Federal Register* and is available from the AEC upon request. The construction manual, "A Guide for Contracting of Construction and Related Engineering Services," is available from the U. S. Government Printing Office for 15 cents (see Appendix 8).

Contracts for Concentrates

In negotiating contracts for ore processing in the contractor's own plants, the price AEC agrees to pay is related to the estimated grade of ore available and the estimated processing cost, including provision for amortization of plants and equipment and for profit. Substantial expenditures have been made, largely by the owners of the processing plants, to rehabilitate plants closed since World War II's end, and to make modifications needed to treat ores primarily for uranium content, rather than for vanadium, the recovery of which had dictated the original design.

The incentive to the supplier for improving operating efficiency is provided by the possibility of greater profit through decreasing costs and increasing metallurgical recovery.

Feed Materials Contracts

The chain of feed materials plants is operated almost entirely through negotiated contracts with private commercial firms under which they agree to process AEC-owned uranium at a specified price per unit.

Most of the original contracts established by the MED were cost-plus-fixed-fee. The present unit-price contracts contain a provision for periodic—usually quarterly—redetermination of price. To establish a price which is fair and equitable to both parties, the scope of work to be performed must be made definite, and there must be a sound basis for evaluating the contractor's price proposal, either costs experienced by other AEC contractors in similar work, or a realistic AEC engineering estimate of the cost of performance. Hence these contracts require that the AEC have access to the contractor's books.

Selecting Feed Materials Contractors

Unit-price contractors are selected in two ways. If the specifications and requirements are sufficiently firm to allow competitive bids, the responsible contractor is chosen who submits the lowest bid.

Where competitive bidding is not practicable, the AEC discharges its responsibility to obtain the most competent and economical contractor by making a careful survey of interested firms. Firms whose experience indicates they might be able to carry out the work are canvassed. Among the important considerations in AEC's screening of the proposals are:

a) Experience of the firm.
b) Caliber and number of company personnel available for AEC work.
c) Reputation of the company in commercial trade, its financial reserves and credit rating.
d) General services it offers to the Government's advantage.
e) Availability of space or facilities in the firm's plant.

Fixing Feed Materials Unit Price

If restricted data are involved, the Federal Bureau of Investigation, investigates the necessary staff members of a selected company, and

AEC determines whether they may have access to classified atomic energy information. If so, the firm receives the data needed to develop a proposal for final negotiations, including estimates of cost of product and an offer of a unit price.

The unit price includes costs and profit, and is a negotiated figure. As a guide, average costs and profits in similar industries are considered. However, since the unit prices are forecast for short periods with consequently reduced risks, and since no sales or advertising costs are involved, the mark-up above direct costs is usually less than that for normal commercial business. If agreement on price cannot be reached with the selected firm, negotiations are undertaken with another firm.

In a contract for new work, since no actual costs are available, unit prices for the first quarter are necessarily estimates. At the end of a quarter of operation, the contractor submits his costs projected for the quarter ahead with explanations of price changes. An AEC auditor inspects his books and a general discussion is held on increases or reductions. The AEC then establishes a standard for negotiations in which all elements of the various items of cost are discussed individually before a price is agreed upon for the next quarter.

Lump-Sum Contracts

Lump-sum contracts, under which a concern agrees to do a job for a fixed price, have been used by AEC principally for construction work. They may also be used for architect-engineering design and other service and supply contracts. Standard contract forms are being developed for architect-engineer contracts, and have been issued for lump-sum construction contracts, allowing appropriate adaptation to specific situations.

The AEC's Construction Contract Manual details the policies, practices, and procedures to be followed in contracting for construction and associated engineering services. It defines the authority to make engineering and construction contracts, gives basic policies to be followed in providing these services, and requires establishment at operations offices of contract boards for the primary purpose of selecting contractors and negotiating contracts on other than competitive awards.

The manual describes in detail the various types of contracts and subcontracts AEC uses in this field. It sets forth the basic policy for letting work to the low bidder after publicly advertising for bids, and establishes the conditions under which other methods may be used. When advertising is not practicable, a selected group of contractors is usually invited to submit competitive bids.

An Illustrative Lump-Sum Construction Contract

A building for the new permanent quarters of Oak Ridge National Laboratory, being erected now, was contracted for by methods and under procedures illustrative of those prescribed by the AEC manual. The building is located in a restricted area, but it could be planned

fully in advance, and detailed specifications drawn; time pressure was not paramount. Nineteen of twenty-one construction contracts under way currently at Oak Ridge are under standard lump-sum contracts in the letting of which full advertising and competitive bids was possible despite the fact that 11 of the jobs are in areas from which people are barred unless they are cleared by regular FBI-AEC security procedures.

As soon as detailed plans and specifications for the building were completed, open invitations were mailed to 368 general contractors and 726 potential subcontractors and suppliers who had signified their interest in AEC construction work.

Nine general contractors and 52 subcontractors or suppliers interested in providing supplies and services to the successful general contractor requested plans and specifications, but when the bid opening date arrived, only one bid had been received from a general contractor and it was substantially above the engineer's estimate. The AEC posted public notice rejecting the bid and advising that new bids were being requested.

On the same date, new invitations were mailed to 358 general contractors and the same list of subcontractors and suppliers. Notices were posted in 20 post offices. Press releases announced the project and the availability of detailed plans and specifications in a large number of daily newspapers and in 18 construction trade journals. Plans and specifications were placed on file at 30 plan libraries maintained by various trade associations and reporting services.

Eight general contractors and 49 subcontractors or suppliers applied for and received copies of plans and specifications and 4 general contractors submitted bids.

Public Opening of Bids

The bids were opened in public with representatives of most of the bidders in attendance. The AEC analyzed the bids and awarded the contract upon determination of (*a*) the bid most advantageous to the Government in view of the various alternates proposed in the plans and the unit-price items established in the invitation to bid, and (*b*) the competence and financial responsibility of the low bidder.

RESEARCH LUMP-SUM CONTRACTS

A type of lump-sum contract whose purpose bears little relation to those already reported has been used by AEC to promote basic research, in university and private nonprofit laboratories in fields of special interest to the atomic energy program. Under these contracts, the AEC typically contributes a negotiated fraction of the total costs of the project for carrying out a line of investigation for a specified length of time.

AEC has found lump-sum contracts adequate where the total cost is relatively small, or where it can be estimated accurately, such as in projects where costs consist largely of salaries and wages or the price of equipment of known cost. Very large projects, or projects the cost of which cannot be estimated with reasonable accuracy require

the use of cost reimbursement contracts in which the AEC agrees to pay either certain costs or a certain fraction of all the costs.

Benefits under these contracts in support of basic research are necessarily long-range since this research is directed toward increasing man's fundamental knowledge in the sciences basic to atomic energy, rather than toward obtaining specific data of value in a particular AEC undertaking, as in applied research. Almost by definition, each project supported must deal with something which is not known, not understood, or at least sufficiently in doubt to need confirmatory research.

Almost all proposals for Commission support of projects for basic research originate with a scientist in a research institution, though they are presented to the Commission by the administration of the institution. In some cases, the AEC may contact qualified researchers and seek to interest them in undertaking basic research in a particular field important to atomic energy which otherwise might be neglected. But the AEC believes that its contract support of basic research cannot include Government planning of research, that proposed projects should be planned on the basis of their significance to fundamental science, and that the initiative and final responsibility for the direction of basic research should rest with the scientists actively engaged in research. This does not, of course, apply to AEC contracts for applied research.

Policies on Choosing Projects

Under these conditions, the AEC uses chiefly three criteria to select contractors for basic research projects. The paramount consideration, of course, is whether a project proposed by a scientist is in a field of interest to the atomic energy sciences. Beyond that, the AEC places primary emphasis on evaluating the competence of the investigator making the proposal; and, except in rare cases, AEC policy requires that research projects must be supported jointly by the contracting institution and the AEC, rather than wholly financed by the AEC.

Evaluating a Proposal

Review of a project starts when a scientist suggests a line of research either by letter or by talking with AEC staff. The investigator then may be invited to prepare a formal proposal. A "Guide for the Submission of Research Proposals"[4] for support of research projects prescribes that the proposal include a discussion of the relation of the results of the project to general knowledge, a detailed discussion of the techniques to be used including itemization of special materials and equipment, and a proposed budget showing the total direct and overhead cost of the project, identifying those contributions the contractor expects to make, as well as those to be provided by the Commission.

AEC studies the proposal and often obtains independent review and comment from recognized authorities in the field.

If the technical aspects of the proposal are approved, AEC reviews the proposal to assure availability of funds, and soundness of financial arrangements, and also to determine whether special contract

[4] The Guide may be obtained by writing to the Division of Biology and Medicine, or the Division of Research, U. S. Atomic Energy Commission, Washington 25, D. C.

provisions are necessary. Where it is anticipated that a number of projects may be supported by the AEC at one institution, a type of master contract may be used under which each of the projects is specifically included when authorized.

Policy of Cooperative Financing

The AEC policy of cooperative financing of projects, in which it shares the costs of research with a research institution, is designed to accomplish these things:

a) Assure that the contractor has a genuine interest in the research to be done.

b) Assure that the research institution will carefully screen research proposals before they are submitted to the AEC.

c) Assure that the contractor will follow normal business procedures to assure economical expenditures of funds, an important consideration since most lump-sum contracts for basic research make no specific requirements regarding accounting procedures.

d) Provide, through the contractor's contribution, the necessary budgetary flexibility to carry the project to completion since basic research rarely can be budgeted in advance with such accuracy that changes will not be required.

The AEC sometimes deviates from the policy of joint participation. A few important basic research projects require expenditures so large that private resources can contribute only a small fraction of the total cost. In some work involving the construction and operation of particle accelerators in private laboratories, the AEC supports as much as 90 percent of total costs. But the contractor makes a very significant contribution in organizing and maintaining a team of research talent, and such intangible factors are recognized as important contributions to the success of any basic research undertaking.

Cost Contracts

Many kinds of work necessary for advancing atomic energy cannot be contracted for under fixed-price contracts. For such jobs and operations, AEC uses contracts under which it reimburses contractors for specified costs. It may or may not pay a fixed fee, negotiated at the time the contract is drawn. Contracts of this kind have been used for operations in Government-owned plants, laboratories, and other facilities, for large development undertakings such as those for new kinds of nuclear reactors, and for particular construction jobs.

Large development projects are beset with uncertainties of cost and time. The contracts for development of reactors, for example, like those for architect-engineering design, require that the contractors work closely with AEC personnel, laboratories, other contractors, and on occasion with other Government agencies, in attacking scientific, technical, and engineering problems. Many of these problems can be foreseen or defined at the start. Nevertheless,

it usually is not possible to estimate the cost accurately enough to obtain bids, or to negotiate a fixed-price contract. Contracts for such work therefore provide for the payment of a contractor's costs, generally plus a negotiated fixed fee.

The size and complexity of a large construction project for erecting a production plant, or a reactor, and the need for its early completion may require starting construction before the design is completed. There is no basis upon which a prospective contractor can make a firm bid. Moreover, in such cases, the AEC is buying not only a physical asset, but also time—time during which the facility can be operating. A cost contract is negotiated by the Commission after a survey, conducted in accordance with the procedures prescribed in the Contract Manual, to find the construction firm best fitted to perform the work.

COST CONTRACTS FOR CONSTRUCTION

A key role in letting cost contracts for construction is played by the contract boards established in every AEC operations office under the Contract Manual. The manual sets forth the circumstances under which engineering and construction services may be obtained by procedures other than the normal competitive lump-sum methods. For lump-sum architect-engineers, and for all cost-plus-fixed-fee contracts, it provides maximum fee and other schedules to be used as guides in negotiating these contracts.

The Contract Board, as prescribed, consists of at least three members appointed by the manager of an operations office. Its duties consist of (*a*) recommending to the manager the construction contractor or contractors to be selected to perform work on a cost-plus-fixed-fee basis and architect-engineers to perform work on a lump-sum or a cost-plus-a-fixed-fee basis; (*b*) negotiating fees; (*c*) negotiating other substantive provisions of contracts; (*d*) negotiating adjustments in fees or in contract prices; and (*e*) performing a number of other functions as provided in the manual or as assigned by the manager of operations.

Choice of Cost-Type Contract

A construction job is described below to exemplify a cost-type construction contract. It is assumed that it is necessary to complete a plant to produce fissionable material at the earliest possible date. The only way to complete construction in time to meet the assumed production schedules is for design and construction to go ahead together; waiting for completion of detailed design so that bids can be solicited on a firm basis will considerably delay start of actual construction.

Details of design and construction for such plants are secret under the Atomic Energy Act, and making adequate security arrangements covering both the personnel and the physical custody of plans requires that firms be selected as early as possible to prevent additional delays when design has progressed far enough to begin construction.

Thus considerations of both urgency and secrecy prevent the solicitation of lump-sum bids and dictate the making of a cost-plus-fixed-fee contract.

Selecting the Contractors

The manager of the AEC operations office concerned is responsible for selecting architect-engineers, construction contractors, and engineer-constructors. For this assumed project, because of the size of the job involved, the final group of firms from which a selection is made must be approved in advance of the selection by the director of the Division of Production in Washington. The local Contract Board in this assumed case is responsible among other functions for recommending selection of contractors. The Board includes directors of various phases of the activities of the operations office and other top staff so that its recommendation provides the manager with the combined judgment of his staff.

The process of selecting a contractor for the project actually begins a few weeks after the Commission authorizes preliminary planning. As functional design and design criteria are prepared by the operating contractor, the Contract Board is kept advised and thus can judge which type of contractor can furnish the necessary services, and which type of contract is appropriate, and can estimate the cost of the different services, equipment, and material required to design, build, equip, and place the plant in operation.

In the assumed project, as actually was the case in one AEC project, the Contract Board might study brochures furnished by as many as 140 different architect-engineer firms and construction contractors. In this case, Washington headquarters, upon request, supplied information on 12 additional firms, or combinations of firms, known to be qualified to furnish the necessary services. Brochures contain, in general, brief histories of the firms, descriptions of work in which they specialize, a listing of key personnel and their qualifications, and comprehensive lists, usually with illustrations, of important jobs they have done.

The Contract Board screens the field on the basis of the job to be done as measured against qualifications given in information supplied by the contractors. After receiving the necessary approval of the Washington headquarters, the Board then enters into preliminary negotiations with the firms chosen in the screening. Representatives of each of the firms, after being cleared through FBI investigation and AEC evaluation procedures for access to classified data, are supplied with basic descriptive information covering the planned construction.

Further Investigation

AEC representatives visit the home offices of the concerns and develop information concerning:

a) Reputation and standing of the firm and its principal members in performance of the contemplated type of work.

b) Past record in performing work for the Commission and, if available, for other Government agencies.

c) Adequacy of any necessary home office facilities.

d) The volume of work of the firm in previous years, and the extent to which the firm is currently engaged in other work.

e) Ability to assign an adequate number of qualified key personnel, including resident representative having considerable experience in responsible positions on work of a similar nature.

f) Additional management qualifications, such as record in labor relations, safety record, and adequacy of accounting system.

g) Ability of the firm to perform a major portion of the work with its own forces.

h) Ability of the firm to furnish or to obtain adequate construction plant and to procure required material and equipment.

i) Financial resources.

j) Geographical location of home office and familiarity with the locality in which the project is located.

The Final Choice

In the assumed case, the Contract Board recommends an architect-engineering firm and a construction firm who have demonstrated their qualifications to handle a complicated coordination of engineering and construction effort.

Typically, on such a major job as construction of a plant to produce fissionable materials, the AEC may contract separately with a concern to design such specialized facilities as, for example, those for electric power or mechanical work. The operating contractor for existing similar plants would work with these special-facility designers as would the architect-engineer.

In the handling of construction also, the prime construction contractor might employ subcontractors to install special facilities. The operating contractor for similar plants would similarly work with these subcontractors, testing equipment against specifications and before installation. Any or all of these contracts—those entered into by the AEC, and subcontracts determined upon by the construction contractor with AEC assent—might be handled on the basis of cost-plus-a-fixed fee. In all such cases, the pattern of screening competitive firms on the basis of established criteria, preliminary negotiation, selection, and actual negotiation of contract would be either handled directly by the AEC, as in the case of the design contractors, or by the prime contractor in accordance with AEC standards and with AEC review for approval before the subcontract could be signed.

The Contract Group

The contract family which thus might evolve for the total job would consist of—

A plant operating contractor, responsible for process design, for establishing the design criteria, and procuring the major items of process equipment.

An architect-engineering contractor, responsible for providing the design of the plant and for field inspection of construction, with the exception of the electrical power facilities, additions, and alterations.

An electrical engineering contractor, responsible for design and field inspection of the construction of the electric power facilities, additions, and alterations.

A general contractor for construction.

A subcontractor for electrical work.

COST CONTRACTS FOR DEVELOPMENT

For large research and development projects, the AEC generally reimburses the contractor for his direct costs plus an overhead allowance, and in some instances pays a fixed fee. The AEC arranges under these contracts for such activities as work on the design of a new reactor, general studies on, for example, development of heat transfer systems, or investigations into new and better methods of extracting uranium from ores. In effect, the Commission is buying the management and technical "know-how" of contractors on a cost or cost-plus-fixed-fee basis.

The Commission's prime cost contractors for development also use lump-sum and unit-price subcontracts whenever possible to procure supplies, equipment, and construction services on a competitive-bid basis. In some contracts, for example those for developing radiation instruments, fixed-price contracts are used and, where possible, competitive bids are obtained.

The "Administrative" Contract as a Management Tool

The type of cost contract used to a large extent by the Commission for development work may perhaps best be described as an "administrative contract." A main emphasis here, as in many other contracts, is upon cooperation between the Government and the contractor to accomplish the particular task. This is described in a contract clause:

> It is the intent of the Commission and the Contractor that this agreement shall be carried on in a spirit of partnership and friendly cooperation with a maximum of effort and common sense in achieving their common objectives.

The contract describes in broad terms the scope of the work to be done, and places considerable emphasis upon the development of long-term and annual work programs, and upon provision for reports and information on results and accomplishments. It establishes broad administrative and fiscal policies and procedures, with details set forth in contract appendixes and in other administrative documents which can be revised without formal amendment of the contract. Authority and responsibility are placed on the contractor to carry out the program in accordance with the broad provisions of a negotiated contract.

Negotiation of each contract presents its special problems. AEC typically adopts the personnel, accounting, purchasing, and other policies of contractors—particularly industrial contractors—to the fullest extent consistent with basic governmental requirements. It has moved away from requiring detailed approvals of individual transactions of small monetary value and depended upon developing sound policies and making spot checks to assure compliance. Contract problems have arisen over patent provisions, overhead allowances, purchasing and subcontracting, personnel and labor provisions, and fixed-fee negotiations.

Provisions on Subcontracting

Typical cost contracts for development work provide that subcontracts must be approved by an AEC representative when they are over

a stated amount. This requirement enables the contractors and the AEC to develop, by mutual agreement, appropriate policies, procedures, and standard forms on subcontracting. It also assists review of individual subcontracts, (*a*) in the interim period during which a new contractor is getting started, and (*b*) for specific approval of any subcontract of an unusual nature, or for a large sum. Purchases over a stated figure, or of an unusual nature, are subject to approval.

Whether a cost contractor does a particular piece of work himself or subcontracts with an outside firm to have it done is determined by such considerations as timing, economy, and security of information. In many cases it is more economical to subcontract work to outside suppliers who are peculiarly suited by experience and equipped with facilities to do the work. On one major reactor, for example, about 35 percent of the work will be accomplished by subcontractors. Many of the reactor components are being designed and fabricated by manufacturing concerns.

Some subcontracts such as those for design and development work on the more complicated and novel manufactured items cannot be placed on a lump-sum basis and cost subcontracts have been negotiated. About 75 percent of the subcontracted work on the reactor mentioned above has been lump sum, and 25 percent cost type.

Use of a contractor's own products. It may be in the interest of the Government for a cost-type contractor or subcontractor to obtain and use for AEC jobs articles which he manufactures. In such cases, a typical contract provision is that these articles cannot be charged to the AEC at prices higher than those currently paid by any other customer buying substantially the same quantities. The AEC reserves the right, by giving written notice, to require prior written approval of any order in which the total cost to the Government exceeds specified amounts. The AEC may require the contractor to obtain competitive bids, or may itself procure and substitute equivalent articles sold by other manufacturers at a lower price.

COST CONTRACTS FOR OPERATIONS

Operation of major installations of the atomic energy program—production plants, or laboratories, and the communities associated with some of them—is carried out under cost contracts. Contracts are drawn up through negotiations to cover the particular operations involved; in many cases they are evolved from contracts originally worked out by the Manhattan Engineer District.

The cost contracts for these various operations are the major instruments through which AEC carries out the programs for operating the industry and for advancing the science and technology of atomic energy.

In one case, Hanford, the prime contract with the General Electric Co. covers operation of the plutonium plant, construction, research, and development both at Hanford and at Knolls Atomic Power Laboratory, Schenectady, N. Y., and covers also operation of the 22,000-population community of Richland, complete with commercial and recreational facilities, bus lines, residences, etc., to accommodate plant personnel and their families.

At Oak Ridge, the gaseous diffusion plant and the national laboratory are operated under a contract with Union Carbide & Carbon Corp. The community of Oak Ridge, however, is serviced largely under a separate contract with another corporation (Roane-Anderson Co.). AEC handles construction for plant and community. Bus lines, necessary to carry residents to the facilities which are some miles distant, are operated under a separate contract with American Industrial Transport, Inc.

Other laboratories are operated under contracts drawn exclusively for that purpose—Argonne National Laboratory is operated by the University of Chicago; Los Alamos Scientific Laboratory by the University of California; Brookhaven National Laboratory by a corporation, Associated Universities, Inc., formed by nine eastern universities. The community at Los Alamos is operated by the Zia Co. which has responsibility also for servicing the laboratory, a function the other laboratory contractors perform for themselves. AEC handles all construction at Los Alamos.

In each case, the contract is drawn to carry out the special tasks, or combinations of tasks, to be performed, to deal effectively with local requirements, and to fulfill the needs of the contractor.

Production Contracts

In the case of production installations, major industrial corporations do the work in facilities which under the Atomic Energy Act are owned by the Government, as is the product they turn out—plutonium at Hanford, uranium 235 at Oak Ridge. Their operations are financed through the Federal budget, and their costs are subject to Federal audit. Their contracts are directed toward accomplishing efficient performance of their job, turning out on schedule the quantities of materials determined upon by the Government, and seeking to improve processes and decrease costs. They are obligated to protect the health of their workers and to safeguard the public from the peculiar hazards of nuclear radiation, and are required to maintain tight security controls over personnel and facilities. These many considerations require contracts framed primarily to establish a good working arrangement between the contractors and AEC—one that blocks out the areas of responsibility and obligation and makes it possible to set up flexible administrative machinery to carry them out efficiently and economically in a way satisfactory both to the Government and the corporation.

A rigid contract would not meet these various needs. AEC negotiates flexible instruments that permit wide variation in the character and extent of controls that may be exercised. One great advantage of the contract method of doing business is the management skill that the corporation's experience in competitive enterprise brings to the atomic energy industry. AEC contracts are designed to give that skill the freest possible play consistent with fulfilling AEC responsibilities to the President, the Congress, and the Nation.

A clause from a production contract, carried over from MED contracts, provides ". . . All work and services under this contract shall be subject in all respect to the approval of the contracting officer . . .," the responsible AEC official. Under such a clause, the contractor may

be under the complete direction and supervision of AEC, or the contractor may be given a large degree of freedom of action. The course that AEC follows in administering the contract (reported in the succeeding chapter) depends upon the job being done, its experience with the contractor, and the functioning of the systems of reports and controls developed for that particular kind of operation.

Laboratory Operation

For laboratory operation, where the program combines both basic research and developmental work, contracts have been supplemented with statements of operating policy jointly drawn up by the AEC and the operating contractor. Effective integration of basic research and developmental work requires both stability and flexibility—stability for long-range basic research and flexibility for developmental programs in which the scope and objective may change frequently. To provide this, in the case of one laboratory, the AEC has, subject to availability of funds, committed itself to the long-term support of a cadre of selected senior scientists capable of serving either as project leaders in developmental work or as individual research workers. While the AEC has expressed its intention of supporting an adequate basic research program at this laboratory, it declared its intention at the same time that the developmental group would be larger in size than the basic research group and would be engaged in projects carrying priorities assigned by the AEC, and that it operate under the discipline necessary to insure that efforts are directed toward goals for which funds are allocated.

Community Operations

The contracts for operating the services of the 3 communities that support major atomic energy installations—Oak Ridge with 30,000 population, Richland 22,000, Los Alamos 11,500—are largely without precedent. These communities began as Army posts and were operated as such. Housing and many of the community and commercial facilities have been Government-built—stores, houses and apartments, hospitals, recreational facilities—and are Government-owned. (In the last 3 years, many privately financed structures for commercial use have been built.) Utilities and civic services, such as fire protection, police, waste removal, must be provided, and bus lines must be operated to and from the plants themselves some miles away from the communities. At Oak Ridge and Los Alamos, the AEC has met this problem of managing the real estate and providing essential services through contracts with corporations set up specifically for the jobs.

AEC's objective is that, to the extent practicable and consistent with requirements for efficient operation of its plants and maintaining their security, these communities become wholly self-governing and self-supporting and enjoy private ownership of commercial and residential property. When and how best to achieve these objectives are questions not easily answered. The Commission recently appointed a Community Operations Panel, headed by Mr. R. G. Scurry, of Dallas, Tex., to study the role of the communities in the atomic energy program

with particular attention to possible means for realizing the AEC objectives.

Fees Paid Contractors

To some of the cost contractors of its various key operations, AEC pays a fee. The community contractors at Oak Ridge and Los Alamos, for example, receive fees;[5] university operators of laboratories generally do not. In the case of the corporations operating production installations, provision is made for home-office or off-site administrative charges over and above reimbursable on-site costs: sometimes by an administrative fund against which charges must be justified, sometimes as part of a fee, sometimes by an overhead allowance. Special risks arising out of the type of operation are chargeable to the Government, and the AEC indemnifies contractors by various devices and in varying degrees according to other arrangements for payment under the contract.

Where a fee is paid, the contract commonly stipulates the scope of operations anticipated, and a change in scope may entail negotiation of a new fee.

The way in which the contracts are administered, the key to successful operations of these atomic energy installations, is reported in the succeeding chapter.

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[5] In passing the 1951 Independent Offices Appropriations Act, the Congress required that "no part of the foregoing appropriation or contract authorization shall be used in connection with the payment of a fixed fee to any contractor . . . or contracts at any installation of the [Atomic Energy] Commission where that fee for community management is at a rate in excess of $90,000 per annum, or for operation of a transportation system where that fee is at a rate in excess of $45,000 per annum."

These requirements affected the contracts for Oak Ridge and Los Alamos community operations, and the contractors have agreed to operate these communities at a rate within the congressional limitation. In the case of the bus-line operator at Oak Ridge, the fee had been reduced, under a contract signed in June 1950, from $90,000 to $31,200 a year, with a reduction in the number of personnel the contractor furnished without reimbursement.

III

ADMINISTRATION OF ATOMIC ENERGY CONTRACTS

To administer the contracts through which the various atomic energy operations are carried out, the Atomic Energy Commission sometimes has had to find new ways for Government and industry to work together, and to develop management devices not previously used in Government programs.

This is more generally true of cost-reimbursement contracts, but even in administering lump-sum and unit-price contracts, AEC has responsibilities not ordinarily found when contractors undertake to provide specified supplies or services to the Government at a fixed price. The descriptions of contract provisions and devices in the previous chapter underscored some of these: maintenance of security, protection of workers' health, and the public against special hazards, and accountability for atomic energy materials.

Where contracts are for operating facilities in the fissionable materials production chain, AEC must closely schedule output and take every necessary precaution against delay of work. The unit-price production contracts, found in the feed materials operations, call for periodic redetermination of price (p. 45), and AEC must therefore review costs of such contractors to an extent not usually necessary in fixed-price contracting.

Cost-Reimbursement Contracts

It is in the administration of cost-reimbursement contracts, however, that the management problems most characteristic of the atomic energy program are met with. The firms operating large Government-owned production plants, carrying on extensive development projects, and undertaking urgent construction jobs, work in close day-by-day cooperation with the Commission and its staff. They have been selected for their competence, and the Government is contracting with them not only for technical ability but for managerial ability as well. The working relationships between the Commission and its operating contractors resemble in some aspects those between industrial companies and their branch offices. The contractor undertakes to carry on an extensive operation; the Commission establishes the objectives and makes the decisions required to fit the operation into the national program, and exercises the controls necessary to assure security, safety, desirable personnel administration, and prudent use of the public funds.

Of the many administrative innovations required to make possible this kind of relationship between a Government agency and a number of industrial concerns, those in the field of finance are fundamental.

AEC Finance

The financial procedures in use in the atomic energy enterprise in 1947 when the Commission took office were the traditional Government system employed during the war emergency and were not specifically designed for industrial operations like the atomic energy program.

The record-keeping practices and audit procedures, in line with Government requirements, were intended primarily to provide the Government with justification of the cash expenditures under their contracts, item by item. These methods did not provide the up-to-date meaningful records of costs and the adequate basis for financial control of property so essential in the management of industry. The general accounts did not reflect the difference between capital and operating expenditures. They did not recognize the existence of such items as year-end accruals, inventories, and other factors necessary for preparing meaningful financial reports. They were not adapted to development of the accounting data necessary to provide the essential basis for sound management.

The customary procedure in the audit of certain contracts was resulting in a triple item-by-item voucher check—first by the contractors' employees, then by AEC staff, and finally by auditors of the General Accounting Office. The real purpose of an audit was lost in a mass of papers. Instead of giving the entire operation a critical review for general conformity with the purposes of the contract and with generally accepted standards for internal control and good accounting practices, the audit consisted primarily of a recalculation of items supporting contractors' expenditures. The sheer volume of paper work incident to the detailed pre-audit of reimbursements to contractors caused irritating delays. Reconciliations of contractors' records with those of AEC were unnecessarily difficult.

Cost of the Work the Basis for Accounting

In developing a system better suited to its needs, AEC has had the support of the Congress and the Bureau of the Budget, the General Accounting Office, and the Treasury Department. By July 1948, AEC had developed and was beginning installation of accounting and financing systems designed to fit its Government-contractor operations with all their industrial ramifications. By the spring of 1949 enough accounting data were available to permit AEC to draw up a budget request for proposed fiscal year 1951 activities in terms of the costs of performing the work to be done; that is, it had what the Hoover Commission has designated a "performance" budget, based on costs by functions rather than simply on the cash expenditures required. AEC in 1949 recast its 1950 budget in terms of the costs of the activities and has now had a complete year of experience with the cost-based performance budget.

A report on the accounting support of the budget of the various Government agencies, prepared by special survey teams at the request of the House Appropriations Committee, contains the following comments on the AEC system:

Except for agencies under the Government Corporation Control Act, the AEC was the first Federal agency to adopt both an industrial-type accounting system and the cost-based performance budget for all of its operations. In view of the increasing interest in the use of industrial accounting principles for Government agencies, it should be pointed out that the Commission possesses two of the essentials without which the full benefits of such a system cannot be realized; appreciation by management of the value of a good accounting system, and recognition of the need for an adequate accounting organization manned by qualified personnel. In the installation of the new system, which began in 1948, AEC has had the active cooperation of the GAO-Treasury-Budget Bureau Joint Accounting Program. The accounting principles employed have been approved by the Comptroller General.

The accounting is well integrated with budgetary preparation and execution. The activity classification and the cost accounting records and reports together constitute an effective tool for the financial and general management of operations. Its usefulness should increase as AEC refines its systems and gains experience in their use.

"Integrated" Contractors

The basic concept that has made possible the development of such a system in a contractor-operated Government enterprise is that of the "integrated" contractor. For accounting purposes, major cost-type contractors are treated as though they were branch offices and the AEC the home office. Under this arrangement AEC generally advances funds to its major cost-type contractors and then holds them responsible for a proper accounting. The contractors' financial and accounting operations under AEC contracts are required to be clearly separated and departmentalized from their other activities. The contractors maintain "branch" books of account and internal controls for AEC operations that are in conformity with generally accepted accounting principles and approved by the Commission. Contractors' accounts thus become an integral part of the AEC accounting system.

The contractor submits comprehensive monthly financial statements to AEC showing the financial results of contract operations. AEC periodically conducts examinations of the contractors' accounts and procedures for work under the AEC contracts, similar to the examinations performed by public accountants in the certification of financial statements. The result is to eliminate duplication of audit work and serious delays in reimbursement to contractors.

AEC's major cost-reimbursed operating contractors and most large contractors for development work are "integrated" in this way. Examples are the Carbide & Carbon Chemicals Division of the Union Carbide & Carbon Corp., the Nucleonics Department of the General Electric Co., and the Atomic Power Division of the Westinghouse Electric Corp. The salient points concerning accounting and financing under one of these AEC contracts are as follows:

a) Contract operations are financed from funds advanced to this contractor by the Commission and deposited in a special bank account.

b) Payments from these funds are audited periodically by AEC.

c) A separate and distinct set of accounts is set up and maintained to provide detailed data both by operating units of the contractor's organization and by AEC activities. Thus, the contractor and

AEC can consolidate data as needed by each with comparable data for other operations.

d) Contractors' methods of handling payrolls, procurement, and stores have been adopted in general, with only slight modification to meet AEC requirements.

e) The contractor accounts for all funds, property, and facilities furnished to the activity. Accounts are audited by AEC and the General Accounting Office.

f) Periodic and special financial and operating reports are available to provide the basis for management and budgetary decisions.

Nonintegrated Accounts

There are numerous cost contractors whose accounts are not integrated with those of AEC, generally those with contracts involving relatively small sums of money or short periods of time. Even some large cost-type construction contracts, because of their limited duration, are not accounted for on an integrated basis. In such cases, AEC reviews the contractor's accounting procedures in advance to assure that they will provide the cost data necessary for the maintenance of AEC accounts.

Auditing

The installation of a modern industrial-type accounting system with provisions for internal controls made necessary the adoption of modern auditing techniques patterned after the methods of the public accounting profession. The primary aims of this type of examination are to see that funds and property are adequately protected by systems of internal controls and to establish the integrity of the financial statements. The audit includes the examination and verification of assets, liabilities, income, expenses, and cost distributions. Supporting documents are checked only to the extent considered necessary to determine the adequacy and accuracy of the general records. The accounting and internal control systems are reviewed to determine whether they are adequate to provide reasonable safeguards over assets, and furnish accurate and reliable information. The major improvement in the over-all audit program represents another instance in which AEC has adapted commercial methods to its operations.

Three Phases of the Audit

Where the accounts of a contractor are integrated with the AEC accounting system, the audit by AEC generally has three phases. A reimbursement audit is performed primarily to verify the contractors' net expenditures for approval of reimbursement or recoupment vouchers. Interim examinations are made from time to time during the year to test the adequacy of accounting records and internal controls. These examinations are a part of a comprehensive audit customarily completed once a year to verify the balance sheet and operating statements of the contractor.

Examinations and reviews independent of the comprehensive audit are made of financial operations under the various provisions of all

contracts. In addition to verifying the correctness of the related financial transactions, these reviews provide valuable information to management and reveal ways of improving procedures and tightening controls.

The audit branches in operations offices are under the administration of the directors of finance and are independent of the accounting branches. Auditors from the Washington Office conduct on-the-site reviews of operations office audits and also review the copies of audit reports sent to the AEC controller.

GAO Audits

The General Accounting Office has cooperated with AEC in all of its auditing problems. In accordance with an agreement with the Comptroller General in October 1947, the GAO Audit Division has a staff stationed at each major AEC site. Since most contractors' records are now examined at the site by both AEC and GAO, the problem of duplicate records is largely eliminated. Both the contractors' records and the AEC audit reports and working papers are available at all times to the GAO auditors. The GAO Corporation Audits Division is now starting a comprehensive audit of AEC accounts.

Accounting and Contract Administration

The AEC accounts have been established in the exact pattern of the work to be done throughout the enterprise; that is, the divisions and subdivisions of the budget and reporting classification are the same as the divisions and subdivisions of the operating program. Thus the making of the budget (estimation of future costs) is inseparable from program planning, and the accrual and periodic reporting of costs incurred is the basis for progress reporting as the program is carried out.

The budgeting and accounting systems provide one of the means through which AEC and its contractors jointly plan the jobs ahead, dividing and subdividing the major objectives into specific activities for which cost estimates are prepared. Similarly, in the execution of the programs, the contractors' periodic cost reports, along with their reports of physical work accomplished, make possible the continual measurement both of work done in relation to schedule and costs in relation to estimates. At the same time these reports provide the basis for planning the work ahead.

Contract Administration

Underlying the relationship of AEC to its major cost-reimbursed contractors—whether they be contractors for plant operation, laboratory operation, development, or construction—there are certain mutually recognized principles growing out of AEC's basic policy for contractor operation and method of selecting contractors. Briefly, they are:

a) The contractor recognizes that the AEC is responsible under the law for the conduct of the atomic energy program.

b) The AEC recognizes that the contractor is an established industrial, business, or academic organization with proved capabilities, both technical and administrative.

c) The contractor recognizes that the proper discharge of the AEC responsibilities under the law requires that the AEC shall have full access to information concerning the contractor's performance of the contract work and the power to exercise such control and supervision under the contract as the AEC may find necessary.

d) Both the AEC and the contractor recognize that the proper discharge of the contractor's responsibilities for management requires that it shall, to the fullest extent compatible with the law, exercise its initiative and ingenuity in carrying out the contract work.

Basic Points for Coordination

Through these relationships a major part of the control is exercised, but to be successful all of the participants must be kept adequately informed on four basic points, plus innumerable points subsidiary to each. These points may be illustrated—in oversimplified terms—as they would apply to a contract for operation of a production plant:

a) What is the goal to be accomplished over a period of time and at what rate; how much material is to be produced over this period of time and how much must be produced—today, this week, or this month, to reach the over-all goal?

b) How much was produced today, this week, this month? If not as expected—why?

c) How much is it expected to cost to produce the quantity established as the goal for the period, and at what rate will the costs be incurred?

d) How much did it cost to produce what was produced today, this week, this month? If not as expected—why?

PLANNING CONTRACTORS' PROGRAMS

To provide a firm basis for estimates for future periods, an AEC operating division, after preliminary consultation with the local operations office and the contractor, issues broad program plans. These plans indicate—in a production program, for example—which plants are to be operated, the dates on which new plants are expected to come into production, and the over-all level of production activity. Detailed programs consistent with these broad general plans are then prepared by the operations office and the contractor. The subsequent review of the detailed estimates is then on a basis which allows each feature of the total program to be assessed in view of the amount it is expected to cost and in relationship to the remainder of the program.

Primary attention can thus be focused on two questions: "Is this particular item worth what it will cost?" and, if so, "Can it be done now or must it be postponed to enable a more important job to be accomplished?"

When changes in the program occur—and in the fast developing field of atomic energy they occur frequently—the budget can be reviewed to see if funds can be made available to finance the new work. Such reviews are made each quarter and at other times if necessary.

Planning Increased Production—Example

A contemplated increase in production of fissionable materials, for example, would require close coordination between the Washington Division of Production, the local operations office, the contractor, and, through the Division, other AEC offices and contractors whose work might be affected. In the first place, such an increase, if substantial, would probably require construction of new plant capacity. From an administrative viewpoint, therefore, initial action authorizing increased production would be in the form of authorizing a construction program. Other actions dealing entirely with the operation of the new facility, as opposed to its construction, may be taken either simultaneously with the authorization of construction or during the period of construction, depending almost entirely on the time schedule. These actions would be as follows:

a) The Production Division forwards to the operations office proposed production goals or operating levels covering facilities as a whole. These are based on a preliminary analysis and breakdown among all of AEC's production facilities of the work needed to produce the over-all quantities of fissionable materials called for.

b) The operations office and the contractor analyze these production goals or operating levels for the entire plant and further break them down into goals or operating levels for each of the individual facilities.

c) The contractor then restates these assumptions in terms of additional work expected from each of its organizational units. All told, the number of additional units of work to be considered in planning the production increase will total many hundreds.

d) Estimated operating costs are then prepared, unit by unit, on the basis of these assumptions and reviewed at each of the steps involved in approval of budget estimates.

e) Meanwhile, the AEC Production Division, by appropriate instructions to other operations offices, will have taken similar action with respect to operations contributing to the contractor's ability to place the new facility in operation (e. g., increasing production of feed materials and delivery of raw materials, provision of special equipment and supplies).

f) Upon approval of the operating cost estimates, the Production Division will establish the cost ceilings for the operations office within which the established program is expected to be accomplished, the latter will establish cost ceilings for the contractor's operation, and the contractor will establish cost ceilings for its organizational units.

Planning Research and Development

Program planning with the operating contractor of a large atomic energy laboratory follows much the same pattern. To guard against sharp fluctuations in the over-all work load, AEC, in consultation with the contractor, establishes an "operating level" of work and funds for the institution as a whole. Within this limitation, the planning and budgeting of projects in programmatic research and development is based upon the same detailed analysis of units of work used in production planning. Cost estimates, however, cannot always be as accurate, for two reasons. In the first place, it is never certain in a development project how much effort or time may be required to arrive at a given point of achievement. In the second place, there is a scarcity of contractors with experience in such projects, brought about by the acceleration of development activity involved in the atomic energy program, especially in the field of nuclear reactors.

For budgeting purposes, these difficulties are sometimes met by setting fixed levels of expenditures for projects. On urgent projects, however, the budget must attempt to forecast the cost of arriving at answers within definite periods of time. No specific project is allowed to run more than a fixed percentage over its budgeted costs within a given year unless specific approval is given by AEC to the contractor; and in the aggregate, total estimates for an entire developmental program—including all projects—must not be exceeded.

Planning Basic Research

Because of the greater difficulty in describing goals in basic research, and because responsible scientists plan their own basic research projects, such programs are not budgeted or controlled in the detail found in applied research planning. Dollar estimates and dollar limitations are coupled with classes of work such as "neutron physics" and "chemistry of the rare earths," leaving to the laboratory director and his scientific staff the choice of specific investigations and methods of attack, within the totals fixed under each major budget program.

CARRYING OUT CONTRACT PROGRAMS

At its operations offices on the sites of major cost-type contract operations, AEC maintains staffs of its own employees adequate to keep the Commission informed about operations; to assure compliance with contract terms; to assist with the planning and budgeting of programs; to assist the contractors' liaison with other related operations and with Washington headquarters; to receive, audit, consolidate, interpret, and transmit contractors' reports; to review progress and take action when difficulties appear; to assure that accounting and other business operations are conducted efficiently and economically; and to assist contractor operations as required.

The extent to which the AEC staff assists and supervises the operations of contractors varies widely with the circumstances. Under routine conditions it is at a minimum in plant or laboratory operation conducted by contractors selected primarily because of their ability to carry on such work; it may be greater at installations where groups

of contractors, say for construction, are working together. It is considerable where the task of managing and providing for a community is involved.

AEC Coordination of Contractors—Example from Construction

As noted in the preceding chapter, the construction of a large plant under cost-type contracts may involve several contractors working closely together, each with large and complex responsibilities and many of them with varieties of subcontracts to administer. AEC staff supervision of such a job has many aspects. In addition to supervising and administering the prime contracts with their many provisions, the staff must plan and schedule construction activities, expedite procurement, review design and construction activities, and institute methods to control cost and progress.

Successful completion of the plants on schedule depends upon close coordination of intercontractor relationship. One of the foremost responsibilities of the AEC staff is to mold the various contractors' organizations into one working unit. The importance of this coordination is illustrated by a list of points at which teamwork between contractors is required:

The plant operating contractor must furnish basic process design information and design criteria to the architect-engineer contractor and sometimes to suppliers of specially fabricated equipment.

The architect-engineer contractors must prepare specifications on materials for use of the general construction contractor in letting purchase orders for materials.

The construction contractor, on the basis of his general knowledge of the design, must furnish the architect-engineer with a schedule of dates on which working drawings for specified portions of the work will be needed.

The architect-engineer contractors before they can complete the working drawings for their respective design responsibilities, must have available the shop drawings of equipment from the suppliers with whom the procurement orders for equipment have been placed.

The construction contractor must have available the equipment delivery schedules and be aware of the time required for testing equipment and preparing it for installation.

In such a construction and design job, this interplay among the contractors begins the first day they are notified of their selection and must continue until the end of the project. The AEC staff coordinates the many determinations that must be made between alternatives as design progresses. The construction contractor reviews the preliminary design drawings to offer suggestions on how construction may be simplified. When faced with design alternatives for which construction costs are a deciding factor, the architect-engineer obtains estimates from the construction contractor before selecting an alternative. Many thousands of dollars can be saved on jobs as a result of this cooperative work.

AEC Guidance to Contractors for Community Operation

The three communities which AEC operates through contractors in the furtherance of its production and weapons programs have an

aggregate population of 63,500. Operation of these Government-owned towns calls for three broad kinds of management:

Municipal services. Provision for such services as police and fire protection, schools, recreation, and all other services usually provided by a municipality.

Community facilities. Provision of utilities, such as transportation systems, electricity, gas, water, and fuel, and, in some cases, hospitals and other establishments and institutions which serve a modern community.

Housing and commercial facilities. Provision, maintenance, and management of housing for all residents, and the assurance of adequate facilities for stores, theaters, etc., including unimproved land on which private enterprise has built or is building such facilities.

In addition, there are ever-pressing problems related to the unusual nature of these communities—problems of self-government, support of schools, relations with surrounding political entities, encouragement of private enterprise, maintenance of security, and many others.

As a rule AEC's contractors for community operation have experience in real estate management, but no organizations were available with experience in managing the community job as a whole. AEC operations offices at these sites are staffed for day-by-day control of community management and for coordinating the work of contractors where more than one is involved.

Reporting by Contractors

It has been consistent practice of AEC to place contractors on notice that costs are a major consideration, despite the urgency of time schedules. Adoption and maintenance of cost controls by the contractors has been a major factor in assuring economical accomplishment of the work.

Cost reporting, as has been seen, serves other purposes than that of economy; when properly supplemented by other operating reports, it provides a measure of progress, a check on the validity of previous plans, and a basis for planning ahead. Also cost accruals provide an important administrative control at all levels of all programs.

Financial Planning

The cost estimates set forth in the quarterly financial plan for each office of operations for each operating program constitute ceilings which the operations manager may not exceed without prior approval. In addition, directors of Washington program divisions may specify that costs shown in the plan for each quarter or for any program subclassification may not be exceeded. Program changes that the manager of operations cannot carry out within the limit budgeted for each program or within the range of flexibility permitted for subordinate activities are submitted to Washington for approval.

Quarterly review and adjustment. In any case, all financial plans and related allotments are subjected to a comprehensive review each quarter. About 3 weeks before the end of each quarter, managers of operations offices resubmit their financial plans for the year, requesting any changes in allotments required for carrying out their operations and

construction work during the remainder of the year. The revised plans reflect actual costs incurred during completed quarters and up-to-date estimates for the current and succeeding quarters. The directors of program divisions and the General Manager reconcile conflicting needs and priorities and approve whatever changes are required in the over-all financial plan for AEC. Finally, the revised over-all financial plan is the basis for review with the Bureau of the Budget.

Cost Reporting Procedures

Typically, the cost-report chain begins with monthly cost statements for each of the divisions of an integrated contractor's organization, an over-all summary of his costs for each activity, and, in reporting to Washington headquarters, a summary of total costs incurred from all sources under the jurisdiction of the local operations office. In each case, the categories by which costs are reported are identical or can be reconciled with the categories by which the budget estimates were originally made and by which the approved budget limitations were established.

Cost reporting in construction. On a construction job, AEC sets up requirements for cost reporting which provide important assistance in coordination of the work. In one especially complex case, involving a number of contractors the reporting called for the following coordinated activities:

First, a detailed estimate on the entire job was worked out. This included a detailed breakdown of estimated costs on each unit or major feature of the total job. Then accounts were set up which showed for each major feature at a given date (*a*) how costs incurred and committed compared with estimated cost, (*b*) whether progress in work was in step with costs as estimated for that particular stage of completion of the work, and (*c*) a new estimate, on the basis of progress, of remaining costs. Review procedures worked out in connection with the estimate and the accounting system were developed so that it was possible to tell, at any given time, whether each major feature of the job was being completed within the cost ceiling established.

The accounts covering each major feature of such a job and the cost ceiling placed on each account are in effect for each participating contractor. The construction contractor may collect monthly reports from each participating contractor showing for each account the costs he has incurred at a given date, and estimated costs to complete the work. These cost reports are then appraised in view of the original ceiling established for each account. If a report indicates "overruns" or "underruns," the costs incurred are checked against actual material deliveries, actual progress, and the amount of work remaining to be done.

Such periodic studies, conducted jointly by the AEC staff and all the contractors, immediately spotlight any segment of the work requiring further investigation because of cost disparities or lag in meeting schedule.

Construction accounting manual. A construction accounting manual is now in use on a test basis. This manual serves as a guide for both the AEC staff and the construction contractors as to the required accounting policies and standards for construction projects. It emphasizes the four basic requisites of cost control in construction: sound estimates of cost; measurement of current actual accomplishment in terms of cost and comparison of the actual with the estimated costs; investigation of variances between the estimated and actual costs; and prompt corrective action where needed in the construction processes. In addition to the principles of cost control, the manual sets forth general accounting principles most of which apply to contractors generally. For instance, AEC contractors are required to maintain internal controls sufficiently broad in scope to safeguard assets, check the accuracy and reliability of accounting data, promote operational efficiency, and encourage adherence to prescribed policies.

Community Accounting

Community accounting poses special problems. Questions raised in the early spring of 1948 suggested the need for more detailed town-operation information than was available from the MED or AEC accounts. Three public accounting firms were employed to obtain data from the accounts of the contractors for town operations on their current operating costs and income. The findings demonstrated the need for improving the accounting by these contractors and for integrating their accounts with those of AEC. After careful consideration and discussion the three principal town contractors (Roane-Anderson Co., Zia Co., and General Electric Co.) employed a public accounting firm to install uniform accounts for the three communities.

Progress Reporting

Cost reports from contractors could not measure progress or serve for future planning without additional reports showing actual accomplishment during the same periods. In a production contractor's organization, reporting includes a daily or weekly log of operating data for each of the operating facilities, a monthly summary report describing activities and accomplishments (including actual production figures and a general review of progress on developmental projects) for each of the divisions in the contractor's organization, material balance reports—showing such information as the material month-end inventory, monthly consumption for each plant, estimated consumption for the following month, quantity on order with tentative delivery schedule, and transfers of material. In addition, there are periodic technical reports on developmental activities. Copies of reports are furnished the AEC operations office which, in turn, makes a weekly report on major activities and a monthly status and progress report summarizing data on all activities to Washington.

Reports on Applied Research and Development

The typical monthly progress report made by a contractor for applied research and development to the local AEC office contains

administrative information and a brief review of work on each problem under investigation. For the large contractor whose work proceeds on a number of projects, it is generally not feasible for the monthly progress report to give sufficient technical detail for interested scientific and technical workers. In such cases, quarterly progress reports and topical reports are made. The former give details on a limited range of related topics, the latter present thorough treatments of a particular investigation at conclusion of the project, or at the time of some major developments.

The various reports are distributed promptly by the originating contractor among interested agencies and workers in related fields through standard distribution lists maintained by Washington divisions.

Reports on Basic Research

The AEC follows a policy of asking for a minimum number of interim reports on contracts for basic research. The investigator is asked to report on progress near the end of the first year's investigation, primarily to help the AEC determine its future action in support of the project (termination or extension of the contract, or modification of support in view of greater or lesser interest in the work), and to disclose any particular problems which the AEC might be interested in exploring further. In the latter connection, should significant or unusual results develop at any time, the investigator is normally required by the contract to report his findings immediately so that the Commission may lend more assistance if merited or take other action. The Washington scientific staffs, of course, maintain scientific liaison with the project and follow the progress of the work in this way.

If the project is renewed or extended after the first year, an annual scientific report on progress is required, plus a final scientific report upon termination of the contract. The investigator is encouraged to publish his results in scientific journals or by any other means the investigator may deem appropriate if they do not include material that must be kept secret.

Reporting Source and Fissionable Materials

For the source and fissionable materials which are peculiar to atomic energy operations, the degree to which control is required is considerably beyond that necessary or practical for other types of materials. From the source and fissionable materials inventory reports of a production contractor, it is possible to obtain a material balance in all operating processes every month. Representatives of the local operations office work in close association with contractor personnel in accounting for other than normal fluctuations. With this information as a control, all source and fissionable material is accounted for on a current basis.

Consolidated source and fissionable material inventories, which include "SF materials" held by all contractors, are submitted to a central office, where the materials must be related to the control totals based on the assay made when ore or ore concentrates were first received.

Security

The Commission is responsible for the security of the enterprise. To this end, it has developed a system consisting of three interdependent programs: (1) *personnel security*, to determine the eligibility for security clearance of all employees of the Commission and of those employees of its contractors and licensees who are to have access to restricted data; (2) *physical security*, to prevent unauthorized access to installations, materials, and information, and to protect such property from sabotage, espionage, or theft; and (3) *document and information control*, to withhold classified information from unauthorized persons.

These procedures are supervised by security personnel on the AEC staff, who are located at all installations requiring protection.

Security Protection in Construction

In construction of fissionable material plants and other secret installations, the task of guarding the security of atomic energy processes is usually more complex than at installations in routine operation. At the site itself, work areas are segregated and fenced off so that workers who do not require access to restricted data for their jobs have no opportunity to acquire it.

The minimum personal investigation includes a check of FBI central files. For any workmen who will have access to restricted data, the full FBI investigation and AEC clearance procedure are necessary. Other security checks are made on workmen who do not have access to restricted data but who work in proximity to vital or sensitive areas.

Security representatives of the operations office concerned, working with the security section of the contractors' organizations, also determine the adequacy of the physical security measures—placement of fences, guard forces, and facilities for storage of plans and other papers containing classified information.

Complicating the security picture on a large job are the large numbers of firms and workers who will be involved but who will never come near the site itself. For example, many of the architect-engineer employees may be located at the home offices of the firm. This necessitates not only the clearance of employees or others who require access to restricted data but also assurance of the physical security of the papers and plans located in those offices.

Security on Basic Research Projects

Another special security problem arises in connection with "unclassified" basic research contracts. Most of the research which is supported in the basic atomic energy research program as described here is unclassified by virtue of its very nature. However, on some projects there is more likelihood than on others that data may be discovered that must be safeguarded, and procedures have been devised to deal with this eventuality.

If the Washington divisions giving technical approval to a basic research project consider that the chance of developing restricted data

is essentially zero, none of the investigators is required to have formal clearance under security procedures. If there is even a very small chance of developing restricted data, the senior scientist is required to be investigated by the FBI and cleared by the AEC so that he can be advised of the classification policy of the Commission and serve as security monitor for the work. If at any time he considers that restricted data have been or may be discovered, the security monitor so informs the manager of operations administering his contract, and steps are taken to safeguard the information. There are, of course, a few basic research problems which, though they involve restricted data, are most appropriately carried on outside the Commission's laboratories. In such cases AEC security clearances are required for all investigators, and procedures are established by the manager of operations administering the contract to provide adequate physical security for the project.

AEC BUSINESS MANAGEMENT OF CONTRACTS

In tailoring business-management methods to fit the requirements of the atomic energy industry, AEC has drawn upon the experience of both Government and private enterprise. As in finance, many principles and practices of private enterprise have been applied. The property-management concept through property accounting has been substituted for that of personal accountability; procurement policies have been expressed in a Procurement Policy Guide; inventory accounting has brought more adequate inventory controls; and inspections coupled with properly detailed information have brought improvements in the utilization and disposal of excess and surplus property.

As in all its contract administration, AEC has attempted to give assistance and guidance to its contractors in business management matters without detailed regulation of methods. The effectiveness and economy of the contractor in performing the work under his contract is maintained through a close relationship of the management staffs at the AEC operations offices with the contractors. These relationships at the operations areas are supplemented by visits from the Washington staff. Continuing efforts are being directed by AEC and contractors toward developing more effective methods for measuring and contributing to business efficiency and economy.

IV

CONTRACTOR LABOR RELATIONS AND AEC

About 65,000 persons are employed by AEC contractors. The Atomic Energy Commission has attempted to help contractors develop and maintain conditions and management which encourage employees to work up to their limit of ability.

Responsibility of the Commission

The Atomic Energy Commission has considerable responsibility in this field both under the Atomic Energy Act of 1946 and as an administrator of Government contracts. When contracts are on a cost basis, it reimburses contractor expenses and hence must assure that public funds buy full value, and that the contractor maintains working conditions comparable to good practices in the industry or locality. Within broad limits of public policy each contractor determines his own personnel arrangements.

Security. Under the Act, the Commission must determine that granting an employee access to information and localities necessary to his job will not endanger the common defense or security. Not all contractor employees require access to restricted data. For those who do, an FBI investigation must be completed and AEC clearance granted before an employee may enter on duty on a job requiring such access. In order to prevent harmful delays in the program, the Atomic Energy Act of 1946 [1] permits clearances to be granted in case of emergency by the AEC before the FBI investigation is complete.

Other services. The AEC Division of Organization and Personnel offers some special services to participating contractors: collecting and distributing information on employment, wage rates, and labor-management relations, assisting in key recruitment, and coordinating a safety and fire protection program for the industry.

Recruiting Atomic Energy Workers

Construction. Growth of the atomic energy plant has demanded great numbers of construction workers. Only a few thousand construction workers were employed early in 1947. By the end of that year, employment in construction work had increased to about 18,000, and by the end of 1948 to over 27,000. New construction at Hanford was largely responsible for this increase in employment. During 1949, construction employment declined to about 14,000 at the end

[1] Sec. 10.

of the year. During 1950, the construction forces grew again at a rate of approximately 1,000 a month.

Recruitment of construction workers is made more difficult where the sites of new plants are distant from large industrial centers. Temporary housing must often be provided. In some cases, construction workers must travel as far as 150 miles daily in going to and from work. In keeping with normal practice in the construction industry, the building trades unions affiliated with the American Federation of Labor have performed a large part of the recruitment of employees in this area of the program.

Other contractors. Aside from construction, contractor employment has remained relatively stable at around 35,000 to 40,000. These figures, however, conceal some fluctuations in the numbers employed by individual contractors. Improvements in technology and elimination of some processes made it possible to reduce the number of workers in production; at the same time many had to be added in research and development work. At the electromagnetic separation and gaseous diffusion plants in Oak Ridge, employment was reduced from about 15,000 at both plants on January 1, 1947, to fewer than 2,000 at the former and 4,000 at the latter in 1950. During the same period, operating contractor employment as reported by operations offices increased from about 100 to more than 1,500 for Schenectady; from about 600 to more than 3,000 for New York; from about 2,000 to over 5,000 for Chicago; and from about 5,000 to more than 8,000 for Santa Fe.

Recruiting of Key Personnel

In recruiting key personnel for atomic energy operations, contractors often have to go beyond the immediate labor market. The Manhattan Engineer District provided some assistance to contractors in finding persons who had skills that few possessed, or that were in short supply in relation to demand. Under AEC, operations offices similarly cooperated.

In December 1949, the AEC established a method designed to assure that in recruiting key technical or scientific personnel, all the resources available to AEC should be systematically used. A specialist in key recruitment was placed in the Division of Organization and Personnel in Washington. Whenever an operations office has a key Government job to fill, it notifies the specialist in key recruitment. (A key position is defined as one which is so important to the program that the search for the best available people should not be limited to the vicinity of the office in which the position is located.) The specialist is similarly notified when a contractor requests an operations office for help in finding people of particular abilities. He then canvasses the other field offices and informs the hiring office of the available people (those already employed and applicants for employment) who meet the requirements of the job to be filled. If necessary, the specialist taps outside sources, including professional societies, industrial and governmental establishments, colleges and universities, etc., to identify needed people.

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A byproduct of this service has been to widen the opportunities of employees to advance and utilize their ability beyond the immediate needs of the office in which they are employed. More progress in achieving these objectives has been made in the field of Government employment than in contractor employment. Contractors, however, are making increasing use of this service.

Labor-Management Relations

A smoothly operating policy on labor-management relations within the atomic energy industry is essential to the continued production of weapons and fissionable materials and to the successful conduct of research and development programs upon which progress depends. In carrying out its programs through contractors, the Atomic Energy Commission places its major reliance for efficient operations upon the managerial skills of the contractor. In personnel matters, as in other phases of contractor-Government relationship, the degree and mechanism of AEC supervision affects the rate of progress in the program. To help determine the best methods, the Atomic Energy Commission appointed boards and committees to advise it on maintaining such a relationship with its contractors as would both promote the highest performance by the contractors and assure the fulfillment of AEC responsibility.

Advisory Board on Contractual Relationships. In February of 1947, the General Manager appointed this board under the chairmanship of John R. Loofbourow. Its field of study and recommendations included all phases of administration and management. Although its report placed special emphasis upon AEC relationship with academic contractors in the conduct of research, the board stated that its conclusions were equally applicable to other contract operations. On contractor personnel administration, the Loofbourow board recommended:

> The Commission should go no further than to arrive at mutually agreed upon general personnel policies with contractors. The Commission should then place full responsibility on contractors for seeing that these policies are carried out. It should be borne in mind constantly that the Commission is purchasing management from its contractors. It is a waste of Government funds for the AEC to attempt to provide duplicate management services, for such purposes, for example, as passing upon the appropriateness of individual salaries of contractors' personnel or approving individual promotions. Judgment in such matters should be the responsibility of the contractor, for which he should be held strictly accountable, as a result of careful and periodic review, within the parameters of the negotiated agreement.

Advisory Committee on Scientific Personnel. In the same year, a committee headed by F. W. Loomis was appointed to study all phases of personnel management in AEC research facilities. The committee endorsed the finding of the Loofbourow board and stated:

> In general, we believe, in full accord with the report of the Loofbourow board, that the effective functioning of the program requires a maximum possible devolution to the contractors . . . of responsibility for the formulation, as well as the implementation, of personnel policies.

President's Commission on Labor Relations in Atomic Energy Installations. In June of 1948 the President of the United States appointed a Commission on Labor Relations to study the complex problems of atomic energy labor relations. (The circumstances are reported more fully on p. 78.) This Commission was to ". . . concern itself with the broad code of conduct which should be observed by management and labor in their relation with each other in the vital program." In April of 1949, the President's Commission filed a report to the President wherein it proposed that "the aspects of wages, hours, and working conditions which are the substance of collective bargaining be left to management and labor" without AEC intervention except as is necessary to discharge its responsibility for the atomic energy program.

CARRYING OUT THE POLICIES

The recommendations of these advisers have consistently called for broad delegation of authority and responsibility to the contractors in personnel administration and labor-management relations. All stressed the need for keeping Government supervision of details to the minimum consistent with Government responsibility.

Under the principles laid down by the Commission, the AEC has limited its intervention in labor-management affairs, and promoted normal labor-management relations throughout the atomic energy industry. At the same time, the Commission has sought to assure continuity of production, the full necessary security protection, and the prudent expenditure of funds.

During the last 4 years, the Atomic Energy Commission has acted to establish those rights and privileges both for the contractor and the workers which are traditional in America, at the same time that it has attempted to prevent work stoppages at vital installations.

Employees of atomic energy contractors now have the right to choose a collective bargaining agent if they wish. Almost without exception, groups of employees organized as bargaining units work under agreements which assure that they will not strike during the term of the contract. Special machinery has been set up to settle disputes which arise. Contractors and unions have, by and large, pledged that they will maintain production and working conditions during discussions of contract renewal. Steps have been taken to assure that those who participate in the program as bargaining representatives of employees are loyal to the United States.

The AEC has also acted to reduce any possible conflicts between the procedures normally followed in collective bargaining and the protection which it must maintain over the security of its programs, but without compromising the standards of protection.

Wartime Labor Relations

Cost contracts under MED. AEC's predecessor, the Manhattan Engineer District, found it necessary to intervene in labor-management relations of cost contractors.

On research and operations, union recognition was deferred by intervention of MED. The National Labor Relations Board was re-

quested not to process any petitions for representation filed by unions.

The Government also intervened in wage rates. Although contractors could recommend rates and working conditions, they were subject to the approval of MED and the wartime wage stabilization agency.

In MED construction work, although wage rates were governed by Federal wage stabilization policies, contractors and unions maintained well-recognized labor agreements, and the unions played an important role in recruiting skilled employees for the projects.

Changes After the War

After the war, there were immediate demands that the restrictions against union organization be lifted. After a reexamination of security implications, the MED decided (March 1946) to allow the National Labor Relations Board to handle cases at Oak Ridge. Procedures were worked out to do this under special security controls. An examiner underwent a security investigation and was approved, then made a field study. Contractor and union representatives who had been similarly cleared appeared at secret hearings before the Board. The Board then published a description of the collective-bargaining unit found to be appropriate.

Elections were held in August 1946 in two plants and a laboratory in Oak Ridge. As a result, the United Gas, Coke and Chemical Workers' Union of America of the Congress of Industrial Organizations (CIO) was certified as bargaining agent in the gaseous diffusion plant, and the Atomic Trades and Labor Council of the American Federation of Labor (AFL) in Oak Ridge National Laboratory. In the electromagnetic separation plant at Oak Ridge, the employees voted to reject union representation.

Early AEC Labor Policy

Upon assuming operation of the program, the Atomic Energy Commission sought to define its own role in relations between its contractors and labor unions. The Commission selected a committee of three labor relations experts (David Morse, George Taylor, and Lloyd Garrison) to analyze the proposed labor contracts negotiated after the NLRB representation elections. Their report, submitted on January 4, 1947, suggested the Commission should pass upon three major portions of labor contracts, i. e., labor expenditures, continuity of work, and security matters, but that, under a contractor theory of operation, the Commission should not concern itself with the other provisions.

The First Dispute

The original labor contracts at Oak Ridge carried stipulations that specified clauses dealing with security and continuity of operations were not subject to renegotiation. However, another issue proved to be a greater subject of controversy. Early in 1947, the CIO requested the Carbide and Carbon Chemicals Corp., which operated the gaseous diffusion plant for the AEC, to modify the agreement covering em-

ployees at that plant so as to meet the conditions in the agreement Monsanto Chemical Co. had negotiated with the AFL for employees of the Oak Ridge National Laboratory. The CIO claimed the MED had assured that no contractor would be allowed to grant terms more favorable than those granted by another. Discussions of these demands were carried on by the contractor and the union throughout the term of their agreement.

The AEC at first made some moves toward intervention but in the end decided against trying to require all contractors to maintain like working conditions or to make identical concessions to employees. The dispute was not settled until a new contract was signed late in 1947.

Efforts To Set Standards

The nature of the industry and the continuing dispute during 1947 at the gaseous diffusion plant led to many demands, both internal and external, that the Commission create some "formula" for contractor-union relations that would give an absolute guarantee of continuity of production. The plants at Oak Ridge had been opened up for collective bargaining on an experimental basis. Certain basic contradictions were apparent between traditional collective bargaining and a cost-reimbursement contractor system operation in a plant where even momentary work stoppage was against the national interest.

Before extending collective bargaining to other areas it was felt that the possibility of a formula had to be explored. Extensive discussions followed with contractor and union representatives. In January 1948, the Commission reported to the Joint Committee on Atomic Energy of the Congress that it was moving in a direction of minimum intervention in relations between contractors and unions; that it hoped to arrive at the needed assurance of continuous operation by voluntary agreement of labor and management; and that discussions were being conducted with the following goals:

a) Wholehearted acceptance by contractors and by labor and its representatives of the moral responsibility inherent in participation in the atomic energy program.

b) Development of procedures to assure (1) that all participants in the program are loyal to the United States, including those whose participation involves the exercise of negotiating and disciplinary authority over bargaining units, and (2) that determination of unit, jurisdiction, and similar questions will not breach security.

c) Continuity of production at vital AEC installations.

d) Consistent with the Commission's responsibility under the law, the least possible governmental interference with the efficient management expected from AEC contractors.

e) Minimum interference with the traditional rights and privileges of American labor.

Discussions with contractor and union representatives continued during early 1948, but no agreement was reached and no formula found.

"Nonintervention" in 1948

The 1948 policy discussions were interrupted by a threatened strike at Oak Ridge National Laboratory. At that time, AEC announced

it would intervene only to the extent necessary to assure that the contractor did not establish conditions which were clearly unwarranted or substandard.

This degree of self control was never completely achieved. The dispute at Oak Ridge National Laboratory represented the other side of the same issue in dispute during 1947 at the gaseous diffusion plant. The unions felt that wages and working conditions at the laboratory were superior to those in the plant. This differential had been established during the war. The CIO union, representing workers in the gaseous diffusion plant, was dedicated to removing the differential; the AFL union, representing workers in the laboratory, to retaining it. Negotiations over a renewal of its contract with Carbide and Carbon Chemicals Corp.,[2] which had meantime assumed operation of the laboratory, broke down early in March 1948. The threat of a strike caused the emergency procedures of the Taft-Hartley Act to be invoked. The AFL had desired to take the dispute to arbitration; the contractor refused. Carrying out its nonintervention policy, the AEC would not compel the contractor to arbitrate.

In actuality, the nonintervention policy was modified in several respects during negotiations. In order to give the Board of Inquiry under this Act time to report, the Commission directed Carbide, as its agent, to maintain the existing conditions. After the Board of Inquiry reported, the Department of Justice obtained an injunction compelling *status quo* for the 80-day injunction period of the Act.

AEC also intervened directly at the end of the 80-day period. After the employees had voted overwhelmingly to reject the employer's offer and the injunction had been dissolved with no settlement in sight, the Chairman of the Commission met with top AFL officials. He told them that AEC intended to insure that operations continued, and stressed that the Commission would not review the conditions proposed by Carbide except to assure they were not substandard. AFL leaders were successful a few days later in obtaining local acceptance of their decision that there should be no strike.

The President's Commission on Labor Relations

The President announced his intention of appointing a Commission on Labor Relations in the atomic energy installations in a message to Congress on June 18, 1948, which dealt with the threatened strike at Oak Ridge National Laboratory and was transmitted to Congress under the emergency provisions of the Taft-Hartley Act. The President declared in his message:

> . . . I believe that special study should be given to the problem of peaceful and orderly settlement of labor disputes in Government-owned, privately operated atomic energy installations. . . . I propose, therefore, to establish a Commission composed of men having expert knowledge in the field of labor relations, to study this problem and to make such recommendations as they may find necessary. The Commission should explore the question whether any special legislation should be enacted to protect the national interest without depriving management or labor organizations of the initiative and freedom necessary for the progress of our atomic energy program. The Commission should study ways and means of

[2] A unit of Union Carbide and Carbon Corp., now the Carbide and Carbon Chemicals Division of Union Carbide and Carbon Corp.

adapting to the atomic energy program the best of our experience in the complex field of labor relations. The Commission should concern itself also with special aspects of the problem, such as questions of bargaining representation, uniformity of working conditions and wages, and procedures for grievance handling.

The Commission should concern itself, in short, with the broad code of conduct which should be observed by management and labor in their relations with each other in this vital problem. . . .

As members of his Commission, the President chose William H. Davis, former Chairman of the War Labor Board; Aaron Horvitz, New York lawyer and arbitrator; and Edwin E. Witte, University of Wisconsin economics professor and former public member of the War Labor Board. John Dunlop, Harvard University economics professor, was named as the Commission's consultant, and Donald B. Straus, of New York, as executive secretary.

The President's Commission conferred for 6 months with contractors, union leaders, and AEC officials, circulated their report in draft form among these groups, consulted with the Congressional Joint Committee on Atomic Energy, and discussed the problems with the Federal Mediation and Conciliation Service. The Commission's report submitted in April 1949 [3] was accepted by the President and AEC for a trial period of 2 or 3 years.

Recommendations of President's Commission

The President's Commission proposed that, subject to certain necessary limitations, the normal aspects of wages, hours, and working conditions should be left to collective bargaining free from governmental interference. Several specific suggestions were designed to facilitate bargaining: that all labor agreements include effective grievance procedures with arbitration as a final step; that the highest level of management and labor should participate in the settlement of critical disputes; that bargaining units and representatives should be determined by agreement and consent elections in preference to contested proceedings before the National Labor Relations Board; and that in atomic energy plants the union should be integrated into the plant organization as a "two-way channel of communication and a medium of understanding between management and workers."

The report stated that AEC had absolute and final authority in the area of security and that security rules and their administration were not matters for collective bargaining.

Machinery to Prevent Work Stoppages

For settling disputes, the report proposed machinery designed to preserve as far as possible the normal relationship of collective bargaining. Experience showed that when governments set up machinery for compulsory arbitration, a device frequently used for settling emergency disputes, there was a tendency for all disputes to be referred to this authority. This greatly modifies the collective bargaining relationship.

In normal collective bargaining, the union leadership is uncertain how long a strike may last and must balance the sacrifices involved

[3] Complete text in Sixth Semiannual Report of the Atomic Energy Commission, Superintendent of Documents, Washington 25, D. C., 45 cents.

against possible gains. Likewise, company bargainers have to balance possible losses in production and sales against the cost of granting union demands.

The President's Commission felt that it was possible to retain an element of uncertainty even in collective bargaining in which, as in the atomic energy operations, a strike could not be permitted to occur. The effort was to create a plan whereby the risks and uncertainties involved in a pending work stoppage could be replaced by the risks and uncertainties of referring issues to a settlement agency.

Panel of Three Recommended

The Davis report recommended that a Labor Relations Panel of three impartial members be appointed by the President and "that the Panel be empowered to take jurisdiction of any management-labor dispute which collective bargaining and the normal processes of conciliation have failed to resolve and which threatens to interfere with an essential part of the atomic energy program."

The right to strike or to change working conditions was placed in the keeping of the Panel through pledges given AEC whereby unions and contractors agreed they would not interrupt production or services or change working conditions unilaterally under conditions laid down by Panel procedures. As members of the Panel, the President appointed the same men who had composed his Commission.

The way in which the Panel exercises its jurisdiction is purposely left indistinct. The procedure provides for certain time limits for issuing recommendations or for ending Panel jurisdiction. However, the Panel is given full discretion in its handling of the dispute, and it may return particular issues to the parties for settlement, terminate its jurisdiction, or decline to assert it in the first instance.

The procedures are designed to discourage either unions or management from trying to use the body as a crutch to support a faltering or untenable position. The Panel may even decide that a dispute referred to it does not involve critical work and refuse to assert jurisdiction. The President's Commission conceived of the Panel as being a body not easily available to contractors and unions. The report stated that "the creative possibilities of responsible collective bargaining should always be zealously preserved. The parties should not be encouraged or allowed to evade their own primary responsibility to meet their own problems and to settle them by mutual consent."

Cases Handled by Panel

Most of the cases the Panel has handled have been settled by union and contractor negotiators. In its 18 months of existence, the Panel has handled 20 disputes. (Its reports have been printed in the Seventh and Eighth Semiannual Reports.) Most of these cases have been settled by mediation either before or after the Panel had formally asserted jurisdiction. A few cases were returned to the parties for further direct negotiations because the Panel felt the negotiators had not exhausted other applicable means of settling their disputes.

Formal recommendations have been issued in only six cases. One of these involved assignment of work on a construction project in

Oak Ridge. In effect, the Panel dismissed the case and recommended that the disputed work be done in the same manner as in the past. This was accepted by the parties. In a second case involving the same construction project the parties accepted a recommendation that their dispute be submitted to arbitration. (For a full report of these cases, see Appendix 9 of the Eighth Semiannual Report.) Two other recommendations involved last summer's negotiations for renewal of the contracts at the national laboratory and the gaseous diffusion plant in Oak Ridge. Five-cent per hour general wage increases were recommended and adopted in both instances.

In September 1950, the Panel made recommendations to the parties in the negotiation of an initial agreement between Bendix Aviation Corp. and International Association of Machinists, representing employees at the Kansas City plant. More recently, in November 1950, the Panel issued recommendations to Sandia Corp., and the AFL union representing its production and maintenance employees.

Few Operational Work Stoppages

Since September 1948, when the Commission decided to lift its ban on contractor recognition of unions outside of Oak Ridge, many unions have been certified as collective bargaining representatives of employees in the program. AFL unions now represent bargaining units of employees at Argonne, Brookhaven, Oak Ridge, Sandia, Hanford, Schenectady, Reactor Testing Station, and Kansas City; CIO unions are bargaining agents for certain units at Schenectady, Argonne, Miamisburg, Monticello, Utah; and Oak Ridge.

The past 2 years have seen intensive organizational activity in the atomic energy industry. One measure of the success of the Panel has been the absence of serious work stoppages during this period of organization and negotiation of first contracts. Since the advent of Panel procedures, only three minor work stoppages have involved operating personnel. On May 15, 1950, 34 atomic energy steamfitters walked out with about 350 steamfitters in General Electric's private operations at Schenectady. The atomic energy employees returned to work on May 24, and the others remained out for almost two months. On September 5, 1950, the production and maintenance employees at atomic energy installations in Schenectady remained out for half a day. And on August 8, 1950, about half the employees in the bargaining unit at the Bendix plant in Kansas City walked off the job for half a day.

Several stoppages have occurred on construction projects. The Atomic Energy Commission has not viewed all construction as being continuously covered under its procedures but the Panel has been successful in ending several construction strikes by asserting its jurisdiction after they have started.

A great danger in the use of a dispute settlement agency such as the Panel is in its being used too often. In a sense, the limited number of recommendations issued by the Panel demonstrates that it has avoided this hazard. In only one company-union relationship has the Panel intervened in both 1949 and 1950 in contract renewal negotiations. Since the appointment of the Panel, AEC contractors and unions have negotiated more than 50 labor agreements without Panel

intervention. These have included renewals of contracts covering vital AEC operations in Hanford, Chicago, Miamisburg, and Brookhaven.

In November 1950, the President appointed three additional members to the Panel. They are: Frank P. Douglass, Oklahoma City attorney and former chairman of the National Mediation Board; John T. Dunlop, Harvard University professor and heretofore a consultant to the Panel; and Godfrey P. Schmidt, New York City attorney. The appointment of new members was made at the Panel's request to expedite the handling of critical problems that arise on short notice. It is expected that in the future, the Panel chairman will designate one or more Panel members to serve in a particular dispute.

PROGRAM SECURITY AND LABOR-MANAGEMENT RELATIONS

The security requirements of the program as applied to the field of labor relations raise some other problems. The overriding responsibility of the Commission for protecting the security of the program has led to situations which contradict normal collective bargaining practices. The Commission must retain final authority in the area of security. It has attempted to carry out this responsibility with the least possible interference in normal collective bargaining. Nevertheless, the security of the program remains the paramount consideration.

Loyalty of union officials. Consistent with the Atomic Energy Act and the Labor Management Relations Act of 1947, it is the settled policy of the Atomic Energy Commission that atomic energy facilities be operated in a manner best calculated to assure that those who participate in the program are loyal to the United States. This policy is specifically intended to include persons having line responsibility in respect to collective bargaining whether or not any access to restricted data or areas is involved.

Ordinarily, no access is involved in the upper ranks of union representation but line responsibility for contract administration is present. In such cases, the statutory requirement of full FBI investigation and clearance by AEC is not applicable and has not as a general practice been resorted to. However, if information is available concerning alleged Communist affiliation or association of union officers who are in a position where they exercise administrative, negotiating or disciplinary authority over employees on classified atomic energy work, the Atomic Energy Commission will review the situation, offer the union officials an opportunity to clear up the matter, and will take such steps as may be appropriate to improve the situation.

In 1948, when a serious question of loyalty to the United States arose in respect to certain officials of the United Electrical Workers, then affiliated with the CIO, the General Electric Co. was directed to cease recognizing the union as representative of atomic energy workers in Schenectady. The union officials were not themselves employees of the contractor, but they did exercise authority over employees and it was therefore considered that a threat to the security of the pro-

gram might exist. (This action was reported in AEC's Fifth Semiannual Report.[4])

Security and NLRB activities. One of the recommendations of the President's Commission was that "management and labor at Government-owned, privately operated atomic energy installations make every endeavor to determine bargaining units and representatives by agreement and consent elections in preference to contested proceedings before the National Labor Relations Board." This is the kind of procedure NLRB uses when the parties can agree regarding such matters as the definition of the bargaining unit and the time and place of the election. When there is no agreement, the formal procedure is used, including a public hearing with a decision by the NLRB and direction of election.

Hearings of this sort are normally open to the public, as is the record of the hearing. When atomic energy cases first were allowed to come before the board, secrecy was insisted upon. By September 1948, however, the Atomic Energy Commission had worked out methods for holding these hearings in a normal way, open to the public, without endangering security.

A panel of NLRB trial examiners has been cleared for access to classified material so that if it is alleged that information needed to support a position is classified, the trial examiner can talk privately with the party making this allegation, consider the materiality of the information and explore fully whether it can be presented in unclassified form. A representative of the Commission attends the hearings to assist on security questions. With the exception of these safeguards, the hearings now are carried out just as in any other industry and it has been possible for the NLRB to make its determinations without any classified material whatever coming into the open hearings.

Questions of preventing publication of restricted data are avoided in NLRB consent procedures, as recommended by the Panel, but some problems do arise. Union representatives not employed in the plants ordinarily represent employees in conferences where consent procedures are discussed. These representatives may not have received security clearance. It has sometimes been necessary to defer discussion of certain matters for separate conferences between employee and management representatives who have had security clearance. Bargaining representatives have objected to this since it deprives them of the skill and experience of paid union representatives. Similar questions have arisen concerning security clearance of company and union attorneys in legal proceedings. The Commission is still examining this problem and endeavoring to work out improved procedures which will permit the maximum freedom of collective bargaining without endangering security.

In most cases, however, negotiations can be completed without referring to such "classified" material.

Mediators cleared. The assistant director of the Federal Mediation and Conciliation Service has received full investigation and security

[4] Fifth Semiannual Report "Atomic Energy Development 1947–1948," Superintendent of Documents, Washington 25, D. C., 45 cents.

clearance. Sometimes it has been necessary to disclose classified information to him so that he could decide the proper instructions to give his conciliators. One or two commissioners regularly assigned to cases at larger atomic energy installations, also have been cleared.

Contract problems. Problems of maintenance of secrecy arise in many forms in connection with contract administration. For example, the number of union stewards may be influenced by the degree of compartmentalization in the plant, and by security restrictions on the movement of employees within the plant. Normal channels for appeal of grievances may be modified to observe such security compartments. In general, problems arising from compartmentalization have not proved too troublesome.

Normally, labor contracts provide for arbitration of disputes arising out of interpretation or application of the contract. Early in the administration of the program, labor contracts specified that arbitrators would be chosen by the Government agency having jurisdiction. A small panel of arbitrators was investigated and cleared at Oak Ridge and such a panel is still available in cases where classified information is involved. Many proceedings are carried on before uncleared arbitrators because no questions of classified information arise.

REIMBURSEMENT OF LABOR EXPENSE OF COST-TYPE CONTRACTORS

In its administration of the labor expense of cost-type contractors, the Commission has a double responsibility:

a) To assure that employment conditions—including salaries, wages, and such benefits as vacations, pensions and similar benefits—are adequate to attract and hold a well qualified work force throughout the industry. Vigorous research and production programs depend on success in this effort.

b) To assure that tax money is prudently spent in meeting the industry's payroll.

When the AEC assumed its responsibility for the industry in 1947, it continued the procedures used by the Manhattan Engineer District—prior review and approval of all contractor's wage, salary and benefit schedules which the Government reimbursed. Applying the recommendations of the various advisory groups, as reported previously, the Commission on April 29, 1949 announced its policy on labor expense in the "Interim Statement of the AEC in Respect to its Role in Labor-Management Relations at Atomic Energy Installations."[5] This policy was specifically directed to matters of labor costs arising out of collective bargaining, but it applies equally to the whole area of labor costs for AEC cost contractors. It defines the Commission responsibility and stresses normal development of labor-management relationships.

In announcing its policy of minimum supervision over contractors consistent with fulfilling its own responsibilities, the Commission

[5] Complete text in Appendix 12, Sixth Semiannual Report, Superintendent of Documents, Washington 25, D. C., 45 cents.

agreed to issue a statement which would substitute general principles for close supervision, which would establish guides to contractors and employee organizations, and provide a framework within which wages, salary and benefit schedules could be worked out with reasonable assurance of AEC approval. This policy was being worked out in late 1950.

Services To Curb Accidents And Fires

The prevention of fires and accidents is of greater than ordinary importance in the atomic energy program, not only because of the key role of the industry in national security, but also because of special hazards connected with the atomic energy operations. In the Atomic Energy Act of 1946,[6] the Congress specifically charged the Atomic Energy Commission with taking necessary steps to protect life and property from hazards arising out of its work.

Protection of people, financial savings and protection of invaluable production and other facilities are not the sole objectives of the safety effort. Labor and employer relations benefit, better morale and greater productivity often result.

The AEC's Eighth Semiannual Report to the Congress[7] sets forth many of the unique problems that arise within the industry from activities such as the production of fissionable materials and laboratory research in the field; it states the methods that have been applied in the successful control of the large-scale handling of radioactive materials and the attendant hazards. Less novel, but nevertheless extremely important, is the problem of preventing losses from more ordinary types of hazards and accidents—electricity and falls, motor vehicle accidents and burns. Fire prevention takes on a special significance when the safety of unique equipment is involved, or where flames may release radioactive materials.

Each of the contractors through whom the Atomic Energy Commission carries out its work has a responsibility for carrying out its operations safely. The AEC stipulates the standards that are to be complied with, assists in safety engineering and fire prevention planning, maintains records for comparison and evaluation of occurrences of accidents or fires, investigates serious mishaps, provides advisory

[6] Throughout the Atomic Energy Act of 1946, there are provisions relating to safety and the protection of health in the atomic energy program. Examples of such provisions are the following:

SEC. 3. (a) The Commission is authorized and directed to make arrangements for the conduct of research and development activities relating to—(5) the protection of health during research and production activities . . .

Such arrangement shall contain such provisions to protect health, to minimize danger from explosion and other hazards to life or property. . . .

SEC. 4. (c) (2) (Production of Fissionable Materials): Any contract entered into under this section shall contain provisions . . . obligating the contractor . . . to comply with all safety and security regulations which may be prescribed by the Commission.

SEC. 5. (a) (4) The Commission shall not distribute any material to any applicant, and shall recall any distributed material from any applicant, who is not equipped to observe or who fails to observe such safety standards to protect health and to minimize danger from explosion or other hazard to life or property as may be established by the Commission.

SEC. 5. (c) (2) . . . The Commission shall not distribute any byproduct material to any applicant, who is not equipped to observe or who fails to observe such safety standards to protect health as may be established by the Commission . . .

SEC. 12. (a) In the performance of its functions, the Commission is authorized to—(2) . . . establish by regulation or order such standards and instructions to govern the possessions and use of fissionable and byproduct materials as the Commission may deem necessary or desirable to protect health or to minimize danger from explosions and other hazards to life or property: . . .

[7] "Control of Radiation Hazards in the Atomic Energy Programs," Superintendent of Documents, Washington 25, D. C., 55 cents.

services and, through the staff of its operations offices, supervises the contractors' fulfillment of required standards.

During the years 1947–50, inclusive, 29 fatal accidents occurred in all operations of the Commission from the ordinary type of industrial and construction accident. During that period, no fatalities from radiation were reported.

Since 1943, an estimated savings of 17 million dollars was accomplished by fire prevention, since the loss was that much below what it would have been had national averages of losses occurred in atomic energy installations.

In 1949, three major AEC contractors earned National Safety Council Awards for Distinguished Services to Safety and two received the Joseph A. Holmes Safety Association (U. S. Bureau of Mines) Award for excellent safety performance. The three AEC communities, Los Alamos, N. Mex.; Oak Ridge, Tenn.; and Richland, Wash., have been given recognition for various outstanding performances in activities such as traffic control, fire prevention, school safety, traffic law enforcement, and pedestrian protection from such organizations as the National Safety Council, National Fire Protective Association, U. S. Chamber of Commerce, International Association of Chiefs of Police, and American Automobile Association.

The contractors performing the work for the Commission have built a tradition of accident prevention based upon pre-evaluation of the hazards and experience from past losses. As atomic energy operations are introduced to industry, the work done during this development stage should provide a ground work which will help make their operations safe.

SAFETY SERVICES

Contracts contain clauses requiring that contractors carry out their work without danger to employees and to the public. Standard contract provisions for safe operations are included in research and construction contracts. Operations contracts contain clauses, negotiated to fit the conditions of the particular operating agreement. The construction contract safety clause refers to guides and regulations for minimum safety provision in buildings, construction, equipment, and practices. Essentially these are the same standards developed by the American Standards Association, Bureau of Standards, National Safety Council, National Fire Protection Association, and other national standardizing bodies.

The nationally accepted American Standards Association method of reporting and compiling personal injury rates which evaluates the need for accident prevention work is followed in order to be consistent with industry in general. Similarly, motor vehicle accident records are maintained in line with national practices for industry and municipalities. AEC makes periodic audits of the records of its offices and contractors to insure uniform application of these standards, and as a basis for developing corrective recommendations.

The Commission requires investigation of all serious accidents to be submitted directly to the General Manager. The development of programs is also encouraged by personal contact in the every-day dealings between management and contract personnel. Exchange

of information between the operations offices, the Washington office, and the contractors is accomplished through a Newsletter and through annual, or more frequent, conferences on specific accident prevention problems.

Contractors and AEC field offices make detailed analyses of records and only general analyses of the over-all experience are made in the Washington Headquarters. This arrangement encourages better use of accident records in the field and reduces the amount of reporting to headquarters. Monthly summaries are published to show relative performances of contractors and AEC offices. These serve as an index of the effectiveness of the program and as a basis for an annual safety contest among contractors and AEC offices.

For purposes of comparison and evaluation, occupational and traffic injury rates are measured against those of companies having the best records in comparable operations. By continual analysis of each contractor's experience and by inspections, the Commission's field staffs measure the effect of the program. Where accidents increase, the Commission's safety engineers work with the contractor to determine the cause. Corrective action may take many forms including refinement of personnel or supervisory practices, correction of the conditions creating the hazard, reexamination of engineering practices, and, infrequently, disciplinary action.

The Safety and Fire Protection Branch in the Division of Organization and Personnel establishes the standards of performance expected, provides guides for design and operation of its various facilities, and furnishes staff advice to all divisions of the Commission. It has been found possible to provide assistance to the managers of the operations offices in carrying out Commission policies with relatively small staffs. The Commission has found that more effective accident prevention can be attained by safety engineering personnel of the contractors.

Special Problems

New processes. In an industry as new as that of atomic energy, research and development work result in many changes in processes: this condition requires that extra attention be given to the elimination of hazards in initial planning and design stages, as well as during operations. Preliminary plans for buildings prepared by the contractors at the operations offices are reviewed by the engineering and safety personnel before approval, based upon the standards established for Commission-wide use.

New materials. Another situation which requires a special vigilance results from the use of materials which have never before been used in industry. They may be toxic, flammable, or radioactive, or all three. In these instances, there is close cooperation during design, planning, and construction among the research, operation, and engineering personnel at the operations offices. The safe handling of these materials is accomplished by careful evaluation of the hazards beforehand and by their guidance through remote control, dry runs, specially designed physical safeguards, or operating procedures which are worked out by the operating contractors with staff participation by AEC management.

Construction. In construction work, accidents are relatively frequent and severe. Although mishaps in AEC construction are well below national averages, constant effort is made to improve the record. The AEC could experience considerable losses if damage to operating facilities or facilities under construction resulted from unsafe contractor operations, and special practices are being used to try to improve the record. The prevention of accidents in this type of contract is attained by the operations manager and his safety engineering personnel through interviews with the contractor during negotiation of the contract and during its execution. These interviews are designed to establish clearly the high level of accident prevention required, explain the regulations and specifications which are used, and to coordinate the activities of the various contractors on the job.

Universities. Universities administer a number of projects involving tasks normally performed by industrial organizations. Accident prevention work in such operations was largely new to the universities. AEC and university staffs have worked closely and successfully together in the effort to reduce needless manpower and material losses due to accidents. Effective programs for accident prevention, training, and enforcement are required by the AEC managers of the operations offices concerned. Since 1947, the universities as a group have reduced their accident rate from 8 to 2.9 employees injured for each million man-hours of labor.

The Safety Record

Since 1943, there has been a decrease in the average of all injuries from 8.7 per million man-hours to 4.2 during 10 months of 1950. Among those operating contractors which include manufacturers, universities, laboratories, and services, the rates for the same period have been reduced from 11.8 to 2.7. Among Government employees, reductions have been from 5.2 to 2.2 since 1943. The construction injury rate has remained fairly steady, around 8.0, although an increase to 10.1 was experienced in 1949. This has been reduced to 8.5 at the end of October 1950, but may increase due to the speed of the present construction program (see chart, Personal Injury Frequency Rates).

FIRE PREVENTION SERVICES

The AEC methods of assisting contractors in fire prevention parallel those for safety. Since the AEC constructs and owns most contractor facilities, it builds in fire protection in new structures.

However, much of the production and research work carried on for the Commission is housed in buildings erected during the war or taken over from other Government agencies. Many of these buildings are temporary structures, built during the war when shortages existed. Their continued occupancy requires a high degree of fire protection and prevention. All operations offices have long-range plans for elimination, replacement, or improved protection of these buildings.

A standard of protection which compares with better industrial type known as improved risk has been adopted throughout the atomic

energy enterprise. This requires that buildings have fire protection in accordance with the best accepted industrial practice and is based upon standards for protection developed by the Federal Fire Council and used by fire insurance companies. In municipal fire protection, the standards of the National Board of Fire Underwriters are followed, and 5-year surveys are made by the NBFU in order to maintain desirable levels of fire protection in the towns. In evaluating the results of the fire prevention program comparisons are made with the statistics compiled by the National Board of Fire Underwriters. By this standard, the atomic energy industry's losses have averaged during 5 years 1.6 cents per $100 valuation of property as compared with a national average of 15 cents. During the first 10 months of 1950, the atomic energy loss rose almost to 3 cents, due chiefly to two large fires, one at Oak Ridge and one at Berkeley.

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APPENDIX 1

U. S. Atomic Energy Commission, Principal Staff, and Managers of Operations and Area Offices

Atomic Energy Commission	Gordon Dean, *Chairman.*
	T. Keith Glennan.
	Thomas E. Murray.
	Sumner T. Pike.
	H. D. Smyth.
General Manager	Marion W. Boyer.
Deputy General Manager	Walter J. Williams.
Secretary to Commission	Roy B. Snapp.
Director of Intelligence	Walter F. Colby.
Director of Classification	James G. Beckerley.
General Counsel	Everett L. Hollis (*Acting*).
Controller	Lindsley H. Noble.
Director, Division of Research	Kenneth S. Pitzer.
Director, Division of Production	Richard W. Cook.
Director, Division of Military Application	Brig. Gen. James McCormack, Jr.
Director, Division of Reactor Development	Lawrence R. Hafstad.
Director, Division of Engineering	George G. Brown.
Director, Division of Biology and Medicine	Dr. Shields Warren.
Director, Division of Organization and Personnel.	Fletcher C. Waller.
Director, Division of Information Services	Morse Salisbury.
Director, Division of Security	John A. Waters.
Managers of Operations and Area Offices:	
Chicago (Ill.) Operations Office	A. Tammaro.
Ames (Iowa) Area Office	W. W. Lord.
Berkeley (Calif.) Area Office	H. A. Fidler.
Pittsburgh (Pa.) Area Office	Lawton D. Geiger.
Hanford (Wash.) Operations Office	David F. Shaw.
Idaho Operations Office	L. E. Johnston.
New York (N. Y.) Operations Office	Wilbur E. Kelley.
Brookhaven (Long Island, N. Y.) Area Office.	E. L. Van Horn.
Cleveland (Ohio) Area Office	Edward C. Sargent.
St. Louis (Mo.) Area Office	C. L. Karl.

Managers of Operations and Area Offices—Continued	
Oak Ridge (Tenn.) Operations Office	S. R. SAPIRIE.
Dayton (Miamisburg, Ohio) Area Office	FRED H. BELCHER.
Kentucky (Paducah) Area Office	KENNETH A. DUNBAR.
Raw Materials (Washington, D. C.) Operations Office.	JESSE C. JOHNSON.
Colorado Office	FRANK H. MACPHERSON.
New York Office	PHILLIP L. MERRITT.
Santa Fe (N. Mex.) Operations Office	CARROLL L. TYLER.
Sandia (N. Mex.) Field Office	GEORGE P. KRAKER.
Savannah River (Ga.) Operations Office	CURTIS A. NELSON.
Dana (Terre Haute, Ind.) Area Office	BOURKE SAMPLES.
Schenectady (N. Y.) Operations Office	JON D. ANDERSON.

APPENDIX 2

MEMBERSHIP OF COMMITTEES

STATUTORY COMMITTEES

Joint Committee on Atomic Energy—Eighty-second Congress

This committee was established by the Atomic Energy Act of 1946 (sec. 15) to make "continuing studies of the activities of the Atomic Energy Commission and of problems relating to the development, use, and control of atomic energy." The committee is kept fully and currently informed with respect to the Commission's activities. Legislation relating primarily to the Commission or to atomic energy matters are referred to the committee. The committee's membership is composed of nine members of the Senate and nine members of the House of Representatives.

Senator BRIEN MCMAHON (Connecticut), chairman.
Representative CARL T. DURHAM (North Carolina), vice chairman.
Senator RICHARD B. RUSSELL (Georgia).
Senator EDWIN C. JOHNSON (Colorado).
Senator TOM CONNALLY (Texas).
Senator CLINTON P. ANDERSON (New Mexico).
Senator BOURKE B. HICKENLOOPER (Iowa).
Senator EUGENE D. MILLIKIN (Colorado).
Senator WILLIAM F. KNOWLAND (California).
Senator JOHN W. BRICKER (Ohio).
Representative CHET HOLIFIELD (California).
Representative MELVIN PRICE (Illinois).
Representative PAUL J. KILDAY (Texas).
Representative HENRY M. JACKSON (Washington).
Representative W. STERLING COLE (New York).
Representative CHARLES H. ELSTON (Ohio).
Representative CARL HINSHAW (California).
Representative JAMES E. VAN ZANDT (Pennsylvania).
WILLIAM L. BORDEN, executive director.
HAROLD BERGMAN, deputy director.

Military Liaison Committee

This committee was established by the Atomic Energy Act of 1946 (sec. 2. (c)) as a group which the Commission shall advise and consult with on all atomic energy matters which the MLC deems to relate to military applications. According to the Act, the committee and the Commission are to keep each other informed of such matters pending before the Commission and of atomic energy activities of the Department of Defense. The committee may make recommendations to the AEC and refer matters considered adverse to the responsibilities of the Department of Defense to the Secretary, who, if he concurs, may refer them to the President for decision. In 1949, an amendment to the Act provided that the membership should be composed of representatives of the Army, Navy, and Air Force, and a committee chairman appointed by the President.

Hon. ROBERT LEBARON, chairman.
Maj. Gen. KENNETH D. NICHOLS, United States Army.
Brig. Gen. HERBERT B. LOPER, United States Army.
Rear Adm. CHARLES F. COE, United States Navy.
Rear Adm. FREDERIC S. WITHINGTON, United States Navy.
Maj. Gen. FRANK F. EVEREST, United States Air Force.
Brig. Gen. ROSCOE C. WILSON, United States Air Force.
Brig. Gen. ALVIN R. LUEDECKE, executive secretary, United States Air Force.

General Advisory Committee

This committee was established by the Atomic Energy Act of 1946 (sec. 2. (b)). The nine civilian members are appointed by the President to advise the Commission on scientific and technical matters relating to materials, production, and research and development. Under the Atomic Energy Act, the committee shall meet at least four times in every calendar year; the committee held its first meeting in January 1947, and to date has averaged six meetings a year.

Dr. J. ROBERT OPPENHEIMER, chairman; director, Institute for Advanced Study, Princeton, N. J.
Dr. OLIVER E. BUCKLEY, president, Bell Telephone Laboratories, New York, N. Y.
Dr. JAMES B. CONANT, president, Harvard University, Cambridge, Mass.
Dr. LEE A. DUBRIDGE, president, California Institute of Technology, Pasadena, Calif.
Dr. W. F. LIBBY, professor of chemistry, University of Chicago, Chicago, Ill.
EGER V. MURPHREE, president, Standard Oil Development Co., New York, N. Y.
Dr. I. I. RABI, professor of physics, Columbia University, New York, N. Y.
Dr. CYRIL S. SMITH, director, Institute for the Study of Metals, University of Chicago, Chicago, Ill.
WALTER G. WHITMAN, head, department of chemical engineering, Massachusetts Institute of Technology, Cambridge, Mass.
Dr. RICHARD W. DODSON, secretary; chairman, department of chemistry, Brookhaven National Laboratory, Upton, Long Island, N. Y.

PATENT COMPENSATION BOARD

This board was established in April 1949 pursuant to Section 11 of the Atomic Energy Act of 1946, which provides that upon application for just compensation or awards or for the determination of a reasonable royalty fee certain proceedings shall be held before such a board. By the end of 1950 the board had had 6 sessions; 10 cases had been filed, of which 2 had been finally determined by the board.

CASPER W. OOMS, chairman; of Dawson & Ooms, Chicago, Ill.
ISAAC HARTER, chairman, Babcock & Wilcox Tube Co., Beaver Falls, Pa.
JOHN V. L. HOGAN, consulting engineer, Hogan Laboratories, Inc., New York, N. Y.

PERMANENT PANEL APPOINTED BY THE PRESIDENT—ATOMIC ENERGY LABOR RELATIONS PANEL

The original members of this panel were appointed by the President in 1949 to take jurisdiction and mediate labor-management disputes which threaten to interfere with essential operations of the Atomic Energy Commission. In November 1950 the President appointed three additional members. The panel

operates under procedures designed to safeguard continuity of operations, while not inhibiting free collective bargaining between AEC contractors and unions. To date it has acted upon 20 labor-management disputes in AEC installations, and has reported semiannually to the President on its activities (see Appendix 7).

WILLIAM H. DAVIS, chairman; of Davis, Hoxie & Faithfull, New York, N. Y.; chairman, Patent Survey Committee, U. S. Department of Commerce.
FRANK P. DOUGLASS; of Douglass & Douglass, Oklahoma City, Okla.
JOHN T. DUNLOP, professor of economics, Harvard University, Cambridge, Mass.
AARON HORVITZ, lawyer and arbitrator, New York and New Jersey.
GODFREY P. SCHMIDT, lawyer, New York, N. Y.
EDWIN E. WITTE, chairman, department of economics, University of Wisconsin, Madison, Wis.

SENIOR RESPONSIBLE REVIEWERS

The Manhattan District appointed and the Atomic Energy Commission reaffirmed the need for the Committee of Senior Responsible Reviewers. The committee reviews the major phases of the AEC program and is the principal advisor to the AEC on declassification matters, making recommendations for formulating and modifying the rules and guides for classifying scientific and technical information.

Dr. W. C. JOHNSON, chairman, department of chemistry, University of Chicago, Chicago, Ill.
Dr. J. M. B. KELLOGG, division leader, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.
Dr. W. F. LIBBY, professor of chemistry, University of Chicago, Chicago, Ill.
Dr. R. L. THORNTON, professor of physics, University of California, Berkeley, Calif.
Dr. FREDERIC DE HOFFMANN, secretary; alternate assistant director, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.

ADVISORY BODIES TO THE ATOMIC ENERGY COMMISSION

Advisory Committee on Biology and Medicine

This committee was created in September 1947 on the recommendation of the Commission's Medical Board of Review. The committee reviews the AEC program in medical and biological research and health and recommends to the Commission general policies in these fields. The committee has held 24 meetings and reports to the Commission on each meeting.

Dr. ALAN GREGG, chairman; director for medical sciences, Rockefeller Foundation, New York, N. Y.
Dr. ERNEST W. GOODPASTURE, vice chairman; dean, school of medicine and professor of pathology, Vanderbilt University, Nashville, Tenn.
Dr. DETLEV W. BRONK, president, Johns Hopkins University, Baltimore, Md.; president, National Academy of Sciences.
Dr. EDWARD A. DOISY, director, department of physiology and biochemistry, St. Louis University School of Medicine, St. Louis, Mo.
Dr. E. C. STAKMAN, chief, division of plant pathology and botany, University of Minnesota, Minneapolis, Minn.
Dr. CURT STERN, professor of zoology, University of California, Berkeley, Calif.
Dr. JOSEPH T. WEARN, dean, school of medicine, Western Reserve University, Cleveland, Ohio.

Advisory Committee on Chemistry

This committee was appointed in June 1949 to advise on policy concerning the AEC program of supporting basic unclassified chemistry research in universities, and the relationship of this program to the AEC's own chemistry research program. Most of the work of the committee is accomplished by individual consultation as specific problems arise; the one formal meeting of the group was held in June 1949.

Dr. FARRINGTON DANIELS, professor of chemistry, University of Wisconsin, Madison, Wis.

Dr. G. B. KISTIAKOWSKY, professor of chemistry, Harvard University, Cambridge, Mass.

Dr. JOSEPH E. MAYER, professor of chemistry, University of Chicago, Chicago, Ill.

Dr. GLENN T. SEABORG, professor of chemistry, University of California, Berkeley, Calif.

Dr. DON M. YOST, professor of chemistry, California Institute of Technology, Pasadena, Calif.

Community Operations Panel

This committee was appointed in July 1950 to study the problems of introducing private ownership of real property and self-government in the three AEC communities at Los Alamos, N. Mex., Richland, Wash., and Oak Ridge, Tenn. The committee will visit the three communities and give advice and recommendations to the Commission on how far and by what means these steps can be taken without jeopardy to AEC operations.

RICHARD G. SCURRY, chairman; of Scurry, Scurry & Pace, Dallas, Tex.

FREDERICK M. BABCOCK, private consultant in construction finance and housing, Washington, D. C.

GEORGE E. BEAN, city manager, Grand Rapids, Mich.

GEORGE GOVE, vice president for housing projects, Metropolitan Life Insurance Co., New York, N. Y.

Advisory Board of Contract Appeals

This board was established in February 1950. One or more of its members hears contract appeals arising under the "disputes articles" of AEC contracts and subcontracts and makes recommendations to the General Manager concerning their disposition. Five cases are pending before the board. Rules to govern the handling of contract appeals were recommended by the board and adopted by the Commission in August 1950 (see Appendix 4).

SHELDEN ELLIOTT, dean of the law school, University of Southern California, Los Angeles, Calif.

HERBERT F. TAGGART, assistant dean of the school of business administration, University of Michigan, Ann Arbor, Mich.

CLARK C. VOGEL; of Riker, Emery & Danzig, Newark, N. J.; instructor, Rutgers University School of Law.

Advisory Committee on Cooperation Between Electric Power Industry and AEC

The appointment of this temporary committee was announced in August 1949. Its purpose is to conduct first-hand examination of programs and technical

information in reactor development and to recommend ways to establish continuing cooperation between the electric power industry and the AEC. The committee has visited a number of AEC installations and conferred with AEC and laboratory staff and is now preparing a report of its findings.

PHILIP SPORN, chairman; president, American Gas & Electric Co., New York, N. Y.

EDWARD W. MOREHOUSE, vice president, General Public Utilities Corp., New York, N. Y.

WALTON SEYMOUR, power advisor, Economic Cooperation Administration Mission to Greece.

Advisory Committee on Isotope Distribution

This committee was originally appointed by the Manhattan District to advise on the off-project distribution of isotopes. The Commission approved its continuation in December 1947 to aid in establishing new policies on distributing radioactive materials and to review existing policies. The committee reviews all initial applications for use of radioisotopes in human beings, and all other requests for their use in research, education, and industry which are referred to it by the Commission.

Dr. HENRY BORSOOK, chairman; head, department of biochemistry, division of biology, California Institute of Technology, Pasadena, Calif.

Dr. AUSTIN M. BRUES, director, biology division, Argonne National Laboratory, Chicago, Ill.

Dr. HAROLD COPP, department of physiology, University of British Columbia Medical School, Vancouver, British Columbia, Canada.

Dr. ROBLEY D. EVANS, professor of physics, Massachusetts Institute of Technology, Cambridge, Mass.

Dr. HYMER L. FRIEDELL, director, department of radiology, Lakeside Hospital, Western Reserve University, Cleveland, Ohio.

Dr. STERLING B. HENDRICKS, head chemist, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

Dr. A. H. HOLLAND, JR., medical advisor, Armour Co., Chicago, Ill.

Dr. DONALD E. HULL, research chemist, process division, California Research Corp., Richmond, Calif.

Dr. JOSEPH W. KENNEDY, chairman, department of chemistry, Washington University, St. Louis, Mo.

Dr. L. F. NIMS, chairman, biology department, Brookhaven National Laboratory, Upton, Long Island, N. Y.

Dr. EDITH H. QUIMBY, associate professor of radiology, College of Physicians and Surgeons, Columbia University, New York, N. Y.

Dr. PAUL C. AEBERSOLD, secretary; chief, isotopes division, AEC, Oak Ridge, Tenn.

Patent Advisory Panel

This panel was appointed in January 1947 to make a general review and appraisal of the problems raised by the patent provisions of the Atomic Energy Act of 1946. It makes informal reports and recommendations to the Commission and its staff on various questions of policy and procedure relating to patents and inventions.

H. THOMAS AUSTERN; of Covington, Burling, Rublee, O'Brian & Shorb, Washington, D. C.

WILLIAM H. DAVIS; of Davis, Hoxie & Faithfull, New York, N. Y.; chairman, Patent Survey Committee, U. S. Department of Commerce.

JOHN A. DIENNER; of Brown, Jackson, Boettcher & Dienner, Chicago, Ill.

HECTOR M. HOLMES; of Fish, Richardson & Neave, Boston, Mass.

CASPER W. OOMS; of Dawson & Ooms, Chicago, Ill.

Advisory Committee on Personnel Management

This committee of leading authorities from government, industry, and education was named in September 1948 to provide the Atomic Energy Commission with a continuous review of its personnel management practices and to evaluate the best personnel methods of government and industry in determining over-all AEC policies. The committee meets once a month and usually reports orally to the staff.

ARTHUR S. FLEMMING, chairman; president, Ohio Wesleyan University, Delaware, Ohio; member of the Commission on Organization of the Executive Branch of the Government.

LAWRENCE A. APPLEY, president, American Management Association, New York, N. Y.

ALVIN E. DODD, honorary president, American Management Association, New York, N. Y.

L. CLAYTON HILL, professor of industrial relations, University of Michigan, Ann Arbor, Mich.

WALLACE SAYRE, professor of public administration, school of business and civic administration, City College of New York, N. Y.

THOMAS G. SPATES, professor of industrial administration, Yale University, New Haven, Conn.

Personnel Security Review Board

This board was appointed in March 1949 primarily to review specific personnel security cases which arise under the Commission's administrative review procedure and make recommendations concerning them to the General Manager. The board, in its monthly meetings, also advises the Commission on the broader considerations regarding personnel security, such as criteria for determining eligibility for security clearance, and personnel security procedures.

GANSON PURCELL, chairman; of Root, Ballantine, Harlan, Bushby & Palmer, Washington, D. C.

ARTHUR S. FLEMMING, president, Ohio Wesleyan University, Delaware, Ohio; member of the Commission on Organization of the Executive Branch of the Government.

BRUCE D. SMITH, director, United Corp., New York, N. Y., and Lehigh Coal & Navigation Co., Philadelphia, Pa.

Committee on Raw Materials

This committee was appointed in October 1947 to review the Atomic Energy Commission's raw materials program and to advise on questions of exploration, development, and procurement. The committee has met eight times since its formation.

Dr. DONALD H. MCLAUGHLIN, chairman; president, Homestake Mining Co., San Francisco, Calif.

EVERETTE L. DEGOLYER, petroleum geologist, DeGolyer & McNaughton, Dallas, Tex.

THOROLD F. FIELD, consulting mining engineer, Duluth, Minn.

J. K. GUSTAFSON, consulting geologist, M. A. Hanna Co., Cleveland, Ohio.

WILBER JUDSON, vice president and director, Texas Gulf Sulphur Co., New York, N. Y.

WALTER L. MAXSON, metallurgist, Oliver Iron Mining Co., Duluth, Minn.

ERNEST H. ROSE, chemical engineer, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

WALTER O. SNELLING, director of research and consulting chemist, Trojan Powder Co., Allentown, Pa.

ORVIL R. WHITAKER, consulting mining engineer, Denver, Colo.

CLYDE E. WILLIAMS, director, Battelle Memorial Institute, Columbus, Ohio.

Reactor Safeguard Committee

This committee was established in the fall of 1947 to advise the Commission on the hazards of the operation of reactors. The committee reviews safety studies made by the contractors on proposed reactors for completeness and accuracy and may make recommendations for modifications or further study. This committee of experts in the fields of physics, chemistry, sanitary engineering, meteorology, and medicine meets whenever problems arise which require their consideration. In the past this has been about four times a year.

Dr. EDWARD TELLER, chairman; assistant director, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.

Dr. MANSON BENEDICT, chemical engineer, Hydrocarbon Research, Inc., New York, N. Y.

Dr. HYMER L. FRIEDELL, director, department of radiology, Lakeside Hospital, Western Reserve University, Cleveland, Ohio.

Col. BENJAMIN HOLZMAN, meteorologist, Office of Director of Research and Development, U. S. Air Force, Washington, D. C.

Dr. JOSEPH W. KENNEDY, chairman, department of chemistry, Washington University, St. Louis, Mo.

Dr. FREDERICK SEITZ, professor of physics, University of Illinois, Urbana, Ill.

Dr. JOHN A. WHEELER, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.

Dr. ABEL WOLMAN, head, department of sanitary engineering, Johns Hopkins University, Baltimore, Md.

Security Survey Panel

This panel was appointed in December 1949 to survey the organization, administration, and functions of the security operation in the AEC. The panel members visited the Commission's installations and reported their findings in April 1950.

JOHN S. BUGAS, chairman; vice president for industrial relations, Ford Motor Co., Detroit, Mich.

DAVID LUKE HOPKINS, executive vice president and director, The Safe Deposit & Trust Co., Baltimore, Md.; vice president of board of trustees, Johns Hopkins University, Baltimore, Md.

Dr. PAUL E. KLOPSTEG, director of research, Technological Institute, Northwestern University, Evanston, Ill.; chairman, board of governors, Argonne National Laboratory, Chicago, Ill.; member of executive committee, American Institute of Physics.

J. ARTHUR MULLEN, president, Glenvale Products, Detroit, Mich.; vice president, Standard Life & Accident Insurance Co., Detroit, Mich.

Stack Gas Problem Working Group

The appointment of this group was authorized in May 1948 to advise the Commission on the development of methods and equipment for keeping the atmosphere at and near AEC installations free of toxic or radioactive contamination. The group has held five meetings. Individual members also give consulting advice on specific proposals and problems.

Dr. ABEL WOLMAN, chairman; head, department of sanitary engineering, Johns Hopkins University, Baltimore, Md.

Dr. PHILIP DRINKER, professor of industrial hygiene, Harvard University School of Public Health, Boston, Mass.

Dr. LYLE GILBERTSON, research division, Air Reduction Sales Co. Laboratory, New York, N. Y.

Dr. GEORGE R. HILL, director, department of agricultural research, American Smelting & Refining Co., Salt Lake City, Utah.

Dr. H. FRASER JOHNSTONE, professor of chemical engineering, University of Illinois, Urbana, Ill.

Dr. WILLIAM P. YANT, director of research, Mine Safety Appliances Co., Pittsburgh, Pa.

Ad Hoc Committee on Technological Information for Industry

This committee was appointed in July 1949 to advise the Commission on ways to improve the dissemination of its technical information to industry. A working committee was cleared and appointed in January 1950 to examine the Commission's technological files and processes with a view to recommending material which should be submitted for declassification. The working group has met four times since its appointment; it submitted a number of recommendations in February and in August 1950 and will continue its study of atomic energy technological developments.

SIDNEY D. KIRKPATRICK, chairman; member of working committee; vice president and director of editorial development, McGraw-Hill Book Co., Inc., New York, N. Y.

Dr. HENRY A. BARTON, director, American Institute of Physics, New York, N. Y.

H. E. BLANK, editor, Modern Industry, New York, N. Y.

GENE HARDY, Washington editor, Chilton Publications, Inc., Washington, D. C.

KEITH HENNEY, member of working committee; consulting editor, Electronics and Nucleonics, McGraw-Hill Publishing Co., Inc., New York, N. Y.

EDWARD KREUTZBERG, editor, Penton Publishing Co., Washington, D. C.

Dr. WALTER J. MURPHY, editor, Chemical and Engineering News, American Chemical Society, Washington, D. C.

CHARLES S. RICH, editor, Electrical Engineering, American Institute of Electrical Engineers, New York, N. Y.

GEORGE STETSON, editor, Mechanical Engineering, American Society of Mechanical Engineers, New York, N. Y.

GEORGE F. SULLIVAN, managing editor, The Iron Age, Chilton Publications, Inc., New York, N. Y.

E. E. THUM, member of working committee; editor, Metal Progress, American Society for Metals, Cleveland, Ohio.

S. A. TUCKER, member of working committee; standards manager, The American Society of Mechanical Engineers, New York, N. Y.

F. J. VAN ANTWERPEN, member of working committee; editor, Chemical Engineering Progress, American Institute of Chemical Engineers, New York, N. Y.

Dr. ALBERTO F. THOMPSON, secretary; chief, technical information service, division of information services, AEC, Washington, D. C.

Technical Information Panel

This panel, representing the major AEC research contractors, was appointed in June 1948 to advise the Commission on all aspects of its technical information services. Meetings are held three times a year to consider technical information problems and to make recommendations toward improving the Commission's technical information services.

Dr. ALBERTO F. THOMPSON, chairman; chief, technical information service, division of information services, AEC, Washington, D. C.

Dr. RUSSELL BALDOCK, research physicist, isotope research and production division, Carbide & Carbon Chemicals Division, Union Carbide & Carbon Corp. (Y–12), Oak Ridge, Tenn.

Dr. HENRY A. BLAIR, director, Atomic Energy Project, University of Rochester, Rochester, N. Y.

BREWER F. BOARDMAN, technical advisor, technical information service, division of information services, AEC, Oak Ridge, Tenn.

W. E. DREEZEN, administrative aide to director, Ames Laboratory, Ames, Iowa.

Dr. M. M. HARING, director, Mound Laboratory, Miamisburg, Ohio.

SYLVAN HARRIS, manager, documents department, Sandia Corp., Albuquerque, N. Mex.

W. L. HARWELL, head, patents and declassification department, Carbide & Carbon Chemicals Division, Union Carbide & Carbon Corp. (K–25), Oak Ridge, Tenn.

JOHN F. HOGERTON, technical reports director, The Kellex Corp., New York, N. Y.

Dr. E. J. MURPHY, assistant to research director, Carbide & Carbon Chemicals Division, Union Carbide & Carbon Corp. (ORNL), Oak Ridge, Tenn.

Dr. G. M. MURPHY, professor of chemistry, New York University, N. Y.

Dr. DANIEL J. PFLAUM, chief, materials and information branch, division of research, AEC, Washington, D. C.

DENNIS PULESTON, head, information and publications division, Brookhaven National Laboratory, Upton, Long Island, N. Y.

Dr. RICHARD F. RILEY, chief, radiation chemistry section, Atomic Energy Project, University of California, Los Angeles, Calif.

Dr. CHARLES SLESSER, director, technical information and declassification service, AEC, New York, N. Y.

Dr. RALPH CARLISLE SMITH, assistant director for classification and security, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.

Dr. J. R. STEHN, physicist, theoretical physics division, Knolls Atomic Power Laboratory, Schenectady, N. Y.

C. G. STEVENSON, chief librarian, General Electric Co., Richland, Wash.

Dr. R. K. WAKERLING, chief, information division, Radiation Laboratory, University of California, Berkeley, Calif.

Dr. H. D. YOUNG, director, information division, Argonne National Laboratory, Chicago, Ill.

APPENDIX 3

MAJOR RESEARCH CENTERS OF THE U. S. ATOMIC ENERGY COMMISSION

Ames Laboratory (Iowa State College, contractor) Ames, Iowa

Director ..... Dr. FRANK H. SPEDDING
Associate Director ..... Dr. H. A. WILHELM
Assistant to Director ..... Dr. E. I. FULMER
Senior Physicist ..... Dr. G. W. FOX

Argonne National Laboratory (University of Chicago, contractor) Chicago, Ill.

The participating institutions are:

Battelle Memorial Institute
Carnegie Institute of Technology
Case Institute of Technology
Illinois Institute of Technology
Indiana University
Iowa State College
Kansas State College
Loyola University (Chicago, Ill.)
Marquette University
Mayo Foundation
Michigan College of Mining and Technology
Michigan State College
Northwestern University
Notre Dame University
Ohio State University
Oklahoma Agricultural and Mechanical College
Purdue University
St. Louis University
Washington University (St. Louis, Mo.)
Western Reserve University
University of Chicago
University of Cincinnati
University of Illinois
University of Iowa
University of Kansas
University of Michigan
University of Minnesota
University of Missouri
University of Nebraska
University of Pittsburgh
University of Wisconsin

Director ..... Dr. WALTER H. ZINN
Deputy Director ..... Dr. NORMAN HILBERRY
Associate Director ..... Dr. JOSEPH C. BOYCE

Brookhaven National Laboratory (Associated Universities, Inc., contractor) Upton, Long Island, N. Y.

The participating institutions are:

Columbia University
Cornell University
Harvard University
Johns Hopkins University
Massachusetts Institute of Technology
Princeton University
Yale University
University of Pennsylvania
University of Rochester

President, AUI ..... Dr. FRANK D. FACKENTHAL
Director, Laboratory ..... Dr. LELAND J. HAWORTH
Assistant to Director ..... Dr. GERALD F. TATE
Assistant Director and Business Manager ..... JAMES KNOX
Assistant Director, University Liaison ..... Dr. ROBERT A. PATTERSON
Assistant Director, Biology and Medicine ..... Dr. DONALD D. VAN SLYKE

Knolls Atomic Power Laboratory (General Electric Co., contractor)
Schenectady, N. Y.

General Manager ..... WILLIAM H. MILTON, JR.
Director ..... Dr. K. H. KINGDON

Los Alamos Scientific Laboratory (University of California, contractor)
Los Alamos, N. Mex.

Director ..... Dr. NORRIS E. BRADBURY
Assistant to the Director ..... Dr. JOHN H. MANLEY
Technical Associate Director ..... Dr. DAROL K. FROMAN

Mound Laboratory (Monsanto Chemical Co., contractor)
Miamisburg, Ohio

Project Director ..... Dr. C. A. HOCHWALT
Executive Director, AEC Projects ..... Dr. JOSEPH J. BURBAGE
Laboratory Director ..... Dr. M. M. HARING

Oak Ridge National Laboratory (Carbide & Carbon Chemicals Division, Union Carbide & Carbon Corp., contractor)
Oak Ridge, Tenn.

Director ..... Dr. C. E. LARSON
Executive Director ..... L. B. EMLET
Research Director ..... Dr. A. M. WEINBERG
Assistant Research Director ..... Dr. J. A. SWARTOUT
Assistant Research Director (Y–12) ..... Dr. E. D. SHIPLEY

Oak Ridge Institute of Nuclear Studies (contractor)
Oak Ridge, Tenn.

The sponsoring universities of the Institute are:

Agricultural and Mechanical College of Texas
Alabama Polytechnic Institute
Catholic University of America
Duke University
Emory University
Georgia Institute of Technology
Louisiana State University
Mississippi State College
North Carolina State College
Rice Institute
Tulane University of Louisiana
Vanderbilt University
Virginia Polytechnic Institute

University of Alabama
University of Arkansas
University of Florida
University of Georgia
University of Kentucky
University of Louisville
University of Mississippi
University of North Carolina
University of South Carolina
University of Oklahoma
University of Tennessee
University of Texas
University of Virginia

Chairman of Council—Dr. Louis A. Pardue
Vice Chairman of Council—Dr. G. H. Boyd
President of Institute—Dr. Paul M. Gross
Vice President of Institute—Dr. J. W. Beams
Scientific and Educational Consultant—Dr. George B. Pegram
Executive Director of Institute—Dr. William G. Pollard

9 *Radiation Laboratory* (University of California, contractor)
Berkeley, Calif.

Director—Dr. Ernest O. Lawrence
Associate Director—Dr. Donald Cooksey
Assistant Director—William M. Broeck
Director, Crocker Laboratory—Medical Physics—Dr. Joseph G. Hamilton
Director, Donner Laboratory of Medical Physics—Dr. J. H. Lawrence
Assistant Director, Donner Laboratory—Dr. Hardin Jones

10 *Rochester Atomic Energy Project* (University of Rochester, contractor)
Rochester, N. Y.

Director—Dr. Henry A. Blair
Assistant Director for Education—Dr. J. Newell Stannard
Business Manager—C. M. Jarvis

11 *Sandia Laboratory* (Sandia Corp., contractor)
Sandia Base, Albuquerque, N. Mex.

President—George A. Landry
Vice President—F. Schmidt

12 *University of California, Los Angeles, Atomic Energy Project*
(University of California, contractor)
Los Angeles, Calif.

Director—Dr. Stafford Warren
Business Manager—Robert J. Buettner

13 *Westinghouse Electric Corp., Atomic Power Division* (contractor)
Pittsburgh, Pa.

Manager, Westinghouse Atomic Power Division—C. H. Weaver
Assistant Manager, Westinghouse Atomic Power Division—Dr. Charles M. Slack
Manager of Engineering and Research—F. R. Benedict
Manager of Engineering—R. A. Bowman

APPENDIX 4

REGULATIONS OF THE U. S. ATOMIC ENERGY COMMISSION [1]

PART 3

RULES OF PROCEDURE OF UNITED STATES ATOMIC ENERGY COMMISSION ADVISORY BOARD OF CONTRACT APPEALS

GENERAL PROVISIONS

Sec.
3.1 Purpose.
3.2 Scope.
3.3 Definitions.

PRELIMINARY PROCEEDINGS

3.10 Initial determination.
3.11 Appeal.
3.12 Notice of appeal.
3.13 Transmittal of notice of appeal.
3.14 Notification of parties by the Board.
3.15 Request for hearing.
3.16 Consideration by Board without hearing.
3.17 Notice of hearing.

HEARINGS

3.20 Absence of parties.
3.21 Recording of hearings.
3.22 Scope of the proceedings.
3.23 Conduct of hearings.

DECISIONS

3.30 Findings and recommendation.
3.31 Disposition by the General Manager.

MISCELLANEOUS

3.40 Modification of rules.

AUTHORITY: §§ 3.1 to 3.40 issued under 60 Stat. 755–775; 42 U. S. C. 1801–1819.

GENERAL PROVISIONS

§ 3.1. *Purpose.* Contracts entered into by the United States Atomic Energy Commission, and subcontracts entered into under such contracts, usually contain a "disputes article" providing that disputes arising under the contract or subcontract which are not disposed of by mutual agreement shall be decided in the first instance by the representative of the Commission duly authorized to supervise and administer performance of the work under the contract. The typical "disputes clause" further provides that the contractor or subcontractor may make an appeal in writing to the designated representative or representatives of the Commission, whose decision shall be final. The General Manager of the Commission is the designated representative to decide finally all appeals arising under the "disputes articles" of Commission contracts and subcontracts. The Commission has established an Advisory Board of Contract Appeals to assist the General Manager in his discharge of this responsibility by hearing the appeal and recommending to the General Manager appropriate disposition of the appeal. The rules of procedure contained in this part are designed to provide an orderly and expeditious means for handling such appeals.

§ 3.2 *Scope.* The rules contained in this part set forth the procedures which will be followed by the Advisory Board of Contract Appeals, United States Atomic Energy Commission, in arriving at a recommendation to be made to the General Manager of the Commission concerning the disposition of an appeal from a decision of a contracting officer in the matter of a contract dispute arising under the disputes article of a prime contract or subcontract.

§ 3.3 *Definitions.* (a) "Board" shall mean the Advisory Board of Contract Appeals of the Atomic Energy Commission, or any member or members thereof designated administratively by the Advisory Board of Contract Appeals to make a recommendation to the General Manager concerning the disposition of a specific appeal.

[1] Regulations of the U. S. Atomic Energy Commission, announced prior to August 1950, can be found in Appendix 4, Fifth Semiannual Report to Congress, Appendix 10, Sixth Semiannual Report to Congress, and in the *Federal Register*.

(b) "Contracting Officer" shall mean the representative of the Commission who, under the contract, has the responsibility for determining the dispute in the first instance and from whose decision the appeal has been taken.

(c) "Party" or "Parties" shall mean the contractor (or subcontractor) and the contracting officer as defined in this part, as the text may indicate.

PRELIMINARY PROCEEDINGS

§ 3.10 *Initial determination.* In disposing of a contract dispute other than by mutual agreement, the contracting officer shall furnish directly to the contractor a statement in writing of his decision, together with specific findings of fact and a copy of the rules contained in this part.

§ 3.11 *Appeal.* An appeal from the decision of the contracting officer shall be taken by filing a notice of appeal and three copies thereof with the contracting officer within 30 days after receipt by the contractor of the contracting officer's decision, unless the contract provides a different time within which such an appeal may be taken, in which case the time prescribed in the contract shall prevail.

§ 3.12 *Notice of appeal.* The notice of appeal need not follow any prescribed form and may be in the form of a letter addressed to the contracting officer, but it should indicate the decision from which the appeal is being taken, the date of the decision, and the contract number. The notice of appeal should be dated and signed by the contractor, and, if the contractor desires to appear or be represented at a hearing before the Board, should contain a request that such a hearing be held. Argument in support of the appeal should not be incorporated in the notice of appeal.

§ 3.13 *Transmittal of notice of appeal.* When the notice of appeal has been received, the contracting officer will endorse the date of its receipt on the original and promptly forward to the Atomic Energy Commission Advisory Board of Contract Appeals, Washington 25, D. C., the original and two copies, together with three copies of the decision, findings of fact and supporting data, three copies of all correspondence, and other data relevant to the dispute.

§ 3.14 *Notification of parties by the Board.* Upon receipt of the material referred to in § 3.13, the Board will so notify the contractor and the contracting officer and will notify them of the member or members of the Board designated to handle the appeal.

§ 3.15 *Request for hearing.* If a hearing has not been requested in the notice of appeal, the contracting officer when so notified may request that a hearing be held by forwarding such a request in writing to the member or members of the Board designated to handle the appeal.

§ 3.16 *Consideration by Board without hearing.* If a hearing has not been requested in the notice of appeal or by the contracting officer, the Board will proceed to a recommendation on the basis of the record then before it, together with such a brief as the contractor may desire to submit and a reply brief submitted by the contracting officer. The Board will instruct the parties with respect to the time within which such briefs must be submitted and served upon the other parties.

§ 3.17 *Notice of hearing.* If the notice of appeal contains a request for a hearing, the Board will fix the time when and the place where such hearing will be conducted and will give the contractor at least 15 days' notice thereof in writing. In fixing a time and place for a hearing, the Board will consider the convenience of the parties. Ordinarily, hearings will be held at the location of the office of the Commission administering the contract, but may be held in Washington, D. C., or such other place as shall be determined by the Board.

HEARINGS

§ 3.20 *Absence of parties.* In the event of the unexcused absence of a

party at the time and place set for a hearing, the hearing will proceed and the appeal will be deemed as having been submitted without oral testimony or argument on behalf of that party.

§ 3.21 *Recording of hearings.* The proceedings at hearings will be recorded and transcribed. One copy of the transcript of the proceedings will be furnished the contractor without cost to the contractor.

§ 3.22 *Scope of the proceedings.* At a hearing the Board shall receive evidence and arguments presented by or on behalf of the parties. The appeal will be considered de novo and independent findings of fact will be made, although the findings of fact of the contracting officer may be adopted by the Board in whole or in part.

§ 3.23 *Conduct of hearings.* The hearings before the Board will be informal, with no fixed form of procedure, and the manner in which facts are found and conclusions reached shall be a matter for the discretion of the Board; and the Board may limit or otherwise control the issues presented by the appeal and the extent of the evidence, testimony or argument presented as it shall see fit. However, the following general rules will apply:

(a) The parties may present to the Board a signed stipulation setting forth any agreed facts or stating the matters in dispute.

(b) Unless dispensed with by the Board, all testimony offered shall be received under oath. Attention of the witness shall be invited to 18 U. S. C. 1001 or 18 U. S. C. 1621, as appropriate.

(c) Ordinarily, the contractor will be expected to proceed with the affirmative presentation.

(d) Testimony and evidence may be submitted without regard to the formal rules of evidence, but shall, nevertheless, be subject to a determination by the Board with respect to propriety or relevance. Such determination may be made when the testimony or evidence is offered, or the testimony or evidence may be received subject to future determination by the Board.

(e) All witnesses shall be subject to the cross-examination, and also to examination by the Board.

(f) In the discretion of the Board, and upon application in advance of the hearing and with notice to the opposing party, evidence may be submitted in affidavit form.

(g) The parties may be represented at a hearing by any authorized person.

(h) All hearings will be so conducted as to ensure compliance with the security regulations and requirements of the Commission, and the Board may take whatever steps may be deemed appropriate to assure the common defense and security pursuant to the provisions of the Atomic Energy Act of 1946.

(i) Briefs shall be submitted to the Board and served upon the parties in accordance with instructions transmitted by the Board to the parties, and the Board may request preliminary briefs or statements describing the basis for the appeal and the questions involved in advance of a hearing.

DECISIONS

§ 3.30 *Findings and recommendation.* The Board will make specific findings of fact and conclusions, recommending a disposition of the appeal. Such findings, conclusions and recommendations shall be transmitted by the Board to the General Manager of the Commission.

§ 3.31 *Disposition by the General Manager.* If the recommendation of the Board is concurred in by the General Manager (or the Deputy General Manager acting on behalf of the General Manager), such concurrence, together with the findings and conclusions of the Board, shall be transmitted to the parties. If the General Manager (or the Deputy General Manager acting on behalf of the General Manager) does not concur in the recommendation of the Board, he shall make such disposition of the appeal as he deems appropriate.

MISCELLANEOUS

§ 3.40 *Modification of rules.* The rules, contained in this part are intended to render the contract appeal procedure just and simple and to prevent unjustifiable expense and delay. They may be relaxed or modified by the Board in the interests of justice and the expeditious settlement of disputes.

Dated in Washington, D. C., this 23d day of August 1950.

PART 4

SECURITY CLEARANCE PROCEDURES

GENERAL PROVISIONS

Sec.
4.1 Purpose.
4.2 Scope.
4.3 References.
4.4 Policy.

PROCEDURES

4.10 Determination of employment status.
4.11 Notice to individual.
4.12 Additional information.
4.13 Failure of individual to file answers.
4.14 Appointment of boards.
4.15 Conduct of proceedings.
4.16 Recommendations of the board.
4.17 New evidence.
4.18 Actions on the recommendations.

MISCELLANEOUS

4.20 Modification of procedure.

GENERAL PROVISIONS

§ 4.1 *Purpose.* This Part establishes procedures and methods for the conduct of local board hearings and administrative review of questions or recommendations concerning eligibility of an individual for security clearance pursuant to the Atomic Energy Act of 1946.

§ 4.2 *Scope.* The procedures outlined in this Part will be used in those cases in which there are questions as to eligibility for security clearance as a result of application of the standards set forth in "AEC Personnel Security Clearance Criteria for Determining Eligibility" (14 F. R. 42) and which involve:

(a) Employees and applicants for employment with or as consultants to the Atomic Energy Commission.

(b) Applicants, employees, and consultants of contractors, agents, and licensees of Atomic Energy Commission, subject to the security control of the Atomic Energy Commission, or

(c) Those other persons designated by the General Manager of the Atomic Energy Commission.

§ 4.3 *References.* The pertinent sections of the Atomic Energy Act of 1946 are as follows:

SEC. 10 (a) POLICY.—It shall be the policy of the Commission to control the dissemination of restricted data in such a manner as to assure the common defense and security.

SEC. 10 (b) (5) (B) (i). No arrangement shall be made under section 3, no contract shall be made or continued in effect under section 4, and no license shall be issued under section 4 (e) or 7, unless the person with whom such arrangement is made, the contractor or prospective contractor, or the prospective licensee agrees in writing not to permit any individual to have access to restricted data until the Federal Bureau of Investigation shall have made an investigation and report to the Commission on the character, associations, and loyalty of such individual and the Commission shall have determined that permitting such person to have access to restricted data will not endanger the common defense or security.

(ii) Except as authorized by the Commission in case of emergency no individual shall be employed by the Commission until the Federal Bureau of Investigation shall have made an investigation and report to the Commission on the character, associations, and loyalty of such individual.

(iii) Notwithstanding the provisions of subparagraphs (i) and (ii), during such period of time after the enactment of this Act as may be necessary to make the investigation, report, and determination required by such paragraphs,

(a) any individual who was permitted access to restricted data by the Manhattan Engineer District may be

permitted access to restricted data, and

(b) the Commission may employ any individual who was employed by the Manhattan Engineer District.

§ 4.4 *Policy.* Consistent with the security requirements, it is the policy of the Atomic Energy Commission to afford to those individuals listed in § 4.2 maximum opportunity for administrative review of any determination to deny or revoke security clearance.

PROCEDURES

§ 4.10 *Determination of Employment Status.* In those cases where information is received which raises questions concerning the eligibility of an employee for security clearance, the Manager of the office concerned (or in the case of an employee at Washington, D. C., the Deputy General Manager) will, prior to making any recommendation as to the employee's eligibility for security clearance, consult with appropriate AEC staff members and, in the case of a contractor's employee (or consultant), representatives of the employing contractor, and decide, without undue delay, the employment status of the individual to be effective pending the final security clearance determination resulting from the operation of the procedures provided in this Part.

§4.11. *Notice to Individual.* The Manager, or his designated representative, will present personally to the individual a notification letter which shall state: (a) That information obtained as a result of the investigation has created a question concerning the individual's eligibility for security clearance.

(b) The information, stated in as much detail and as specifically as considerations of security permit, upon which doubt arises regarding the individual's eligibility for security clearance.

(c) That a hearing will be scheduled before a Personnel Security Board for the purpose of eliciting information to assist in determining the eligibility of the individual for security clearance.

(d) That within ten days of the date of receipt of the notification letter the individual shall file with the Manager from whom he received such letter his written answer to the matters contained therein and indicate his intention to be present at the hearing.

(e) That the individual will be notified in writing of the membership of a Personnel Security Board when it is appointed by the Manager.

(f) That the individual will have the right to appear personally before a Personnel Security Board, be present during the entire hearing, be represented by counsel of his own choosing, and present evidence in his own behalf, through witnesses, or by documents or both.

(g) That the individual's failure to file written answer and indicate his intention to be present at the hearing, shall be considered as a relinquishment by him of the opportunity of availing himself of the privileges accorded to him under the hearing and review procedure provided in this Part and that in such event a recommendation of the final action to be taken will be made by the Manager of Operations and submitted to the General Manager on the basis of the existing records without reference to a Personnel Security Board.

(h) His employment status until further notice.

(i) The name of the designated AEC official to contact for any further information desired.

§ 4.12 *Additional Information.* An informational copy of the procedure for hearings and review shall be given to the individual with the notification letter.

§ 4.13 *Failure of Individual to File Answers.* In the event the individual fails to file written answer to the notification letter within the prescribed time, a recommendation as to the final action to be taken will be made to the General Manager on the basis of the

existing record. The Manager may for good cause, at the request of the individual, extend the time for filing written answers to the matters contained in the notification letter.

§ 4.14 *Appointment of Boards.* (a) Upon the receipt from the individual of his written answer to the notification letter, signifying his desire to appear before a Personnel Security Board, the Manager shall forthwith appoint a Board consisting of three members, one to be designated as the Chairman.

(b) The personnel of the Boards, when practicable as determined by the Manager, shall consist of at least one member who is familiar with the general field of work of the individual.

(c) The personnel shall be selected from a panel composed of Atomic Energy Commission employees, employees of contractors of the Atomic Energy Commission, or of such other persons as the Manager determines possess the necessary qualifications for sitting as members of a Personnel Security Board. All persons sitting as members of Personnel Security Boards shall have a full "Q" clearance.

(d) No person shall sit in a case as a member of a Personnel Security Board who has prejudged the matter, or who possesses information that would make it embarrassing to render an impartial recommendation, or who for bias or prejudice generated for any reason would be unable to render a fair and impartial recommendation.

(e) Immediately upon the appointment of a Personnel Security Board, the Manager will notify the individual of the names of the members of the Board and of his right to challenge any member for cause, such challenge or challenges to be submitted to the Manager within seventy-two hours of the receipt of the notice.

(f) In the event that the individual challenges a member or members of the Board, the justification of the action of the individual shall be determined by the Manager. Where the challenge of the individual is sustained, the Manager should forthwith appoint such new members to the Board as will constitute a full Board and notify the individual of his action. The Manager will likewise notify the individual of his rejection of any challenge.

(g) At least forty-eight hours' advance notice from time of receipt will be given the individual by the Chairman of a Personnel Security Board of the date, hour, and place the Board will convene for the purpose of receiving the evidence that the individual chooses to present.

§ 4.15 *Conduct of Proceedings.* (a) The proceedings shall be presided over by the Chairman of the Board and shall be conducted in an orderly and decorous manner with every effort made to protect the interests of the Government and of the individual. In no case will undue delay be tolerated nor will the individual be hampered by unduly restricting the time necessary for proper preparation and presentation. In performing their duties, the members of the Board shall avoid the attitude of a prosecutor and shall always bear in mind and make clear to all concerned that the proceeding is an inquiry and not a trial.

(b) The proceedings shall be open only to duly authorized representatives of the staff of the Atomic Energy Commission, the individual, his counsel, and such persons as may be officially authorized by the Board.

(c) During the course of the proceedings the Chairman shall rule in open session on all questions presented to the Board for its determination, subject to the objection of any member of the Board. In the event of an objection by any member of the Board, a majority vote of the Board will be determinative and constitute the ruling of the Chairman. Voting may be either in open or closed session on all questions except recommendations to grant or deny security clearance, which shall be in closed session.

(d) In the event that it appears in the course of the hearing that restricted data may be disclosed, it shall be the duty of the Chairman to assure that disclosure is not made to persons who are not authorized to receive it.

(e) The Board will ask the individual, AEC representatives, and other witnesses any questions calculated to obtain the fullest possible disclosure of relevant and material facts. The proponent of a witness shall conduct the direct examination of that witness.

(f) The Board will not engage in any arguments with either the individual, his witnesses, or his counsel. Nor will the Board permit any person to argue from the witness stand.

(g) The Board will admit in evidence any matters either oral or written which, in the minds of reasonable men, is of probative value to determine the issues involved. The utmost latitude will be given the subject with respect to relevancy, materiality, and competency. Every reasonable effort will be made to obtain the best evidence reasonably available. Hearsay evidence will be admitted without regard to technical rules of admissibility and accorded such weight as the circumstances warrant.

(h) Witnesses will be permitted to testify either under oath, affirmation, or without either, and such weight will be given to this testimony as the circumstances warrant. Attention of the witness shall be invited to 18 U. S. C. § 1001 or 18 U. S. C. § 1621, as appropriate.

(i) The individual will be afforded the opportunity of testifying in his own behalf. His failure to testify may be considered by the Board in reaching its recommendation.

(j) The Board shall endeavor to obtain all the facts that are reasonably available in order for it to arrive at its recommendations. If, prior to or during the proceeding, in the opinion of the Board the allegations in the notification letter are not sufficient to cover all matters into which inquiry should be directed, the Board shall suggest to the Manager concerned that, in order to give fuller notice to the individual, the notification letter should be amended. If, in the opinion of the Board, the circumstances of such an amendment may involve an undue hardship to the individual, because of limited time to answer the new allegations in the notification letter, an appropriate adjournment shall be granted upon the request of the individual.

(k) The entire proceedings shall be taken down verbatim and transcribed into a written record, a copy of which shall be furnished the individual without cost at his request. In the event restricted data are disclosed in the transcription, such restricted data shall be deleted and notation made to such effect before furnishing the transcript to the individual.

(l) The reports of the Federal Bureau of Investigation shall not be disclosed to the individual or to his representative.

(m) When the presence of a witness is deemed by the Board to be necessary to a proper determination of the issues before it, the Board shall request the Manager to make arrangements, if possible, for such witness to appear, be confronted by the individual, and be subject to examination by the individual and by the Board. Upon receipt of such request the Manager shall make every effort through proper administrative channels to comply with the Board's request. Because of the confidential nature of the sources of information or for other reasons, confrontation may not be possible.

(n) The Board may request the Manager to arrange for additional investigation on any points which are material to the deliberations of the Board and which the Board believes need extension or clarification. In this event, the Board will set forth in writing that issue upon which more evidence is requested, identifying where possible persons or sources from which evidence should be sought. The Manager will make every effort through appro-

priate sources to obtain additional information upon the matters indicated by the Board.

(o) When the nature of the case is complex or the Board desires assistance in conducting the hearing, the Manager should designate such person or persons to aid the Board as may be necessary. The person thus named shall not be a member of the Board, shall not participate in the deliberations of the Board, shall express no opinion to the Board concerning the merits of the case, but shall assist the Board in such manner as to bring out a full and complete disclosure of all facts having any bearing upon the issues before the Board.

§4.16 *Recommendations of the Board.* (a) The Board shall carefully consider all material before it including reports of the Federal Bureau of Investigation, the testimony of all witnesses, the evidence presented by the individual, and the standards set forth in "AEC Personnel Security Clearance Criteria for Determining Eligibility" (14 F. R. 42). In considering the material before the Board, the members of the Board, as practical men of affairs, should be guided by the same consideration that would guide them in making a sound decision in the administration of their own lives. In reaching its determination the Board shall consider the manner in which the witnesses have testified before the Board, their demeanor on the witness stand, the probability or likelihood of their testimony, their credibility, the authenticity of documentary evidence, or the lack of evidence upon some material points in issue.

(b) If, after considering all the factors, they are of the opinion that it will not endanger the common defense and security to grant security clearance to the individual, they should so recommend. If they are unable to find that it will not endanger the common defense and security to grant security clearance, they should recommend that clearance be denied.

(c) The Board shall make specific findings as to the allegations contained in the notification letter, whether they are true or false and the significance which they attach to the allegations. These findings shall be supported fully by a statement of reasons made with respect to such findings.

(d) The recommendation shall be determined by a majority vote. In the event of a dissent from the majority, a recommendation from the minority shall be made of record together with a statement of the reasons leading to the conclusion of the minority.

(e) The recommendation of the Board shall be predicated upon its findings, which shall take into consideration whether they establish a pattern of conduct falling within the criteria or a specific category thereof, and shall be submitted to the Manager accompanied by a statement of reasons leading to the Board's conclusions.

§ 4.17 *New Evidence.* (a) In the event of the discovery of new evidence, such evidence will be submitted to:

(1) The Board in the event the Board has not transmitted its recommendations to the Manager, or

(2) The Manager in all other cases.

(b) It shall be the duty of those to whom application is properly made for the presentation of the new evidence to ascertain its materiality and relevancy and further, that the individual and his representative are without fault in failing to present the evidence before. In the event it is determined that such new evidence should be received, those making such decisions will also determine in what form it shall be received, whether by deposition, affidavit, or orally.

§ 4.18 *Actions on the Recommendations.* (a) The recommendations of the Board and any dissent therefrom will be written out, signed by all of the members of the Board, and, together with the record of the case, shall be transmitted with the least practicable delay to the Manager of Operations concerned.

(b) Upon receipt of the recommendation of the Board and the record of the case, the Manager shall forthwith review the entire record. Before making any determination concerning his recommendation as to the granting or denial of security clearance, the Manager shall obtain all relevant data concerning the effect which denial of security clearance would have upon the atomic energy program. Such data shall not be disclosed to the individual or his representative.

(c) In making the determination concerning his recommendation to grant or deny security clearance the Manager shall be guided by the standards set forth in "AEC Personnel Security Criteria for Determining Eligibility" (14 F. R. 42) and shall set forth in writing his recommendation to the General Manager. Such recommendation along with the entire record will be forwarded to the General Manager.

(1) In the event of a recommendation for a denial of security clearance, the individual shall be immediately notified in writing of that fact by the Manager and shall be furnished a copy of the Manager's findings. This letter will also notify the individual of his right to request a review of his case by the AEC Personnel Security Review Board and of his right to submit a brief in support of his contentions. The brief shall be filed with the Manager not later than 20 days after receipt of such notification by the individual. The request for a review should be submitted to the Manager within five days of the receipt of the notice. The individual will also be notified of any change in the status of his employment.

(d) In the event the individual fails to request a review by the AEC Personnel Security Review Board of an adverse recommendation within the prescribed time, the Manager of Operations shall recommend the closing of the case and arrange for any necessary action in connection with the termination of the individual's employment. In such cases the Manager will advise the Director of Security in Washington by letter of the failure of the individual to file a request for further review.

(e) Where the individual requests a review of the adverse recommendation, the Manager shall send the entire record of the proceedings, with all findings and recommendations, to the General Manager via the Director of the Division of Security, Washington, D. C.

(f) Where the Manager has made a recommendation favorable to the individual and the General Manager proposes to transmit the entire record to the Personnel Security Review Board for its recommendation, the General Manager will immediately cause the individual to be notified of that fact and will further inform the individual that he may submit any briefs considered necessary by the individual to sustain his contention. Such brief to be filed not later than 20 days from the receipt of the notice by the individual. The brief will be forwarded to the General Manager via the Director of Security for transmission to the Personnel Security Review Board.

(g) The General Manager will submit the entire record to the AEC Personnel Security Review Board.

(h) The AEC Personnel Security Review Board shall make its deliberations upon the entire record, supplemented by additional testimony, briefs, or arguments, as determined by the AEC Personnel Security Review Board.

(i) After its deliberations, the AEC Personnel Security Review Board shall make its recommendation and submit such recommendation in writing to the General Manager for his decision.

(j) The General Manager will then make a final determination from the entire record, accompanied by all recommendations, whether security clearance shall be granted or denied.

(k) The individual, the Manager, and directors of the divisions concerned will be notified of the decision of the General Manager as soon as practicable.

MISCELLANEOUS

§ 4.20 *Modification of Procedure.* This procedure may be modified by the General Manager as experience and circumstances may make desirable.

Dated in Washington, D. C., this 12th day of September 1950.

PART 50

CONTROL OF FACILITIES FOR THE PRODUCTION OF FISSIONABLE MATERIAL

GENERAL PROVISIONS

GENERAL RESTRICTIONS

APPLICATIONS FOR AND ISSUANCE OF LICENSES

TYPES AND CONDITIONS OF LICENSES

REPORTS

VIOLATIONS

INTERPRETATIONS, PETITIONS, COMMUNICATIONS

SCHEDULES

EFFECTIVE DATE

AUTHORITY: §§ 50.1 to 50.80, inclusive, issued pursuant to the Atomic Energy Act of 1946 (Pub. Law 585, 79th Cong.; 60 Stat. 755-ff).

GENERAL PROVISIONS

§ 50.1 *Basis and purpose.* The regulations in this part, for the control of facilities for the production of fissionable material, are promulgated by the United States Atomic Energy Commission pursuant to the Atomic Energy Act of 1946 (60 Stat. 755; 42 U. S. C. 1801 *et seq.*) to effectuate the policies and purposes of the Act.

§ 50.2 *Definitions.* (a) As used in this part, the term "facilities for the production of fissionable material," means (1) any equipment or device capable of such production and (2) any important component part especially designed for such equipment or devices as determined by the Commission. All such facilities are, for the purposes of the regulations in this part, classified as follows:

(1) Class I: Any facility (other than a Class II facility) capable of producing any fissionable material, including items listed in Schedule A (§ 50.70);

(2) Class II: Any item listed in Schedule B (§ 50.71). The Commission has determined that such items are important component parts especially designed for equipment or devices capable of the production of fissionable material.

(b) The term "person" means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, the United States or any agency thereof, any government other than the United States, any political subdivision of any such government, and any legal successor, representative, agent, or agency of the foregoing, or other entity, but shall not include the Commission, or officers or employees of the Commission in the exercise of duly authorized functions.

(c) The term "Commission" means the Atomic Energy Commission created by the Atomic Energy Act of 1946, or its duly authorized representative.

(d) The term "United States," when used in a geographical sense, includes

all Territories and possessions of the United States and the Canal Zone.

(e) The term "fissionable material" means plutonium, uranium enriched in the isotope 235, any other material which the Commission determines to be capable of releasing substantial quantities of energy through nuclear chain reaction of the material, or any material artificially enriched by any of the foregoing, but does not include source materials, as defined in the Atomic Energy Act of 1946.

GENERAL RESTRICTIONS

§ 50.10 *License required.* Unless authorized by a license issued by the Commission, no person shall manufacture, produce, transfer, or acquire facilities for the production of fissionable material. Licenses issued by the Commission are of two basic types, general and specific (see § 50.30), depending on the nature of the activity to be authorized.

§ 50.11 *Activities incident to export.* A specific license must be obtained to authorize export from the United States of facilities for the production of fissionable material, or to authorize the manufacture, production, transfer, or acquisition of such facilities for export.

§ 50.12 *Domestic activities.* (a) A specific license must be obtained (except as indicated in paragraph (c) below) to authorize manufacture, production, transfer, or acquisition of Class I facilities.

(b) A general license is hereby issued for manufacture, production, transfer, and acquisition of Class II facilities which takes place within the United States and is not for export. This general license shall be deemed to include manufacture, production, transfer, and acquisition of Class II facilities for incorporation into other Class II facilities prior to export of the latter. Each person acting under authority of this general license remains subject to the reporting requirements of §§ 50.40 and 50.41 below.

(c) No license is required for activities expressly excepted from the licensing requirements of the Atomic Energy Act of 1946; that is, for manufacture, production, transfer, or acquisition of Class I or Class II facilities incident to or for the conduct of research or development activities in the United States of the types specified in section 3 of the Act.

§ 50.13 *Other activities.* A specific license must be obtained to authorize manufacture, production, transfer, or acquisition of facilities for the production of fissionable material in cases other than those specified in §§ 50.11 and 50.12 above.

APPLICATIONS FOR AND ISSUANCE OF LICENSES

§ 50.20 *Applications for licenses.* License applications for the activities covered by § 50.11 above shall be filed in duplicate with the United States Atomic Energy Commission, on Form AEC–17, copies of which may be obtained from the Commission. License applications for all other activities shall be filed by letter.

§ 50.21 *Issuance of licenses.* Upon a determination that an application meets the requirements of the Atomic Energy Act of 1946 and of the regulations of the Commission, the Commission will issue a license by approving, upon such conditions as it deems appropriate and in accordance with law, the application filed, forwarding a copy of the license to the applicant.

§ 50.22 *Standards for issuance of licenses.* In making the determination mentioned in the preceding section, the Commission will be guided by the following standards:

(a) Assuring the common defense and security;

(b) Assuring an adequate supply of facilities for the production of fissionable material;

(c) Preventing the use of such facilities in a manner inconsistent with the national welfare;

(d) Effectuating the policies and purposes of the Atomic Energy Act of 1946.

So far as consistent with these stand-

ards, licenses will be granted for the conduct of normal business activities.

TYPES AND CONDITIONS OF LICENSES

§ 50.30 *Types of licenses.* A general license has been issued in the cases specified in § 50.12 (b) above and in such cases the filing of an application with the Commission is not necessary. Specific licenses are issued to named persons in response to applications filed with the Commission. So far as consistent with the Atomic Energy Act of 1946, licenses will be designed to fit the normal business requirements of the licensee.

§ 50.31 *Conditions of licenses.* Each license will require the licensee to comply with certain conditions, including the filing of reports with the Commission. Willful failure of a licensee to file any such report which truthfully sets forth all information required, or willful failure to comply with any other condition of the license, shall constitute a violation of the regulations in this part.

§ 50.32 *Revocation, suspension, modification of licenses.* Any license may be modified, withdrawn, suspended, revoked or annulled at any time in the discretion of the Commission upon a determination by the Commission that the public health, interest, or safety requires such action, or that the licensee has willfully failed to comply with any condition of the license. In the absence of such a determination, no modification, withdrawal, suspension, revocation or annulment of any license will be made except upon application therefor by the licensee or unless, prior thereto, facts or conduct warranting such action have been called to the attention of the licensee in writing and the licensee has been accorded opportunity to demonstrate or achieve compliance with all lawful requirements. Nothing in this part shall limit the authority of the Commission to issue or amend its regulations in accordance with law.

§ 50.33 *Transfer of licenses.* Licenses shall be non-transferable.

REPORTS

§ 50.40 *Reporting possession or title.* (a) Any person (whether or not a licensee) who, on the effective date of the regulations of this part, has possession of or title to any Class I facility for the production of fissionable material (including those listed specifically in Schedule A, § 50.70) shall, not later than 60 days after such date, file with the Commission a reasonably detailed statement of:

(i) The location of the facility;

(ii) Its present use;

(iii) Its proposed use;

(iv) Its engineering specifications, including capacity;

(v) The name, title, and address of the persons having control of the facility.

(b) The requirement of this section does not apply to any facility held under authority of a contract or an arrangement with the Commission.

NOTE.—The term "person" as defined in section 18 (c) of the Atomic Energy Act of 1946 and in § 50.2 does not include the Commission or officers or employees of the Commission in the exercise of duly authorized functions. Consequently, the requirement of this § 50.40 does not apply in such cases.

§ 50.41 *Reports.* Reports in addition to those called for in licenses may be required by the Commission from time to time, subject to approval by the Bureau of the Budget in certain cases, with respect to the ownership, possession, manufacture, production, export, shipment, transfer, acquisition or other handling of facilities for the production of fissionable material, as the Commission may deem necessary.

VIOLATIONS

§ 50.50 *Penalties for violations.* A violation of the regulations in this part shall be deemed to be a violation of the Atomic Energy Act of 1946, and shall subject the violator to the penalties

therein prescribed. In addition, the Commission may take such action with respect to the facilities involved in any violation as it deems appropriate and in accordance with law.

INTERPRETATIONS, PETITIONS, COMMUNICATIONS

§ 50.60 *Valid interpretations.* Except as specifically authorized by the Commission, no interpretation or explanation of the meaning of the regulations in this part issued by any officer or employee of the Commission other than one issued by the General Counsel in writing will be recognized to be valid and binding upon the Commission.

§ 50.61. *Petitions.* Petitions for relief from any restrictions imposed under the regulations in this part may be made by filing a letter, in duplicate, with the Commission, stating the reasons why the petition should be granted.

§ 50.62 *Communications.* All communications concerning the regulations of this part or any license issued under them should be addressed to the United States Atomic Energy Commission, Washington 25, D. C., Attention: Director of Production.

SCHEDULES

§ 50.70 *Schedule A: Class I facilities* (see §§ 50.2, 50.20, and 50.40). As defined in § 50.2 above, a Class I facility is any facility (other than a Class II facility) capable of producing any fissionable material, such as (a) nuclear reactors or piles, (b) facilities capable of the separation of isotopes of uranium, and (c) electronuclear machines (*e. g.*, cyclotrons, synchrocyclotrons and linear ion accelerators) capable of imparting energies in excess of 1 Mev each to positively charged nuclear particles or ions.

NOTE.—Under section 4 (c) (1) of the Atomic Energy Act of 1946 the Commission, as agent of and on behalf of the United States is made the exclusive owner of all facilities for the production of fissionable material *other than* facilities which (A) are useful in the conduct of research and development activities in the fields specified in section 3 of the Act, and (B) do not, in the opinion of the Commission, have a potential production rate adequate to enable the operator of such facilities to produce within a reasonable period of time a sufficient quantity of fissionable material to produce an atomic bomb or any other atomic weapon. The listing of a facility for the purposes of the regulations in this part shall not be deemed to be an expression of the opinion of the Commission as to ownership of any such facility for the purposes of section 4 (c) (1) of the Act.

§ 50.71 *Schedule B: Class II facilities* (see §§ 50.2 and 50.20). A Class II facility is any item listed in this Schedule B. The Commission has determined that the following items are important component parts especially designed for equipment or devices capable of the production of fissionable material:

(a) Radiation detection instruments, and their major components, designed, or capable of being adapted, for detection or measurement of nuclear radiations, such as alpha and beta particles, gamma radiation, neutrons and protons, including the following:

(i) Geiger Mueller, proportional, or parallel plate counter scalers.

(ii) Geiger Mueller or proportional counter rate meters.

(iii) Scalers (adaptable to radiation detection).

(iv) Geiger Mueller, proportional audio, or mechanical detectors.

(v) Integrating ionization chamber meters and ionization chamber rate meters.

(vi) Geiger Mueller, proportional, or parallel plate counter detector components.

(vii) Electrometer tube circuits and dynamic condenser electrometers (vibrating reed, vibrating diaphram, etc.) capable of measuring currents of less than 1 micromicroampere.

(viii) Counter pulse rate meters.

(ix) Amplifiers designed for application in nuclear measurements, including linear amplifiers, preamplifiers and distributed (chain) amplifiers.

(x) Geiger Mueller quenching units.

(xi) Geiger Mueller or proportional coincidence units.

(xii) Dosimeters and electrometers, pocket and survey types, including electroscopes incorporating radiation measurement scales.

(xiii) Chambers, pocket type, with electrometer charger-reader.

(xiv) Electrometer tubes designed to operate with grid currents of less than 0.1 micromicroampere.

(xv) Resistors, values above 1,000 megohms.

(xvi) Scintillation counters incorporating a photomultiplier tube.

(xvii) Photomultiplier tubes having photocathode sensitivity of 10 or more microamperes per lumen, and an average amplification greater than 10^5.

(b) Mass spectrometers and mass spectrographs, of all mass ranges, and their major components, including the following:

(i) Leak detectors, mass spectrometer, light gas type.

(ii) Mass spectrometers or mass spectrographs.

(iii) Ion sources, mass spectrometer or spectrograph type.

(iv) Acceleration and focusing tubes, mass spectrometer and spectrograph types.

(v) Ionization chambers, mass spectrometer detector types.

(vi) Micromicroammeters capable of measuring current of less than 1.0 micromicroampere.

(vii) Electrometer tubes (as listed in (a) (xiv) above).

(viii) Resistors, values above 1,000 megohms.

(c) Vacuum diffusion pumps 12 inches diameter and larger (diameter measured inside the barrel at the inlet jet).

(d) Electronuclear machines, and their basic component parts, capable, with or without modification, of sustaining potential differences in excess of 100,000 volts against the discharging action of positive ion currents in excess of 10^{-7} amperes, such as belt type electrostatic generators (Van de Graaff machines).

§ 50.72 *Schedule B: Exemptions.* The listing in Section 50.71 above of electrometer-type electronic tubes and resistors (see Section 50.71 (a) (xiv) and (xv) and Section 50.71 (b) (vii) and (viii)) shall not be deemed to constitute such items component parts of radiation detection equipment or mass spectrometers when they have been actually incorporated into (or packaged as spares for shipment with) instruments (such as, but not limited to, pH meters, spectrophotometers, moisture meters, and kilovoltmeters) not capable of detection or measurement of nuclear radiation or not capable of use as mass spectrometers.

§ 50.80 *Effective date.* The regulations in this part shall become effective at midnight, November 20, 1947, this effective date, which is less than 30 days, subsequent to publication, is found necessary and appropriate by the Commission for assuring the common defense and security.

Dated at Washington, D. C., this 12th day of November 1947; amended, effective Nov. 1, 1950.

PART 60

Domestic Uranium Program

Guaranteed minimum price for uranium-bearing carnotite-type or roscoelite-type ores of Colorado Plateau area

Section 60.5 of Title 10, Code of Federal Regulations, is amended by extending the expiration date of the guaranteed minimum prices from June 30, 1954, to March 31, 1958, so that § 60.5 shall read as follows:

§ 60.5 *Guaranteed minimum price for uranium-bearing carnotite-type or roscoelite-type ores of the Colorado Plateau area—(a) Guarantee.* To stimulate domestic production of uranium-bearing ores of the Colorado Plateau area commonly known as carnotite-type or roscoelite-type ores, and in

the interest of the common defense and security, the United States Atomic Energy Commission hereby establishes the guaranteed minimum prices specified in § 60.5a effective during the period, February 1, 1949, through March 31, 1958, for the delivery of such ores to the Commission at Monticello, Utah, in accordance with the terms of this section and § 60.5a.

APPENDIX 5

Criteria for Determining Eligibility for Personnel Security Clearance [1]

The United States Atomic Energy Commission has adopted basic criteria for the guidance of the responsible officers of the Commission in determining eligibility for personnel security clearance. These criteria are subject to continuing review, and may be revised from time to time in order to insure the most effective application of policies designed to maintain the security of the atomic energy program in a manner consistent with traditional American concepts of justice and rights of citizenship.

The Commission on the 19th day of September 1950, issued its procedure for the administrative review of those cases in which questions have arisen concerning an individual's eligibility for security clearance. This procedure is published in the *Federal Register* (15 F. R. 6241). This procedure places considerable responsibility on the Managers of Operations and it is to provide uniform standards for their use that the Commission has adopted the Criteria described herein.

Under the Atomic Energy Act of 1946, it is the responsibility of the Atomic Energy Commission to determine whether the common defense or security will be endangered by granting security clearance to individuals either employed by the Commission or permitted access to restricted data. As an administrative precaution, the Commission also requires that at certain locations there be a local investigation, or check, on individuals employed by contractors on work not involving access to restricted data. (Commission authorization to be so employed is termed "security approval.")

Under the Act, Federal Bureau of Investigation has the responsibility for making an investigation and report to the Commission on the character, associations and loyalty of individuals who are to be permitted to have access to restricted data. In determining any individual's eligibility for security clearance other information available to the Commission should also be considered, such as whether the individual will have direct access to restricted data or work in proximity to exclusion areas, his past association with the atomic energy program, and the nature of the job he is expected to perform. The facts of each case must be carefully weighed and determination made in the light of all the information presented whether favorable or unfavorable. The judgment of responsible persons as to the integrity of the individuals should be considered. The decision as to security clearance is an over-all, common-sense judgment, made after consideration of all the relevant information as to whether or not there is risk that the granting of security clearance would endanger the common defense or security. If it is determined that the common defense or security will not be endangered, security clearance will be granted; otherwise, security clearance will be denied.

Cases must be carefully weighed in the light of all the information, and a determination must be reached which gives due recognition to the favorable as well as unfavorable information concerning the individual and which balances the cost to the program of not having his services against any possible

[1] This statement of criteria adopted by the U. S. AEC revises a statement previously published in Appendix 8, Fifth Semiannual Report to Congress, and in the *Federal Register*, Jan. 5, 1949 (14 F. R. 42).

risks involved. In making such practical determination, the mature viewpoint and responsible judgment of Commission staff members and of the contractor concerned are available for consideration by the General Manager.

To assist in making these determinations, on the basis of all the information in a particular case, there are set forth below a number of specific types of derogatory information. The list is not exhaustive, but it contains the principal types of derogatory information which indicate a security risk. It will be observed that the criteria are divided into two groups: Category (A) and Category (B).

Category (A) includes those classes of derogatory information which establish a presumption of security risk. In cases falling under this category the Manager of Operations must refer the cases to the Director of Security in Washington.

Category (B) includes those classes of derogatory information where the extent of activities, the attitudes, or conventions of the iidividual must be weighed in determining whether a presumption of risk exists. In these cases, the Manager of Operations must refer them to the Director of Security in Washington.

Category (A). Category (A) includes those cases in which there are grounds sufficient to establish a reasonable belief that the individual or his spouse has:

1. Committed or attempted to commit, or aided or abetted another who committed or attempted to commit, any act of sabotage, espionage, treason, or sedition;

2. Establish an association with espionage agents of a foreign nation; with individuals reliably reported as suspected of espionage; with representatives of foreign nations whose interests may be inimical to the interests of the United States. (Ordinarily this would not include chance or casual meetings; nor contacts limited to normal business or official relations.)

3. Held membership in or joined any organization which has been declared by the Attorney General to be totalitarian, fascist, communist, subversive, or as having adopted a policy of advocating or approving the commission of acts of force or violence to deny others their rights under the Constitution of the United States, or as seeking to alter the form of government of the United States by unconstitutional means, provided the individual did not withdraw from such membership when the organization was so identified, or otherwise establish his rejection of its subversive aims; or, prior to the declaration by the Attorney General, participated in the activities of such an organization in a capacity where he should reasonably have had knowledge as to the subversive aims or purposes of the organization;

4. Publicly or privately advocated revolution by force or violence to alter the constitutional form of Government of the United States.

Category (A) also includes those cases in which there are grounds sufficient to establish a reasonable belief that the individual has:

5. Deliberately omitted significant information from or falsified a Personnel Security Questionnaire or Personal History Statement. In many cases, it may be fair to conclude that such omission or falsification was deliberate if the information omitted or misrepresented is unfavorable to the individual;

6. Violated or disregarded security regulations to a degree which would endanger the common defense or security;

7. Been adjudged insane, been legally committed to an insane asylum, or treated for serious mental or neurological disorder, without evidence of cure;

8. Been convicted of felonies indicating habitual criminal tendencies;

9. Been, or who is, addicted to the use of alcohol or drugs habitually and to excess, without adequate evidence of rehabilitation.

Category (B). Category (B) includes those cases in which there are grounds

sufficient to establish a reasonable belief that with respect to the individual or his spouse there is:

1. Sympathetic interest in totalitarian, fascist, communist or other subversive political ideologies;

2. A sympathetic association established with members of the Communist Party; or with leading members of any organization set forth in Category (A), paragraph 3, above. (Ordinarily this will not include chance or casual meetings, nor contacts limited to normal business or official relations.)

3. Identification with an organization established as a front for otherwise subversive groups or interests when the personal views of the individual are sympathetic to or coincide with subversive "lines";

4. Identification with an organization known to be infiltrated with members of subversive groups when there is also information as to other activities of the individual which establishes the probability that he may be a part of or sympathetic to the infiltrating element, or when he has personal views which are sympathetic to or coincide with subversive "lines";

5. Residence of the individual's spouse, parent(s), brother(s), sister(s), or offspring in a nation whose interests may be inimical to the interests of the United States, or in satellites or occupied areas thereof, when the personal views or activities of the individual subject of investigation are sympathetic to or coincide with subversive "lines" (to be evaluated in the light of the risk that pressure applied through such close relatives could force the individual to reveal sensitive information or perform an act of sabotage);

6. Close continuing association with individuals, (friends, relatives or other associates) who have subversive interests and associations as defined in any of the foregoing types of derogatory information. A close continuing association may be deemed to exist if:

(i) Subject lives at the same premises with such individual;

(ii) Subject visits such individual frequently;

(iii) Subject communicates frequently with such individual by any means.

7. Association where the individuals have enjoyed a very close, continuing association such as is described above for some period of time, and then have been separated by distance; provided the circumstances indicate that a renewal of contact is probable;

Category (B) also includes those cases in which there are grounds sufficient to establish a reasonable belief that with respect to the individual there is:

8. Conscientious objection to service in the Armed Forces during time of war, when such objections cannot be clearly shown to be due to religious convictions;

9. Manifest tendencies demonstrating unreliability or inability to keep important matters confidential; wilful or gross carelessness in revealing or disclosing to any unauthorized person restricted data or other classified matter pertaining either to projects of the Atomic Energy Commission or of any other governmental agency; abuse of trust, dishonesty; or homosexuality.

The categories outlined hereinabove contain the criteria which will be applied in determining whether information disclosed in investigation reports shall be regarded as substantially derogatory. Determination that there is such information in the case of an individual establishes doubt as to his eligibility for security clearance.

The criteria outlined hereinabove are intended to serve as aids to the Manager of Operations in discharging his responsibility in the determination of an individual's eligibility for security clearance. While there must necessarily be an adherence to such criteria, the Manager of Operations is not limited thereto, nor precluded in exercising his judgment that information or facts in a case under his cognizance are derogatory although at variance with, or outside the scope of, the stated cate-

gories. The Manager of Operations upon whom the responsibility rests for the granting of security clearance, and for recommendation in cases referred to the Director of Security, should bear in mind at all times, that his action must be consistent with the common defense or security.

Dated at Washington, D. C., this 17th day of November 1950.

APPENDIX 6

AEC Federal Employee Personnel Policy[1]

FOREWORD

The people of the United States, through the Congress, have entrusted to the Atomic Energy Commission the vital and urgent task of developing and utilizing atomic energy for the purpose of "improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace." During the past several months it has become increasingly clear that the growing defense effort of the Nation is expanding the manpower needs of the Nation and thereby placing greater emphasis than ever on the importance of accomplishing the most with as few people as possible. We believe that the successful application at all levels of management of the principles contained in this personnel policy will go far toward assuring that the AEC successfully recruits, retains, and utilizes the personnel needed as manpower becomes more scarce. The carrying forward of this mission is "subject at all times to the paramount objective of assuring the common defense and security." The achievement of these objectives requires a high order of skill, ingenuity, patience, loyalty, and perseverance in meeting and resolving many new and complex problems.

All of us serving in this task should be proud to be able to contribute so directly to the welfare of the Nation. Every job is a vital part of our overall program. Our objectives cannot be met unless each individual employee, whatever his duties or responsibilities, is pulling his full weight. Whatever his particular assignment, every employee of the Atomic Energy Commission can derive special satisfaction and inspiration from the knowledge that he works in a unique enterprise of great importance to the national well-being.

The Atomic Energy Act required the Commission to assure itself that the character, associations, and loyalty of workers in atomic energy is of a high order. Conduct and self-discipline, both on and off the job, must measure up to unusual standards. The exchange of information and the handling of equipment, materials, and documents must be precise and within established procedures. In short, many phases of the daily job that are "ordinary" in most organizations become "extraordinary" in the Atomic Energy Commission.

Rapid progress in scientific achievement is the most vital factor in "assuring the common defense and security." Such progress and the forward movement of our own responsibility necessitates a work environment in which each of us has an opportunity to put forth his best effort at the work for which he is best fitted. In developing such an environment it is essential that selection of employees, work assignments, and promotions are on the basis of merit and productivity. Political affiliation, family or other personal relationships or other extraneous criteria cannot be given consideration except as necessitated by security requirements. An essential factor in maintaining an environment that encourages each employee to work enthusiastically and willingly to the best of his ability is an organization which encourages and recognizes initiative in taking the right

[1] Adopted by the U. S. AEC Nov. 21, 1950. An earlier statement of the AEC Federal Employee Personnel Policy was printed as Appendix 10 in the Fifth Semiannual Report to Congress, January 1949.

action promptly and improving the way in which things are done.

The basic personnel policies which are set forth below constitute the broad framework within which our management job will be performed. In their application due consideration will be given to the requirements of national security, but "secrecy" must not be allowed to become a cover for bad management practice.

The policies have been formulated through the participation of the employees and staff officials throughout the organization; giving reflection to their views and indicating acceptance of the underlying principles involved. A sound basis has been thereby provided for the kind of personnel job that is essential to the effective and economical accomplishment of the work goals of the agency.

ORGANIZATION, SUPERVISION AND COMMUNICATION

The General Manager and all other employees who direct the work of others will assure that those under their supervision know their jobs, to whom each is responsible, the authority that goes with their jobs, the relationships of their jobs to other jobs in the organization, and the channels of communication. Each major geographical area will so organize its activities as to provide continuing leadership, guidance and assistance to supervisors and employees in achieving proper application of the principles set forth in this policy.

The structure of the organization will be the result of careful planning designed to meet specific program needs, and to permit independent action to be taken within the limitations of established policies and the minimum of uniform standards and procedures essential for effective operation. The desirability for freedom and informality in staff communications and working relationships at and between all organizational levels is emphasized; always recognizing, however, the single line of authority necessary in taking official action.

The Commission feels strongly that certain sound organization practices such as the following are too often forgotten and therefore they are set forth below as part of this policy.

1. Assignment of responsibility will carry with it commensurate delegation of authority.

2. Any change in duties and responsibilities of a position or a group of positions will be preceded by a definite understanding on the part of all concerned.

3. An employee will not be required to report directly to more than one supervisor.

4. Instructions and directions relating to work assignments will be communicated to him, only through, or with the agreement of, the immediate supervisor.

5. Changes in an employee's work assignment or employment status will be communicated to him, after proper approvals, only by his immediate supervisor.

EMPLOYEE PARTICIPATION

The widest practicable opportunity will be afforded to employees for consultation and explanation in the formulation and development of policies affecting their employment status, working conditions and productivity. This opportunity will be effected through positive encouragement of a free exchange between supervisory and supervised employees of points of view and ideas in their daily work together and in regular departmental staff meetings, supervisory conferences, conferences of management and employee representatives and other effective means.

Employees are urged to avail themselves of these opportunities for participation. Employees have the right to join or refrain from joining employees' organizations of their own choosing without coercion or fear of discrimination. This right, of course,

must be exercised in a manner which is consistent with applicable law and the security responsibilities of the Commission.

It is recognized that employee organizations can make a positive contribution in furthering the atomic energy program. Accordingly, the participation of employee organizations in the program is welcomed. The promotion of sound employee-management relations is a mutual concern and benefits employees and the Commission alike.

PERFORMANCE REVIEW

Formal periodic review of the performance and capabilities of employees will be made against realistic and understood performance standards to determine any merited recognition, need for their further development, or change in job status. Each supervisor will record and use current information on the experience, qualifications and performance of each individual under his direction as a basis of planning for the training and further development of such employees or other appropriate personnel action. Each supervisor will discuss any evaluation and the basis for it with the employee affected to develop mutual understanding.

TRAINING

Consistent with definite needs which arise or are anticipated, employees will be provided with opportunity to improve their knowledges, skills, or attitudes, in order to enable them to perform the tasks assigned to them in the best known ways and to prepare for advancement. This will include programs for orientation and induction before assignment of work, training on the job, upgrading and understudy programs, and training in supervision and management practices.

NONDISCRIMINATION

There will be no discrimination against an employee because of race, color, sex, religion, physical handicap, or national origin.

EMPLOYMENT

The far-reaching significance and scope of the atomic energy program requires high standards of employment which will attract and maintain an adequate organization of capable and well-qualified people. Accordingly:

1. Adequate sources from which employees may be recruited will be developed and maintained.

2. Each job will be filled on a merit basis by selecting the available individual best qualified in terms of the carefully determined requirements of the particular position and in accordance with the Veterans' Preference Act of 1944, as amended.

3. Opportunity for transfer and promotion will be provided in order to make full use of demonstrated skills and abilities. Therefore, well qualified employees will be given first consideration in filling vacancies.

4. The appointment or promotion of individuals or other personnel actions will be made without consideration of political affiliation.

SEPARATIONS

When it is necessary to reduce employment, the selection of employees for retention within an appropriate geographical area will be on the basis of relative qualifications for the work remaining to be done, and in accordance with the requirements of the Veterans' Preference Act of 1944, as amended, including veteran status, and length of Federal service. Reasonable notice will be given to employees whose services are to be terminated and their availability will be made known to other AEC offices. Employees notified of their planned separation shall have an opportunity to appeal such determination.

An employee will be demoted or discharged for cause only after he has been given (1) a statement of the reasons for the proposed action, (2) an opportunity to reply, and (3) an oppor-

tunity to appeal any determination to dismiss. An employee may be put in suspension status without pay pending final determination.

GRIEVANCES

Supervisory and supervised employees have an obligation to make every effort to resolve employment relations problems as they arise. Failing prompt and satisfactory adjustment of any grievance, including those relating to separation, appeal may be made by employees at any work level to higher authority. Employees may designate representatives of their own choosing to assist them in presentation of grievances. In presenting grievances employees will be free from any interference, restraint, or reprisal.

SAFETY AND HEALTH

Each supervisor will take the initiative in the establishment and maintenance of safe and healthful practices and work places for every employee under his supervision, and in assuring that the manner of performance of all operations will minimize personal injury and disease and damage to equipment, materials, and property. Safety is an integral part of each job, and each employee is responsible for the safety phase of his work just as much as he is for any other phase.

SALARIES AND WAGES

Salaries and wages shall be administered so as to compensate employees equitably with due regard to the relative value of the positions, to provide for increases in pay on the same job after reasonable periods of satisfactory service, and to provide for recognition by increases in pay for especially meritorious services.

Determination of the relative value or grade of positions will be based upon systematic analysis of the differences in the requirements of the positions and upon comparisons with approved standards.

Salaries for positions, except those noted below, will be established in line with the pay scales of the Classification Act of 1949, in accordance with the requirements of the Appropriation Act for the current fiscal year.

Wages for laborer and mechanic positions will be established after consideration of rates paid for similar work by other government and private employers in the appropriate geographical area.

Certain scientific and technical positions which the Commission finds must be exempted from the salary scales of the Classification Act of 1949, will receive salaries which are arrived at after consideration of the rates paid for similar work by other government and private organizations.

The method by which the rate of pay for his job is determined will be explained to each employee.

BENEFIT PLANS

Employees will be granted the same benefits with respect to leave, workmen's compensation, holidays, and retirement as are granted to other Federal employees. Information on the details of these plans will be given to employees.

CONCLUSION

The Atomic Energy Commission looks forward to the application of this policy; first, through the wholehearted and effective execution of the principles of sound employee relations by the Commission members, the General Manager, and all the employees who direct the work of others; second, through the wholehearted acceptance by all employees of the obligations that attach to their employment in the atomic energy program; third, through the development of effective employee-management cooperation.

Application of the principles underlying this policy must be an integral part of the daily activities of super-

visors at all levels and of all other employees. The General Manager, aided by the Director of Organization and Personnel, will take such action as is appropriate to implement the policy, to evaluate the adequacy with which the policy meets current program needs and to assure performance in accord with the policy.

Many of the principles have been implemented through the development of more detailed policies and procedures. As additional experience is gained with the policy and principles and as the continuous task of implementing them goes forward, it is expected that employees will continue to make known their views.

APPENDIX 7

Report to the President by the Atomic Energy Labor Relations Panel

June 1 to November 30, 1950

During the period from June 1 to November 30, 1950, the assistance of the Panel was sought in 10 cases. As of November 30th three cases were still open. Three were settled by a combination of Panel mediation followed by Panel recommendations, and four were referred back to the parties. Of the four that were referred back, two were subsequently settled in direct negotiation, and two were settled with the aid of the Federal Mediation and Conciliation Service. A Panel recommendation covering several contract items was issued in one of the "open" cases and on November 30 the parties were still negotiating.

This brings the total number of cases handled by the Panel since its origin on April 26, 1949, to 20. In the first 6 months there were 4 cases, 6 in the next 6 months and 10 in the third 6 months.

The number of cases in which Panel recommendations have been required has increased from none in the first period to two in the second period and four in the third period. The growing case load, as well as the growing number of instances in which recommendations were required, has been of some concern to the Panel. The Panel members have held frequent policy meetings to discuss this problem, and have also met on one occasion with the full membership of the Atomic Energy Commission. The Panel believes that its long run usefulness to the industry depends in a large measure on its ability to keep collective bargaining in private hands. The efforts of the Panel in the months ahead will be concentrated on devising policies and procedures to meet this objective.

Because of the mounting case load, the Panel requested of the Atomic Energy Commission that its membership be increased from three to six. Additional appointments were made on November 16, 1950. The new members are Frank P. Douglass, John T. Dunlop, and Godfrey P. Schmidt. Since all of the case histories covered by this report were handled by the original members of the Panel, they alone are signing it.

A summary of the cases handled during the period covered by this report follows:

CASE NO. 10—AEC INSTALLATION: Knolls Atomic Power Laboratory, Schenectady; PARTIES: General Electric Co.; United Association of Plumbers and Steamfitters (AFL).

The background of this case was given in the previous report of the Panel. As of May 31, 1950, the parties had met with the Panel and had agreed to return to Schenectady for further negotiations.

On July 11 the Panel received a letter from the company advising it that an agreement had been reached with the union and a new contract had been signed.

CASE No. 11—AEC INSTALLATION: Oak Ridge, Tenn.—K-25 Plant; PARTIES: Carbide and Carbon Chemicals Division, Union Carbide and Carbon Corp.; United Gas, Coke and Chemical Workers of America (CIO) Local 288.

BACKGROUND OF DISPUTE. On May 26, 1950, the Panel received a tele-

gram from Martin Wagner, president of the United Gas, Coke and Chemical Workers of America, stating that negotiations between the union and the company had reached an impasse, and indicating that the union was prepared to "take any action it deems necessary to enforce its demands after the expiration of its current contract on June 9, including authorization of a strike."

On May 25 the Panel secretary went to Oak Ridge to get the factual background of the dispute. Negotiations were still in progress and further meetings were scheduled for June 1st under the aegis of the Federal Mediation and Conciliation Service. These negotiations proved ineffective and on June 5th the Panel received a telegram from the Atomic Energy Commission requesting that it "initiate all available steps under Panel procedures to resolve the dispute."

Accordingly, on June 5th the Panel wired the union that it had taken jurisdiction of the dispute and expected both parties to maintain the status quo until full Panel procedures had been exhausted. A meeting in Oak Ridge was set for June 15th. Within 2 days both parties had wired the Panel indicating that they would comply with the Panel procedures.

On June 15th the Panel met with the parties in Oak Ridge. At that time the following issues were in dispute:

1) General wage increase;
2) Severance pay feature to be added to company's pension plan offer;
3) Life and accident insurance to be paid in full by the company;
4) Hospitalization plan;
5) Wage inequities in the power house; and for instrument mechanics, pipefitters, welders, utility mechanics, millwrights and operators;
6) Thirteen maintenance classifications;
7) Combination of operator and operator leader classification in Process Department;
8) Combination of barrier operator and barrier attendant classification with an additional increase in rate for barrier operator;
9) 5 cents to be added on all skilled trades classifications;
10) Extension of the contract.

The Panel remained in Oak Ridge on June 15th and 16th, fully exploring with the parties the above issues. By the evening of July 16th both sides said they were willing to review their respective positions, and the company agreed to supply the union with additional information. The Panel then departed from Oak Ridge, leaving the parties to continue negotiations alone. July 5th was set for the next meeting with the Panel.

When the Panel returned to Oak Ridge on July 5th agreements had been reached on several of the minor issues and the thinking of both parties had been materially clarified on the major issues. For the first time in these discussions the relationship between the K–25 and X–10 plants was introduced. By this time, the Panel had received a request from both union and management at the X–10 laboratory to intervene in a dispute there. (See Case No. 12.) The relationships of wage rates and fringe benefits between these two operations, both located within the Oak Ridge area and both operated by Carbide and Carbon Corporation, have complicated the bargaining from the beginning. The history of these relationships is discussed in some length in prior reports of the Panel. It has always been the policy of the corporation to seek identical wages and working conditions in both plants, and in each successive negotiation management bargaining tactics have been directed toward this long-range objective.

At the July 5th meeting the corporation put forth a proposal which materially increased its last wage offer and which was so distributed as to further narrow the gap in wage rates between X–10 and K–25.

Although this proposal was not accepted, it brought the parties closer together and the Panel suggested that attention be shifted for the balance of the meeting to the question of internal wage inequities. When the meetings adjourned late in the evening of July 7th, all issues as to in-plant inequities had been agreed to except two. In addition, the parties reached agreement on the hospital, medical and surgical insurance plan, group and sickness insurance, and an additional 5 cents increase for certain maintenance classifications.

This left in disagreement only the following four items:

A) The rate for barrier operators;
B) An across-the-board increase;
C) The pension plan;
D) The duration of the contract.

On August 17th the Panel issued its recommendations to resolve these issues. The full text of the Panel recommendations follows:

"At the request of the Atomic Energy Commission on June 5, 1950, the Panel assumed jurisdiction and met with the parties at Oak Ridge on June 15th. At the suggestion of the Panel, direct collective bargaining negotiations were resumed. In these continued negotiations, with some help by the Panel, many items in dispute were resolved. As to the unresolved items the Panel recommends:

"1) That the revised wage schedule should include, in addition to the wage inequity adjustments and the revised job classification and progression schedules agreed to by the parties in their negotiations, a general wage increase of 5 cents per hour, and that the classification of barrier attendant be eliminated by placing all employees so classified in the higher-rated job of barrier operator to be rated in rate group 8 at $1.60 an hour.

"2) That the contract be extended to July 1, 1952, except that the wage schedule may be reopened once only by each party and only for consideration of an across-the-board revision to be made effective on or after July 1, 1951.

"3) That in view of the very substantial wage adjustments and the increased benefits of the pension plan, the group insurance plan and the hospitalization and surgical plan, the Union's request for enlargement of the retirement plan provision be denied. It is noted that preservation of the benefits of the pension plan is assured by the provisions of the Atomic Energy Commission Bulletin No. G. M. 168 of July 26, 1950.

"The Panel notes with gratification the very substantial improvement effected by the wage inequity adjustments agreed to between the respective parties at K-25 and at X-10 and now to be incorporated in the amended wage schedules at these plants. In making its recommendations for a wage increase and for an extension of the term of the contract the Panel has had very much in mind this stabilizing improvement in relative wage relationships, the marked increase in productive efficiency, to which the workers have undoubtedly made their contribution in developing skill with experience and in devotion to their work, and the importance in the present juncture of world affairs of establishing and maintaining stable and highly productive labor relations at these plants."

These Panel recommendations were accepted by both parties and incorporated in a new contract.

CASE NO. 12—AEC INSTALLATION: Oak Ridge, Tenn.—X-10 laboratory; PARTIES: Carbide and Carbon Chemicals Division, Union Carbide and Carbon Corporation; Atomic Trades and Labor Council (AFL).

On June 30, 1950, the Panel received a telegram from the union requesting that it intervene in a dispute at the X–10 laboratory, Oak Ridge, Tenn. The Panel met with the parties in Oak Ridge on July 27th and 28th. As in the case of the K–25 dispute, the relationships between these two Oak Ridge facilities created a major difficulty in the negotiations. The wage discussions involved both an across-the-board increase as well as the adjustment of differences between certain X–10 classifications and those at K–25. There were several other issues in dispute, but it was evident that those could be quickly resolved once the major question of wages was settled.

The Panel first tackled the troublesome issues of inequities. There were various classifications in the lower range of jobs at X–10 which were below K–25 rates, and several among the higher skilled crafts which were also lower. In other instances, X–10 rates were higher. All aspects of these inequities were thoroughly discussed, both from the viewpoint of the X–10—K–25 relationships, as well as from the viewpoint of internal X–10 considerations.

On July 28th the Panel succeeded in getting from the union a "package proposal" which would resolve the inequity problem, leaving unresolved only the amount of an across-the-board increase and the reclassification of operators.

On August 17th the Panel issued a recommendation for resolving the dispute. The comments in this recommendation, and the paragraph on a general wage increase, were identical to the one issued in the K–25 case and quoted under Case No. 11. Both parties accepted this recommendation and embodied it in a new agreement.

CASE NO. 13—AEC INSTALLATION: Oak Ridge, Tenn.; PARTIES: Maxon Construction Company and J. A. Jones Construction Company; International Association of Bridge, Structural and Ornamental Iron Workers (AFL) Local 384.

On July 21, 1950, the Panel received a letter from the union requesting permission to deal through the Panel in the matter of wage rates for their members at Oak Ridge. In making this request the union said that the employers were unwilling to negotiate directly with the union since they were members of the local chapter of the Associated General Contractors, and, therefore, subject to the joint area negotiations between this association and the union.

In the background of this dispute was an arbitration award of 13 cents covering the International Hod Carriers. (See Case No. 9—Panel Report for period November 1, 1949, to May 31, 1950.) In reply to this letter the Panel sent identical telegrams to both parties, taking cognizance of the dispute and suggesting that this wage matter should "be settled by voluntary arbitration as is customary in construction work."

Within a few days the Panel received telegrams from both companies and the union, indicating a willingness to comply with the suggestion for arbitration.

On September 20, 1950, the Panel received the following telegram from the union: "Inasmuch as J. A. Jones Construction Company, and Maxon Construction Company, who are performing work on the Oak Ridge, Tenn., Atomic Energy Commission project have agreed to recognize the newly negotiated wage increase agreed to by Local No. 384 and the Knoxville, Tenn., Associated General Contractors, we are hereby withdrawing our request for wage arbitration as incorporated in our wire of August 15, 1950."

CASE NO. 14—AEC INSTALLATION: Oak Ridge, Tenn.—K–29 and K–31 Projects; PARTIES: Maxon Construction Company; International Teamsters Union, Local 621 (AFL).

On August 3, 1950, the Panel received a joint letter from the company and the union, requesting that the Panel enter a dispute involving material checkers on the K–29, K–31 projects.

On August 15th the Panel wrote to both parties drawing attention to that provision of the Report to the President which recommended that "all available experience and responsibility of individuals at the very highest levels of management and labor" be brought to bear upon the settlement of disputes in atomic energy. The letter then suggested that this dispute be referred to the international president of the union and the top executives of the company for further negotiation.

The Panel heard nothing further from either party concerning this matter, and considers the case closed.

CASE NO. 15—AEC INSTALLATION: Hanford Project, Richland, Wash.; PARTIES: Atkinson Jones Construction Company; Office Employees International Union (AFL).

On August 16, 1950, the Panel received a request from the union that it intervene in a dispute between it and the Atkinson Jones Construction Company. The telegram stated that the Federal Mediation and Conciliation Service had participated in the negotiations but had been unable to achieve a settlement. The dispute was over the renewal of an existing agreement.

On August 17th the Panel sent a telegram to both parties saying that it had initiated its investigation of the case, and requesting that the parties continue negotiations under the auspices of the Federal Mediation and Conciliation Service. The telegram added that "if no agreement is reached by September 1st the Panel will then assume jurisdiction." On August 31st the Panel was informed by the Federal Mediation and Conciliation Service that an agreement had been reached between the parties.

In closing the case the Panel wired to the company and the union as follows: "The Panel thanks both parties for their full cooperation in this critical matter and congratulates them for reaching an agreement through collective bargaining."

CASE NO. 16—AEC INSTALLATION: Sandia Laboratory, Albuquerque, N. Mex.; PARTIES: Sandia Corporation, subsidiary of Western Electric Co.; Atomic Projects and Production Workers, Metal Trades Council (AFL).

On August 17, 1950, the Panel received a request from the union indicating that the Federal Mediation and Conciliation Service had withdrawn from negotiations and requesting that the Panel assume jurisdiction. On August 18th the Panel replied that it would begin its investigation of the background of the dispute and would let the parties know within 15 days concerning further handling of the matter.

On September 1, 1950, the Panel accepted jurisdiction of the dispute and called a meeting of the parties in New York City for September 19th. At the New York meeting the parties each presented to the Panel a full account of its position.

The dispute was over the terms of a new agreement. The sequence of events which had led up to the deadlock in negotiations is important to an understanding of the case.

On November 1, 1949, the Sandia Corporation, a subsidiary of the Western Electric Company, replaced the University of California as the operator of the Sandia Laboratory. Shortly after taking over the operation, the new corporation announced that, in keeping with the general practices of an industrial enterprise, the vacation allowance would be reduced from the 24 days allowed by the University of California to 10 days per year. In making this announcement the company said that each employee who had formerly enjoyed the longer vacation as an employee of the University of California would receive in compensation a 6-percent salary increase.

On January 17, 1950, the Metal Trades Department of the AFL, and the International Association of Machinists indicated a desire to represent the employees of the Sandia Corporation. On

April 19th an agreement for a consent election was reached and on May 11th an election was held which gave this union the bargaining rights.

The first negotiation between the company and the union was held on June 2d. Negotiations continued through the summer but on August 17th reached a deadlock with many contract items still in dispute. It was on this date that the union sent its telegram to the Panel.

The controversy laid before the Panel by the parties was complex, full of conflicting facts and many evidences of frayed nerves as a result of the long and fruitless negotiations. The parties met with the Panel from Tuesday, September 19th through Tuesday, September 26th.

By September 26th it became clear that there were two basic areas of disagreement which, if resolved, would clear the way for a settlement on all other matters. These areas were 1) the request of the union for a return to the 24-day vacation plan, and, 2) the insistence of the company on retaining the job evaluation scheme which the union was seeking to eliminate. At this juncture it was decided to adjourn the meetings in New York. The parties returned to Albuquerque to continue direct negotiations on those specific items.

On October 5, 6, 7, and 8 Panel representatives met with the parties in Albuquerque. Several schemes were suggested by the Panel for resolving the deadlock over the job evaluation plan and vacations. Some of these schemes appeared to be needed for success only to find, at the last minute, that in one respect or another they failed to achieve agreement. Finally, on the afternoon of October 8th, a proposal was advanced which appeared to be acceptable to both sides. The union and the company agreed to continue their negotiations around the suggested formula for a settlement and that afternoon the Panel representatives departed.

Once again the negotiations deadlocked and on October 13th Panel member Horvitz, accompanied by Dr. Dunlop and Mr. Straus, returned to resume meetings with the parties. The Panel representatives remained in Albuquerque until Sunday October 15th. During this period various new proposals were thoroughly discussed by the parties, but without success. Before departing, the Panel told each side that it would issue recommendations for resolving the dispute and requested a summary statement of their respective positions by Monday, October 23rd.

A full meeting of the Panel members was held in New York on Saturday, October 28th to review all of the facts and to propose recommendations. On November 8th the Panel mailed to the parties its recommendations.

These recommendations covered both the controversial job evaluation plan and the vacation schedule. They also proposed a wage structure which incorporated a general wage increase. Numerous other issues were referred back to the parties for further bargaining.

As of November 30th the parties were still in negotiation.

CASE No. 17—AEC INSTALLATION: Knolls Atomic Power Laboratory, Schenectady; PARTIES: General Electric Co.; International Union of Electrical, Radio and Machine Workers, Local 301 (CIO).

On August 22nd the Panel received a letter from Local 301, enclosing a resolution requesting Panel intervention in a dispute between it and the General Electric Co.

In its reply the Panel drew the attention of the local officers to Section 4 (b) of the Report of the President's Commission which recommended that all disputes in atomic energy be handled at the "very highest levels of management and labor" before being referred to the Panel. In keeping with this provision, the letter suggested that the local refer the matter to the international president of the union.

On the morning of Tuesday, September 5th, the officers of Local 301

called their men out on strike. This interruption was halted by union action within 2 hours before there had been any significant effect on the work of the laboratory.

The Panel heard nothing further concerning this matter. The dispute was eventually settled along with the national agreement signed between General Electric Co. and the International Union of Electrical, Radio and Machine Workers, CIO.

CASE NO. 18—AEC INSTALLATION: Bendix Aviation Corp., Kansas City Division; PARTIES: Bendix Aviation Corp.; International Association of Machinists, Lodge 314.

On August 31st the Panel received a telegram signed jointly by the company and the union stating that they had failed to reach agreement over the terms of an initial contract and requesting that the Panel take jurisdiction.

After preliminary investigation the Panel learned that the Federal Mediation and Conciliation Service still believed that further progress in direct negotiations could be made. Accordingly, the Panel replied to the parties requesting that they meet again with representatives of the Conciliation Service. In its telegram the Panel concluded with the following: "If no agreement is reached by September 15th the Panel will then assume jurisdiction. Meanwhile it is requested that both parties cooperate to the fullest extent in an endeavor to bargain out this dispute with the aid of the Conciliation Service."

On September 14th another telegram signed jointly by the company and the union was sent to the Panel which said in part: "As recommended the undersigned parties have continued to negotiate with the assistance of the Federal Mediation and Conciliation Service and have resolved several of the issues in dispute. However still remaining in dispute and in complete deadlock are the following issues: shift differential; union security; vacations; sick leave; wages; retroactivity. . . . in view of the mounting unrest in this vital facility the parties request the Panel to take immediate jurisdiction. . . ."

A meeting was scheduled for September 28th in Kansas City. The Panel met with the parties throughout the day on September 28th and September 29th. All issues were settled by agreement between the parties except for the amount of a general wage increase. Even on the matter of wages the differences had been narrowed to within a few cents.

After deliberation the Panel decided to issue an official recommendation for an across-the-board increase of 10 cents per hour. This recommendation was immediately accepted by both negotiating committees. A contract was signed shortly after the union ratification meeting held the following week.

CASE NO. 19—AEC INSTALLATION: Hanford Works, Richland, Wash.; PARTIES: General Electric Company; Hanford Atomic Metal Trades Council (AFL).

On October 5th the Panel received a letter from James A. Brownlow, president of the Metal Trades Department (AFL), requesting that the Panel take jurisdiction of a dispute between the Hanford Atomic Metal Trades Council and the General Electric Company at the Hanford Works.

The dispute in this case was solely over wages which were open for discussion under a reopening clause in the existing contract.

Mr. Brownlow's letter included a telegram from the local business representative which stated, among other things, that only one or two negotiations had been held and that the aid of the Federal Mediation and Conciliation Service had not been invoked by the parties. Accordingly, the Panel urged Mr. Brownlow to use his "good offices to forward the collective bargaining process."

On October 11th the Panel received from Mr. Brownlow a letter advising it

that he had asked the Federal Mediation and Conciliation Service to enter the case.

On October 24th the Panel was informed by the Conciliation Service that "our Commissioner, after 4 days of intensive negotiations with the parties, was not able to find a formula which would provide for a settlement of this dispute." This was followed by a telegram from the union on October 31st again asking the Panel to accept jurisdiction.

On November 1st the Panel wired both parties for "a brief summary of negotiations, issues in dispute, position of the parties and factual reasons in support of position. This is not a request for a formal brief. Data received will be used as aid in determining further procedures."

On November 3d the Panel learned that a Bureau of Labor Statistics survey of the cost of living at Hanford had recently been compiled and would be available on November 6th. This survey would bring up to date as of November 1st the index for that area. The most recent survey immediately preceding it was as of May 15th. In the light of these new facts the Panel wired to both parties on November 6th as follows: "Panel understands BLS cost-of-living study as of November 1st now available. Since this factual data was not previously available Panel now requests both parties to resume negotiations with aid of Federal Mediation and Conciliation Service. The Service has been asked to report on progress of negotiations to Panel."

On November 29th, the Conciliation Service reported back that "efforts to bring about an agreement—have reached a complete deadlock." Accordingly, as of November 30th, the Panel was preparing to make full use of its own procedures.

CASE NO. 20—AEC installation: Los Alamos, N. Mex.; PARTIES: International Brotherhood of Electrical Workers, Local 611 (AFL); International Union of Operating Engineers, Local 9 (AFL).

On October 13th the Panel received a letter from the International Union of Operating Engineers setting forth a dispute between it and the International Brotherhood of Electrical Workers, over the manning of a steam generating and power plant operated by the Zia Co. at Los Alamos, N. Mex.

The operating engineers stated that in their opinion the work in question was covered by an existing contract between the Zia Co. and their union. In addition, the operating engineers believed that the unit originally established by the National Labor Relations Board, and which was won in an election by the operating engineers, included the workers at the power plant. Their letter indicated that some of the work at the power plant was being claimed by the International Brotherhood of Electrical Workers.

The Panel suggested a meeting between the general presidents of each union, under the auspices of the Panel, to seek "either a solution or some agreed procedure for settling the dispute." Although the proposal for a meeting met with approval, the first mutually convenient date for such a meeting was early in December.

As of November 30th, this matter is still pending.

WILLIAM H. DAVIS, *Chairman.*
AARON HORVITZ, *Member.*
EDWIN E. WITTE, *Member.*
JOHN T. DUNLOP, *Consultant.*
DONALD B. STRAUS, *Executive Secretary.*

December 4, 1950.

APPENDIX 8

PUBLICATIONS OF THE U. S. ATOMIC ENERGY COMMISSION [1]

In addition to the Semiannual Reports to Congress, of which this is the Ninth, the Commission has also published or sponsored publication of the following documents available to the public.

GENERAL REPORTS ON ATOMIC ENERGY PROGRAMS

Handling Radioactive Wastes in the Atomic Energy Program, October 1949, reports on the sources and types of radioactive wastes in atomic energy operations, methods developed for their safe handling and disposal, and methods specified for the safe handling of radioisotopes by private users, 30 pages, 15 cents.[2]

Isotopes—A Three-Year Summary of Distribution—with Bibliography of Uses, August 1949, summarizes the Oak Ridge isotopes production, distribution, and training program, with statistics on the distribution and use of isotopes by state and institution, by field of use, by foreign country, and contains an extensive bibliography of published literature on isotopes, 201 pages, 45 cents.[2]

Prospecting for Uranium, 1949, is a nontechnical booklet prepared by the U. S. Geological Survey and AEC describing the uranium-bearing minerals, where to look for them, and instruments to use in prospecting and in laboratory testing and analysis of ores. Laws, regulations, and price schedules for uranium-bearing ores are included, 123 pages, 30 cents.[2]

Contracting and Purchasing Offices and Types of Commodities Purchased, August 1949, lists the types of items the AEC must procure, the procurement officers, and locations of the offices where the buying is done. Included are descriptions of the AEC Operations Offices and major research centers for whom the materials are procured, and a discussion of security requirements that must be met by firms supplying certain materials to the AEC, 18 pages, 10 cents.[2]

A Guide for Contracting of Construction and Related Engineering Services, November 1949, gives AEC policy on awarding contracts for construction and architect-engineering services, procedures followed when requests for bids are formally advertised and when prices are fixed, and when contracts are negotiated, and includes a list of Operations Offices and officials responsible for letting such contracts, 14 pages, 15 cents.[2]

TECHNICAL PUBLICATIONS ON DEVELOPMENTS IN ATOMIC ENERGY

Sourcebook on Atomic Energy, Samuel Glasstone, D. Van Nostrand Co., N. Y., 1950, presents a comprehensive, technical description of the theory, history, development, and uses of atomic energy. Chapters are included on the structure of the atom, radioactivity, isotopes, neutron research, acceleration of charged particles, and other phases of atomic energy development, 546 pages, $2.90.

The Effects of Atomic Weapons, 1950, prepared for the Department of Defense and the AEC by a board of editors under the direction of the Los Alamos Scien-

[1] Listed as of January 31, 1951.

[2] Available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

tific Laboratory, presents a technical summary of the results to be expected from the detonation of atomic weapons, with chapters describing an atomic explosion, the shock from air, underwater, and underground bursts; blast, radiation, and fire effects; and methods of protecting personnel and decontamination after an explosion, 456 pages, $1.25.[2]

Handbook on Aerosols, 1950, contains chapters from the National Defense Research Committee Summary Technical Report, Division 10, declassified by the Army at the request of the AEC, on the properties and behavior of aerosols, principles and instruments used in meteorology studies, and information useful in studies of the disposal of gaseous radioactive wastes, the dispersal of insecticides, the disposal of industrial gases, etc., 147 pages, 60 cents.[2]

Manual of Analytical Methods for the Determination of Uranium and Thorium in Their Ores, C. J. Rodden and J. J. Tregoning, 1950, presents a number of tested methods for analyzing ore samples for their uranium and thorium content. It is intended to be an aid to assayers, commercial laboratories, and others interested in raw material assay work, 55 pages, 20 cents.[2]

Liquid-Metals Handbook, R. N. Lyon, et al., 1950, compiled by the Department of the Navy and AEC, summarizes current information on the physical and chemical properties of liquid metals, their present industrial uses, and their use and potentialities as heat-transfer media, 188 pages, $1.25.[2]

Trilinear Chart of Nuclear Species, W. H. Sullivan, John Wiley & Sons, Inc., N. Y., 1949, shows physical data for all the nuclear species known as of June 1949, $2.50.

Periodicals and Catalogues

Nuclear Science Abstracts, issued twice a month by the AEC Technical Information Service, contains abstracts of all current AEC declassified and unclassified reports, of non-AEC reports related to atomic energy, and of articles appearing in both the foreign and domestic periodical literature, $6 per year.[3]

Guide to Russian Periodical Literature, a monthly title list prepared by the Brookhaven National Laboratory of available current scientific papers with complete translations of significant articles, 20 cents.[3]

Radiation Instrument Catalogue, compiled by the Radiation Instruments Branch, AEC, lists most of the commercially available radiation instruments, accessories, and components, $2.[3]

Isotopes—Catalogue and Price List, Isotopes Division, U. S. Atomic Energy Commission, Oak Ridge, Tenn., July 1949, lists and describes radioactive and stable isotopes available from Oak Ridge, and includes prices and instructions for ordering the isotopes.

THE NATIONAL NUCLEAR ENERGY SERIES

These volumes were written by the scientists who performed the research and development on the atomic energy enterprise under the Manhattan Engineer District and later under the Atomic Energy Commission. The following volumes have been published for the AEC by the McGraw-Hill Book Co., New York, N. Y.

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[2] Available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

[3] Available from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Division I: The Electromagnetic Separation Process

Vacuum Equipment and Techniques, Vol. 1, edited by A. Guthrie and R. K. Wakerling, 1949, describes the development and study of high vacuum equipment and high vacuum systems for the large-scale separation of isotopes by the electromagnetic process, 264 pages, $2.50.

The Characteristics of Electrical Discharges in Magnetic Fields, Vol. 5, edited by A. Guthrie and R. K. Wakerling, 1949, covers most of the significant studies by the University of California Radiation Laboratory on electrical discharges, with emphasis on studies of electrical discharges in vapors of uranium compounds, 376 pages, $3.50.

Division II: Gaseous Diffusion Project

Engineering Developments in the Gaseous Diffusion Process, Vol. 16, edited by M. Benedict and C. Williams, 1949, describes a number of mechanical, electrical, and chemical engineering developments related to the operation and handling of materials used in the gaseous diffusion process—principally special plant instruments, vacuum engineering, development of heat-transfer equipment, and absorption of uranium hexafluoride and fluorine, 129 pages, $1.25.

Division III: Special Separations Project

Spectroscopic Properties of Uranium Compounds, Vol. 2, edited by G. H. Dieke and A. B. F. Duncan, 1949, presents data compiled from a comprehensive study of the absorption and fluorescence spectra of uranium compounds and describes the experimental techniques used in the studies, 290 pages, $2.75.

Bibliography of Research on Heavy Hydrogen Compounds, Vol. 4C, compiled by A. H. Kimball, edited by H. C. Urey and I. Kirschenbaum, 1949, contains about 2,000 references to published literature on research with heavy hydrogen. References are arranged by subject with an index of the hydrogen compounds and authors, 350 pages, $3.25.

Division IV: Plutonium Project

Radiochemical Studies: The Fission Products, Vol. 9, edited by C. D. Coryell and N. Sugarman, 1950, presents 336 original research papers on the techniques and results of radiochemical studies of uranium and plutonium fission products, 1,855 pages.

The Transuranium Elements. Research Papers, Vol. 14B, edited by G. T. Seaborg, J. J. Katz and W. M. Manning, 1949, includes 163 research papers on neptunium, plutonium, americium, curium, and several of the heavy elements related to them, and historical summaries of transuranium element-research, 1,733 pages (in two parts), $15.

The Chemistry and Metallurgy of Miscellaneous Materials; Thermodynamics, Vol. 19B, edited by L. L. Quill, 1949, contains 10 research papers on thermodynamic properties of the elements and several of their compounds, 329 pages, $3.

Industrial Medicine, Vol. 20, edited by R. S. Stone, 1950, describes the medical program established for the care and protection of workers on the plutonium project, 513 pages.

Histopathology of Irradiation from External and Internal Sources, Vol. 22I, edited by W. Bloom, 1948, is an advanced treatment of the histopathological and cytological effects of total-body irradiation, 808 pages, $8.

Toxicology of Uranium, Vol. 23, edited by A. Tannenbaum, 1950, describes the studies made on the distribution, accumulation, excretion, and chemical and physiological effects of uranium and uranium compounds in the animal body, 323 pages, $3.00.

Division V: Los Alamos Project

Electronics: Experimental Techniques, Vol. 1, edited by W. C. Elmore and M. L. Sands, 1948, describes a number of complete circuits and circuit elements developed at Los Alamos for making nuclear and other physical measurements, 417 pages, $3.75.

Ionization Chambers and Counters: Experimental Techniques, Vol. 2, edited by B. Rossi and H. Staub, 1949, describes the physical principles of ionization chambers and counters, and includes previously unpublished project developments by scientists at the Los Alamos Laboratory, 243 pages, $2.25.

Division VI: University of Rochester Project

Pharmacology and Toxicology of Uranium Compounds, Parts I and II, Vol. 1, edited by C. Voegtlin and H. C. Hodge, 1949, summarizes the results of 3 years' research on the toxicity of uranium compounds and the mechanism of uranium poisoning, and includes a section on the toxicology of fluorine and hydrogen fluoride, 1,084 pages, $10.

Biological Studies with Polonium, Radium, and Plutonium, Vol. 3, edited by K. Fink, 1949, describes the studies made of the biological effects of these alpha-emitting elements in the animal body, air monitoring precautions, and equipment used in atomic energy laboratories where work with these elements is carried on, 411 pages, $3.75.

Division VIII: Manhattan Project Chemistry

Analytical Chemistry of the Manhattan Project, Vol. 1, edited by C. J. Rodden, 1950, describes methods of analyzing the many different materials used in the atomic energy project—with emphasis on analytical methods for the determination of uranium and thorium, 748 pages, $6.75.

Chemistry of Uranium. Part I. The Element, Its Binary and Related Compounds, Vol. 5, edited by E. Rabinowitz and J. J. Katz, 1950, presents the results of chemical research on uranium and its compounds, 580 pages.

APPENDIX 9

Current AEC Unclassified Contracts for Research in Physical and Biological Sciences

PHYSICAL RESEARCH CONTRACTS

Chemistry

Arkansas, University of. R. R. Edwards, Chemical Effects of Nuclear Transformation.

California, University of. J. H. Hildebrand, Studies in Intermolecular Forces and Solubility.

Carnegie Institute of Technology. T. P. Kohman, Nuclear Chemistry Research.

Carnegie Institute of Technology. R. F. Mehl and G. Derge, Electrochemical Studies of Non-Aqueous Melts.

Chicago, University of. S. K. Allison, Radiochemical and Radiobiological Research.

Chicago, University of. H. Taube, Oxygen Atom Transfer Reactions and Purchase of Mass Spectrometer.

Chicago, University of. A. Turkevich and N. Sugarman, Nuclear Chemistry Research.

Chicago, University of. H. C. Urey, Natural Abundance of Deuterium and Other Isotopes.

Columbia University. V. K. LaMer, Filtration of Aerosols.

Columbia University. J. M. Miller, Basic Radiochemical Research.

Cornell University. J. L. Hoard, Studies of Fluorocarbons and Elementary Borons.

Fordham University. M. Cefola, Use of Thenoyltrifluoro Acetate as an Analytical Reagent.

George Washington University. C. R. Naeser, Studies of the Fluorides of the Rare Earth Elements.

Illinois, University of. H. G. Drickamer, The Mechanism of Molecular Motion as Determined From Diffusion and Thermal Diffusion Measurements.

Illinois, University of. P. E. Yankwich, Radiochemistry.

Illinois Institute of Technology. A. F. Clifford, The Acids of the Hydrogen Fluoride System and Basic Chemistry of Polonium.

Illinois Institute of Technology. M. Kilpatrick, The Fundamental Chemistry of Ozone.

Illinois Institute of Technology. M. Kilpatrick and R. C. Vogel, Studies in Chemistry of Ruthenium, Purchase of Mass Spectrophotometer.

Illinois Institute of Technology. M. Kilpatrick and H. E. Gunning, Studies on Decomposition of Organic Molecules by Metal Photosensitization.

Illinois Institute of Technology. S. E. Wood, Study of the Properties of Non-electrolytic Solutions.

Indiana University. F. T. Gucker, Jr., Equipping of Laboratory for Work With Radioactive Tracers.

Iowa, State University of. K. Kammermeyer, The Separation of Gases by Diffusion Through Permeable Membranes.

Iowa, State University of. L. Eyring, Preparation of Rare Earth Oxides.

Kansas, University of. P. W. Gilles, High Temperature Research.

Kansas, University of. J. O. Maloney and H. E. Hughes, Applications of Radioactive Tracers to the Design of Distillation Columns.

Louisville, University of. R. H. Wiley, Syntheses and Properties of Ion Exchange Resins.

Massachusetts Institute of Technology. C. D. Coryell, D. N. Hume, and J. D. Roberts, Nuclear Chemistry Research.

Michigan, University of. C. C. Templeton, Studies of Water-Inorganic Salt-Organic Solvent Systems.

Michigan, University of. E. F. Westrum, Jr., Low Temperature Chemical Thermodynamics.

Missouri, University of. R. A. Cooley, The Kinetics of the Gas Phase Reaction Between Nitrogen Dioxide and Ammonia.

New Hampshire, University of. H. H. Haendler, Inorganic Fluorides.

New York University. C. V. King, Measurement of Metal Dissolution Rates.

North Carolina, University of. S. B. Knight, The Use of the Flame Photometer for the Determination of Small Quantities of Certain Metals.

North Carolina, University of. S. Y. Tyree, Jr., The System: $ZrCl_4$ Esters.

Northwestern University. F. Basolo and G. Pearson, Mechanism of Substitution Reactions of Inorganic Complexes.

Northwestern University. D. D. DeFord, Investigation of the Solution Chemistry of Ruthenium in its Lower Valence States.

Notre Dame, University of. M. Burton, Research in Radiation Chemistry; Purchase of 2 Mev Van de Graaff for Use in Radiation Chemistry.

Oklahoma Agricultural and Mechanical College. P. Arthur, (A) Anodic Reactions in Polarography; (B) Characteristics of a New Polarographic Micro-Electrode.

Oklahoma, University of. J. R. Nielsen, Spectroscopic Properties of Fluorocarbons and Fluorinated Hydrocarbons.

Oregon State College. T. H. Norris and J. Huston, Study of Generalized Acid Based Phenomena with Radioactive Tracers.

Oregon State College. J. Schulein, Separation of Deuterium from Hydrogen by means of Zirconium Metal.

Pennsylvania, University of. K. A. Krieger, Research in Heterogeneous Catalysis.

Pennsylvania State College. P. J. Elving, Research on the Polarography of Organic Compounds.

Pennsylvania State College. W. C. Fernelius, Stabilities of Coordination Compounds and Related Problems.

Pittsburgh, University of. H. Freiser, Development of Organic Reagents for Use in Inorganic Analysis.

Pittsburgh, University of. R. Levine, Synthesis of Beta Diketones and Beta Ketoesters with Heterocyclic Nuclei.

Princeton University. M. G. White, Research in Analytic Chemistry.

Reed College. A. F. Scott, The Atomic Weight of Bismuth.

Rensselaer Polytechnic Institute. L. G. Bassett, Fundamental Investigation of the Mechanism of Solvent Extraction of Inorganic Ions.

Rochester, University of. E. O. Wiig, Radiochemistry.

Rutgers University. E. R. Allen, Polar Inorganic Compounds.

Syracuse University. K. Linschitz, Photochemical Reactions of Complex Molecules in Condensed Phase.

Tennessee, University of. G. K. Schweitzer, A Study of Self Absorption in the Counting of Low Energy Beta Particle Emitting Solids.

Tennessee, University of. H. A. Smith, (A) The Rates of Catalytic Reactions Involving Deuterium; (B) The Relative Vapor Pressures of Water and Deuterium Oxide in the Presence of Certain Salts.

Texas, University of. G. H. Ayers, Spectrophotometric Quantitative Determination of the Platinum Metals.

Utah, University of. H. Eyring, Studies on Surface Chemistry; Induction of Chemical Reactions by High Frequency Discharges in Gases.

Utah, University of. A. L. Wahrhaftig, Ionization and Dissociation of Molecules by Electron Bombardment, and the Interpretation of Such Data.

Washington State College. H. W. Dodgen, The Formulae and Stability of Complex Ions in Solution.

Washington State College. M. Lindner, The Experimental Investigation of the Stationary States of Light Nuclei through a Search for Several Unknown Isotopes.

Western Reserve University. E. L. Pace, Thermodynamic Properties of Gases Absorbed on Solids.

Wisconsin, University of. W. J. Blaedel, High Frequency Titrations.

Wisconsin, University of. F. Daniels, Thermoluminescence of Crystals.

Wisconsin, University of. E. L. King, The Rates and Mechanisms of Oxidation Reactions Involving Cerium (IV).

Wisconsin, University of. J. E. Willard, Application of Radioactive Isotopes to Chemical Problems.

Yale University. L. Meites and J. M. Sturtevant, The Polarographic Diffusion Current.

Metallurgy

Alabama, University of. T. N. McVay, Research Investigations of Enamels for Metals.

American Smelting & Refining Company. A. A. Smith, Jr., Research on Liquid Metals.

California, University of. E. R. Parker, Creep of Alloys.

California, University of. J. A. Pask, Mechanics of Metal Ceramic Bonding.

Carnegie Institute of Technology. R. Smoluchowski, (A) Studies of Grain Boundaries and Lattice Imperfections; (B) Thermodynamic Properties of Binary Alloy Systems; (C) Corrosion of Metals and Alloys.

Chicago, University of. L. Meyer, Research on the Structure and Properties of Graphite.

Columbia University. C. Bonilla, (A) Heat Transfer to Molten Metals. (B) Boiling and Condensing of Liquid Metals.

Columbia University. T. A. Read, The Study of Diffusionless Phase Changes in Solid Metals and Alloys.

Columbia University. T. L. Taylor, Separation of Isotopes by Chemical Exchange.

Dow Chemical Company. J. C. McDonald, The Effect of Nonmetallic and Alkali Metal Impurities on the Corrosion Rate and Corrosion Characteristics of Magnesium; The Room and Elevated Temperature Properties of Magnesium-base Alloys Containing One or More of the Elements Aluminum, Beryllium, and Zirconium.[1]

Illinois, University of. D. Lazarus and F. Seitz, Study of Mechanism of Substitutional Diffusion in Metals.

Iowa, State University of. N. C. Baenziger, The Structure of Intermetallic Compounds.

Massachusetts Institute of Technology. J. Chipman, (A) Thermodynamics of Metal Solutions; (B) M. Cohen, Solid Solutions and Grain Boundaries; (C) M. Cohen, Fundamentals of Cold Working and Recrystallization.

Massachusetts Institute of Technology. A. M. Gaudin, Tracer Techniques in Mineral Engineering.

Massachusetts Institute of Technology. F. H. Norton, Refractories Research.

Massachusetts Institute of Technology. J. C. Slater, Research on Nature of Distortion in Radiation Damaged Materials.

Pennsylvania State College. H. J. Read, A Study of Corrosion of Zirconium.

Pennsylvania, University of. R. M. Brick, Thermodynamic Study of the Iron-Oxygen-Sulfur System.

Pittsburgh, University of. W. E. Wallace, Thermochemistry of Alloys.

Purdue University. K. Lark-Horovitz, Effect of Cyclotron Radiation on Metals and Alloys.

Sintercast Corporation. C. Goetzel, Sintered Zirconium Carbide.

Sylvania Electric Products, Inc. W. E. Kingston, Self-Diffusion and High Temperature Phenomena.

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[1] Contract administered through Office of Naval Research, Washington, D. C.

Tennessee, University of. E. E. Stansbury, Energy Changes from Plastic Deformation.

Wichita, University of. L. Lyon, The Permeability Method of Determining Surface Areas of Finely Divided Materials.

Mathematics and Physics

California Institute of Technology. R. F. Bacher, Construction, Operation, and Experimentation, 1 Bev Synchrotron.

Carnegie Institute of Techonology. E. Creutz, Nuclear Research Using 400 Mev Cyclotron.

Case Institute of Technology. R. S. Shankland and E. F. Shrader, Research with a 30 Mev Betatron.

Columbia University. J. R. Dunning, Nuclear Physics Research.

Duke University. H. W. Newson, Nuclear Physics Using Electrostatic Generator.

Florida, University of. D. O. Swanson, Electrostatic Generator Program.

Iowa, State University of. J. A. Jacobs, Research With Electrostatic Generator.

Institute for Advanced Study. J. Von Neumann, Development of High-Speed Computing Devices.[2]

Johns Hopkins University. H. Dieke, Spectroscopy of Hydrogen Isotopes.

Johns Hopkins University. S. S. Hanna, Research in Field of Nuclear Reactions.

Kenyon College. O. M. Nikodym, Mathematical Studies in Boolean Theory and Hilbert Space.

Michigan, University of. H. R. Crane, 42'' Cyclotron Program.

Minnesota, University of. J. H. Williams, Construction and Operation of 50 Mev Ion Accelerator.

Nebraska, University of. T. Jorgensen, Jr., Study of the Range-Energy Relation of Slow Ions.

North Carolina, University of. A. V. Masket, Nuclear Disintegration in Photographic Emulsions.

Northwestern University. J. H. Roberts, Use of Photographic Emulsions Enriched With Lithium 6.

Notre Dame, University of. M. Burton, Purchase of Helium Leak Detector.

Ohio State University. J. G. Daunt, Low Temperature Physics and Nuclear Paramagnetism.

Pennsylvania, University of. F. C. Nix, Collins Cryostat.

Princeton University. W. H. Furman, Nuclear Research Using 17 Mev Cyclotron.

Puerto Rico, University of. A. Cobas, Low Latitude Cosmic Ray Studies.

Purdue University. K. Lark-Horovitz, Modification of the Cyclotron; Investigation of Effect of Charged Particles.

Purdue University. R. M. Whaley, Research With 300 Mev Synchrotron.

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[2] Joint project with Department of Defense administered under contract with the Army Ordnance Department.

Purdue University. F. F. Rieke, Electron Accelerator for Nuclear Physics Investigation.

Purdue University. E. Bleuler, Research in Nuclear Reactions With Fast Alpha Particles, Deuterons, and Neutrons.

Reed College. K. E. Davis, Investigation of K and L X-ray Lines of Elements.

Rochester, University of. R. Marshak, Research in High Energy Particle Physics.

St. Louis University. A. H. Weber, Investigation of Beta Decay at Low Energies.

Syracuse University. K. Sitte, Cosmic Rays.

Texas, University of. E. L. Hudspeth, Construction and Operation of 4 Mev Electrostatic Generator.

Vanderbilt University. S. K. Haynes, Mass Spectograph Research in Beta and Gamma Ray Spectroscopy on Decay Schemes of Radioactive Isotopes.

Washington, University of. P. M. Higgs, Establishment of Cryogenic Laboratory.

Washington, University of. C. L. Utterback, 60'' Cyclotron Program.

Wesleyan University. H. E. Duckworth, Improvement of Spectrograph Measurement of Isotopic Ration for Various Substances, etc.

Wisconsin, University of. R. G. Herb, and H. H. Barshall, Nuclear Research Program.

Wisconsin, University of. J. Dillinger, Low Temperature Physics.

Wisconsin, University of. R. G. Sachs, Theory of Very Light Nuclei.

Wyoming, University of. C. A. Cinnamon, Nuclear Relaxation Times of Nuclei.

Yale University. W. Watson, Isotope Separation and Related Topics.

BIOLOGY, MEDICINE, AND BIOPHYSICS RESEARCH CONTRACTS

Biology

Agriculture, Department of. F. W. Parker, Soil Management and Crop Production.

Amherst College. H. H. Plough, Research in Radiobiology and Biological Genetics.

Arizona, University of. W. H. Fuller and W. T. McGeorge, Utilization of Phosphorus from Biological Material.

Battelle Memorial Institute. K. S. Chester, Study of Mode of Action of Fungicides.

Boyce Thompson Institute. G. L. McNew, Use of Tracer Fungicides in Determining the Mechanics of Protecting Plants from Fungus Diseases.

California, University of. M. Kleiber, Metabolism Study and Biological Synthesis with Farm Animals.

California, University of. H. A. Barker and W. Z. Hassid, Fundamental Biochemical Reactions in Living Organisms.

California, University of. L. Jacobson and R. Overstreet, Study of Ion Absorption in Plants.

California, University of. F. M. Turrell, F. S. Gunther, R. B. March, and R. L. Metcalf, Use of Radioactive Tracers in Studies of the Modes of Action of Organic Insecticides.

California Institute of Technology. H. Boorsook, Biological Synthesis of Proteins with Use of Isotopes.[1]

California Institute of Technology. G. W. Beadle, The Genetic and Cytological Effects of High Energy Radiation.[1]

Chicago, University of. R. E. Zirkle, Purchase of Van de Graaff Generator.

Chicago, University of. E. M. K. Geiling, Biosynthesis of Radioactive Drug Compounds.

Connecticut Agricultural Experiment Station. J. G. Horsfall and A. E. Dimond, Therapy of Plant Diseases by Nuclear Radiations.

Delaware, University of. M. A. Russell, Comparison of the Effects of X-rays, Neutrons, and Mustard Compounds on the Growth and Development of the Corn Seedling.[1]

Delaware, University of. A. M. Clark, Radiation Effects Upon Haploids and Diploids of Habrobracon.

Duke University. K. M. Wilbur, Shell Formation in Mollusks Studied by Radioisotopes.

Duke University. P. J. Kramer, Study of the Factors Affecting the Absorption of Radioactive Phosphorus by Mycorrhizal and non-Mycorrhizal Roots of Pines.

Fordham University. F. F. Nord, Investigation of Enzymatic Degradation of Native and Chemically Modified Proteins.

Georgia, University of. H. Schoenborn, The Production of Mutant Strains of Euglenoid Flagellates and Their Use in the Study of Carbon Dioxide Fixation Processes.

Harris Research Laboratory, Washington, D. C. M. Harris, The Chemistry of Biosynthesized Isotopically Labeled Cellulose and Allied Polysaccarides.

Harvard University. K. Sax, Dosage Curves under Varying Conditions of Time and Intensity of Radiation.[1]

Howard University. L. A. Hansborough, The Effect of Labeling the Germ Cells Upon Fertilization and Development.

Illinois, University of. H. E. Carter and R. C. Johnson, Metabolism of Vitamins.

Illinois, University of. H. H. Mitchell and D. F. Kampmeier, Content in Human Tissues of Eleven Trace Elements.

Indiana University. T. M. Sonneborn, Specific Immobilization Substances (Antigens) of Paramecium Aurelia.

Interior, Department of. W. A. Chipman, Survey of Accumulation of Radioactivity in Marine and Invertebrate Animals.

Interior, Department of. A. M. Phillips, Physiology of Coldwater Fish.

[1] Contracts administered through Office of Naval Research, Washington, D. C.

Iowa State College. S. Aronoff, Metabolism and Physiology of Roots.

Iowa State College. R. R. Sealock, Combined Biochemical and Physiological Action of Tyrosine and Vitamin B 12.

Iowa State College. C. H. Werkman and F. Schlenk, Studies of Metabolism of Purine and Pyrimidine Basis of Nucleic Acids and Nucleotides.

Iowa State College. J. W. Gowan and J. Stadler, Quantitative Study of Lifetime Sickness and Mortality and Progeny Effects from Exposure of Animals to Penetrating Irridations.

Johns Hopkins University. W. D. McElroy and C. P. Swanson, Modification Through the Use of Supplemental, Environmental Factors of the Frequency of Gene and Chromosome Changes Induced by X-Rays, Radioactive Isotopes, Ultra Violet Light and Nitrogen Mustard.

Kansas, University of. A. B. Leonard and E. R. Hall, Radium Chloride and Hemapoietic Physiology of Rodents.

Long Island Biological Association. M. Demerec, Adoptive Value of Experimental Populations Exposed to Radiations.

Maryland, University of. J. C. Shaw, The Metabolism of Acetate B-hydroxybetric Acid, Glucose and Other Carbon Compounds in Lactating Ruminants.

Michigan, University of. L. F. Wolterink and E. P. Reineke, Hormonal and Nutritional Factors which Alter Half Lives and Differential Absorption Ratios.

Michigan, University of. C. L. Markert, Mutagenic Effects of Different Types of Radiation.

Minnesota, University of. E. C. Stakman, Effects of Radioactive Substances on Plant Pathogens and other Micro-organisms.

Minnesota, University of. W. E. Peterson et al., Study of Milk Formation by the Use of Radioactive Compounds.

Missouri, University of. J. Levitt, Translocation of Mineral Substances in Plants.

Missouri, University of. S. Brody, Determination of Thyroid Activity in Farm Animals by use of Radioactive Tracers.

Missouri, University of. D. W. Barton and L. J. Stadler, Cytogenic Study of the Effects of Radiation on the Differential Chromosomes of the Tomato.

North Carolina State College. W. C. Gregory, Peanut Seed Irradiation Project.

North Carolina State College. N. S. Hall, Study of the Movement of Ions through Soil Systems.

North Carolina State College. D. B. Anderson, Investigation of the Rate of Movement of Organic and Inorganic Compounds in the Tissues of Intact Tree Species.

North Carolina, University of. J. C. Andrews and M. K. Berkut, Trace Studies and Irradiation in Dental Metabolism.

North Carolina, University of. D. P. Costello, Radiation Effects on Salamander Larvae.

Ohio Agriculture Experiment Station. R. S. Davidson, The Physiology and Genetics of Plant Micro-organisms when Grown in the Presence of Various Radioisotopes.

Oklahoma Agricultural and Mechanical College. A. Eisenstark, Study of Azotobacter Mutants Produced by Beta Irradiation.

Oklahoma Agricultural and Mechanical College. R. M. Chatters, Effects of Radiation on Plant Growth.

Oklahoma Research Institute. R. W. Goff, Study of the Effects of Isotopic Irradiation on Embryonic Capillaries.

Oklahoma Research Institute. L. Rohrbaugh and E. L. Rice, Study of the Translocation of Tagged 2, 4–D and Other Growth Regulators in Plants in Light and Darkness.

Oregon State College. V. H. Cheldelin and B. E. Christiansen, Vitamin-amino Acid and Carbohydrate-amino Acid Interrelationships Using Isotopic Tracers.

Oregon State College. J. N. Butts, The Mode of Action of 2, 4–D and I. P. C.

Oregon, University of. P. L. Risley, Localization of Radioactive Isotopes in Germ Cells and Reproductive Tissues During Quiescence and Activation.

Pennsylvania, University of. D. W. Wilson, Synthesis of Isotopic Carbon Compounds used in Biochemistry.

Pittsburgh, University of. M. Lauffler, Study of the Correlation of Radiation Effects with Physical and Chemical Changes in Viruses.

Polytechnic Institute of Brooklyn. C. Neuberg, Factors Influencing the Solubility of Heavy Metal Complexes and their Metabolism.

Polytechnic Institute of Brooklyn. A. D. McLaren, Effect of Ultra-violet Radiation on Enzymes and Viruses.

Purdue University. H. Koffler and P. A. Tetrault, Use of Radioactive Isotopes in Studying Mold Metabolism.

Purdue University. H. Koffler and D. M. Powelson, The Physiology of Hydrogen Bacteria.

Rice Institute. R. V. Talmage and A. C. Chandler, Action of Relaxin and Related Studies on Cellular Metabolism.

Rutgers University. H. H. Haskin, Distribution and Accumulation of Radioisotopes of Physiological Importance in Shellfish.

South Dakota State College. A. L. Moxan and E. I. Whitehead, Metabolism of Selenium and Sulfur in Plants.

Southern California, University of. H. J. Deuel and A. L. S. Cheng, Effect of Radiation on Intestinal Absorption and Metabolism of Fats and Carbohydrates.

Southern Research Institute. H. E. Skipper, Study of Dosage of Carbon 14-Labeled Sodium Formate Required to Produce Radiation Effects.

Stanford Research Institute. R. Pencharz and D. Singman, Experimental Study of the Direct and Indirect Effects Produced by X-irradiation of the Spleen.

Tennessee, University of. W. K. Baker, Investigation of the Influence of Oxygen Tension on the Frequency of X-ray Induced Mutations and Chromosome Aberrations in Drosophilia.

Texas, University of. J. Myers, Study of the Relationships of Algae to the Disposal of Radioactive Wastes.

Texas, University of. J. W. Foster, Research in Mold Metabolism.

Texas Agriculture Experiment Station. R. Reiser, Metabolism of Glycerides.

Utah, University of. L. P. Gebhardt and L. T. Samuels, Use of Labeled Phosphorus in the Study of Nerve Tissue Metabolism during Invasion of Neurotropic Viruses.

Utah, University of. I. D. Spikes and R. W. Lumry, Studies of Photosynthetic Processes in Cell-free Preparations.

Utah State Agriculture College. C. Biddulph, Use of Radioisotopes in the Study of Reproduction.

Utah State Agriculture College. D. W. Thorne, Use of Radioiron in Studying Lime-induced Chlorosis.

Washington State College. O. Biddulph, Absorption, Translocation, and Disposition of Various Elements in Plants.

Washington State College. N. Higinbotham, The Rate of Movement of Ions into and through Plant Parenchyma Tissue as Affected by Rate of Water Uptake.

Wisconsin, University of. D. E. Green, The Cyclophorase System of Animal Tissue.

Wisconsin, University of. R. H. Burris, P. W. Wilson, and M. J. Johnson, Metabolism of Organic Acids in Higher Plants and Micro-organisms.

Wisconsin, University of. R. H. Burris and P. W. Wilson, Biological Nitrogen Fixation With Isotope Tracers.

Wisconsin, University of. A. J. Riker and J. E. Kuntz, The Use of Radioactive Isotopes in Determining the Role of Root Grafting in Forest Trees.

Wisconsin, University of. P. H. Phillips, Long-time Effects of Intermittent Radiation on Dogs.

Wyoming, University of. I. Rosenfeld, Investigations of the Interrelationship of Sulfur, Phosphorus, and Calcium in Selenium Metabolism in Plants and Animals.

Yale University. E. C. Pollard, Irradiation of Viruses and Large Molecules.

Yale University. N. H. Giles, Jr., Investigations on the Mechanics of Radiation-induced Chromosomal Rearrangements in Tradescantia and Gene Mutations in Neurospora.

Yale University. D. M. Bonner, Relationship of Genes to Biochemical Reactions in Neurospora.

Medicine

Baylor University. J. H. Gast, Chemistry and Metabolism of Radioactive Sulfur Oxides.

Botwick, M. Furnishing Kits for Determining Blood Group and Research in Development of Cross-matching System.

Boston University. B. R. Lutz, The Effect of Irradiation on the Function of Small Blood Vessels on the Hampster and the Frog.

California, University of. H. Becks, Metabolism of Radioactive Fluorine With Reference to Dental and Skeletal Structures.

Chicago, University of. C. P. Miller, Bacteriological Aspects of Radiation Sickness.

Chicago, University of. R. W. Gerard, Metabolism of the Nervous System.[1]

Chicago, University of. I. Gersch, Histochemical Study of the Cement Substance of the Normal and Abnormal Lens.

Chicago, University of. H. S. Anker, Investigation of the Mechanism of Antibody Synthesis by the Tracer Technique.

Chicago, University of. W. L. Palmer, Study of the Carcinogenic Effect of Irradiation Therapy in Peptic Ulcer.

Childrens' Medical Center, Boston. M. H. Wittenborg, Effects of Radiation Therapy During Infancy and Childhood on Growth of the Spine.

Cincinnati, University of. R. A. Kehoe, Beryllium Experimentation.[1]

Colorado, University of. J. R. Lacher, et al., Relationships Between Chemical Structure, Physical Characteristics, and Biological Activity in the Intermediate Metabolism of Nucleic Acid Derivatives.

Colorado, University of. P. M. Dean and O. J. Sweeting, Metabolism of Nucleic Acid Derivatives.

Colorado, University of. T. Puck, Study of the Radiation Chemistry of Bacteriophage Invasion and Reproduction in Host Cells.

Columbia University. S. C. Werner, Use of Radioactive Iodine in Developing Quantitative Assay Method for Thyrotropic Hormone.

Columbia University. D. Nachmansohn, Effect of Exposure to Radioactive Material and to X-ray Irradiation on New Tissue.

Columbia University. A. Gorbman, Biological Effects of Radiation from Excessive Amounts of Radioiodine.

Denver, University of. F. E. D'Amour, Physiologic and Pathologic Effects of Radioactive Cobalt.

Duke University. P. Handler, Training Program; Metabolic Studies Using Isotopes.

Duke University. J. S. Harris, Studies of Electrolyte and Fluid Balance in Health and Disease.

Duke University. K. M. Wilbur, Isolation and Properties of Rat Liver Nuclei.

Georgetown University. C. F. Geschickter, Study of the Redistribution of Bivalent Metallic Ions in Bone Metabolism and in Bone Disease and Neoplasms through the Use of Radioisotopes and Novel Chelating Compounds.

Georgia, University of. S. A. Singal, The Effects of Nutritional Deficiencies on the Synthesis of Phospholipids and Nucleoproteins in the Rat.

[1] Contracts administered through Office of Naval Research, Washington, D. C.

Harvard University. W. B. Castle, Destruction of Red Blood Cells in Hemolytic Anemia.

Harvard University. A. B. Hastings, Use of Isotopes in Study of Metabolism and Organic Substances in Mammalian Tissue.

Harvard University. L. C. Fogg, Effects of Radiation upon Developing Rat Embryos.

Harvard University. V. E. Kinsey and R. D. Evans, Effects of Neutrons and Other Radiations on the Optic Lens.

Harvard University. R. F. Sognnes and J. H. Shaw, Metabolism of the Teeth.

Harvard University. D. G. Cogan and R. D. Evans, Production of Cataracts by Neutrons and other Radiations.

Harvard University. H. L. Blumgart, The Use of I 131 in the Treatment of Heart Diseases and Follow-up Studies on Biological Effects of Radiation.

Haskins Laboratory. C. P. Haskins, et al., The Micro-biological Assay of Nucleic Acid Constituents Produced by Radiation Injury.

Henry Ford Hospital, Detroit, Mich. F. W. Hartman, Chemical Sterilization of Blood and Plasma with Nitrogen Mustard.

Institute of Cancer Research, Lankenau Hospital, Philadelphia, Pa. S. Weinhouse and G. Medes, Origin and Fate of Amino Acids in Plants and Animals.

Illinois, University of. A. C. Ivy, Effects of Radiation of the Gastric Mucosa.

Iowa, State University of. T. C. Evans, Quantitative and Morphologic Study of Radiation Induced Cataracts.

Johns Hopkins University. J. E. Howard, Investigation of the Mechanism of Bone Deposition and Related Physiological Studies.

Johns Hopkins University. R. Ballentine, Metabolism and Functional Significance of Cobalto-protein.

Kansas, University of. R. Stowell, Cytochemical, Microchemical, and Biophysical Studies of Tumors and Effects of Radiation Upon Cells.

Louisiana State University. R. W. Brauer, Studies of Liver Physiology and Pathology, Involving the Use of Bromsulphthalein Containing S 35.

Massachusetts General Hospital. J. H. Means, Effects of Radioactive Iodine on Biology of the Thyroid Gland.

Massachusetts General Hospital. W. H. Sweet and B. Selverstone—The Use of Phosphorus 32 for the Precise Localization of Brain Tumors.

Massachusetts Memorial Hospital. J. F. Ross, Physiological and Therapeutic Investigations and Fundamental Blood Studies Using Radioactive Isotopes.

Massachusetts Memorial Hospital. F. J. Inglefinger, Effects of Radiation on Function of the Digestive System, Particularly the Gastro-intestinal Tract of Man.

Meharry Medical College. P. F. Hahn, Use of Radioactive Gold in Treatment of Tumors.

Michigan, University of. R. L. Kahn and F. T. Hodges, Universal Serologic Action Following Irradiation.

Michigan, University of. F. H. Bethell, Biological Effects of Irradiation.

Minnesota, University of. S. W. Hunter, Zirconium as Radio-opaque Media.

Minnesota, University of. S. Swartz, Synthesis of Hemoglobin in Bone Marrow and Maturation and Multiplication of Blood Cells.

Minnesota, University of. C. J. Watson, The Influence of Radiation and Chemically Induced Bone Marrow Injury upon Porphyrin Metabolism.

Minnesota, University of. G. E. Moore, Localization of Radioactive Materials in the Nervous System.

Minnesota, University of. W. D. Armstrong, Effect of Ionizing Radiations on Electrolyte and Water Metabolism.

Montifiori Hospital, New York City. D. Laszlo and K. G. Stern, The Relationship of Stable and Radioactive Lanthanum to Nucleic Acid Synthesis in Normal and Neoplastic Tissue.

Mount Sinai Hospital, New York City. H. Sobotka, Use of Isotopes in the Study of the Etiology of Drug Eruptions.

New England Deaconess Hospital. S. P. Hicks, et al., Acute Radiation Injury.

New York Medical College. A. Copley, Study of Vascular Factors in Radiation Hemorrhage and other Hemorrhagic Diatheses in Patients and Experimental Animals.

New York University. M. Sulzberger, Skin Changes Produced by Low Voltage Roentgen Ray Irradiation.

New York University. N. Nelson, Influence of Particle Size on the Retention of Mist Particles in the Human Respiratory System.

New York University. H. W. Smith, Sodium and Potassium Distribution in Man.

North Carolina, University of. A. Roe, Effect of C 14 on the Course of Certain Organic Reactions.

North Carolina, University of. H. D. Bruner, Blood Flow in Liver and Kidney.[1]

North Carolina, University of. C. D. Van Cleave and C. T. Kaylor, Radioautographic Study of Distribution and Retention of Beryllium in the Rat.

Northwestern University. J. A. D. Cooper and H. L. Alt, Radiobiology Training Program.

Northwestern University. J. G. Bellows, Studies on Radiation Cataract

Notre Dame, University of. J. A. Reyneirs, Study of the Effect of X-radiation on Germ Free Rats.[1]

Ohio State University. J. L. Morton, Use of Radioisotopes for Cancer Therapy.

Oklahoma, University of. S. P. Wender, Isolation and Identification of Flavonoid Pigments of Use in the Control of Radiation Injury.

Oregon, University of. E. S. West, Studies on the Metabolism of Cholesterol and Ketone Bodies.

Oregon, University of. F. B. Queen, Evaluation of Body Content of Radium in Individuals with no Known Exposure.

[1] Contracts administered through Office of Naval Research, Washington, D. C.

Peter Bent Brigham Hospital. F. D. Moore, Intracellular Changes in Trauma Depletion and Repair; Biochemical Studies in the Human Being with the Aid of Isotopes.

Pittsburgh, University of. A. J. Allen and C. Moses, Effects of Neutrons from a Cyclotron on Mammals with Particular Reference to the Development of Cataracts.

Presbyterian Hospital, Chicago, Ill. R. G. Gould, The Mechanism of CO_2 Fixation.

Reed College. F. Hungate, The Application of the Radioactive Tracer Technique in the Field of Cellular Metabolism.

Reed College. A. H. Livermore, The Biochemical Synthesis of the Peptide Bond.

Reed College. A. F. Scott, General Training and Research Program.

Rochester, University of. G. H. Whipple, Plasma Protein Studies.[1]

Sloan-Kettering Institute for Cancer Research. C. P. Rhodes, et al., Biological Effect of Radiation and Related Biochemical and Physical Studies.

Syracuse University. E. L. Lozner, Body Defenses Against Hemorrhage in Health and Disease.[1]

Tennessee, University of. E. F. Williams, Absorption and Intermediary Metabolism of Calcium.

Tennessee, University of. D. H. Sprunt, Effect of Various Amino Acids on the Susceptibility of Mice to Infection with Influenza Virus.

Tennessee, University of. L. Van Middleworth, Thyroid Metabolism.

Tennessee, University of. R. R. Overman and D. B. Silversmit, Mechanisms of Ionic Imbalance and Pathophysiologic States.

Tennessee, University of. D. S. Carroll, J. Cara, and D. H. Sprunt, Study of the Use of Radioactive Ruthenium in the Treatment of Superficial Lesions.

Trudeau Foundation. F. W. Klemperer and A. J. Vorwald, Biochemical Aspects of Pulmonary Diseases in Beryllium Workers; Biologic Hazards of Beryllium.

Trudeau Foundation. A. J. Vorwald, Clinical Effect of Cortisone on Chronic Pulmonary Granulomatosis.

Tufts College. D. Rapport, Study of the Relation of Radiation on Reactions Associated with Growth.

Tulane University. G. E. Burch, Electrolyte Balance Studies on Humans.

Utah, University of. John Z. Bowers, Toxicity Studies of Plutonium and Other Substances in Animals.

Vanderbilt University. W. J. Darby, Study of the Absorption and Metabolism of Liquids and the Alterations which Occur in Acute Radiation Injury.

Virginia, University of. C. L. Gemmill, Effects of Beta Radiation on the Distribution of Phosphates in Red Blood Cells and in Cardiac Muscles.

Virginia, University of. A. Chanutin, Fractionation of Plasma Proteins.

Wake Forest College. C. Artom, Formation of Tissue Phospholipids.

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[1] Contracts administered through Office of Naval Research, Washington, D. C.

Wake Forest College. G. T. Harrell, et al., Toxicity of Radiation as Related to Previous Damage and the Functional Capacity of an Organ; The Effect of P 32 and X-rays on Liver and Marrow.

Wake Forest College. G. T. Harrell, Distribution and Turnover of Sodium and Potassium in Acute Infection.

Washington, University of. C. A. Finch, Isotope Study in Iron Metabolism; Studies Related to Blood Preservation.

Washington, University of. R. D. Ray, Mobilization of Radioactive Emitters from Bone.

Washington, University of. R. H. Williams, The Biological Effects of Radioactive Sulfur.

Washington, University of. H. J. Dauben, Synthesis of Carbon 14 Labeled Diethylstilbestrol and a Study of its Metabolism in the Body.

Washington University, St. Louis, Mo. D. Lipkin, Synthesis of Nucleotides and Related Compounds.

Washington University, St. Louis, Mo.—F. J. Dixon, Investigation of the Effects of Agents Used in the Treatment of Cancer, X-ray and Nitrogen Mustards on the Immunological Response of Experimental Animals.

Washington University, St. Louis, Mo. G. B. Forbes, Electrolyte Balance and Thyroid Metabolism Absorption and Distribution and Thyroid Physiology in Humans.

Washington University, St. Louis, Mo. W. M. Allen, Use of Gamma Ray as a Therapeutic Agent of Carcinoma.

Western Reserve University. H. G. Wood, Intermediary Metabolism of Carbohydrates by Bacteria.

Western Reserve University. A. R. Moritz, Physiological and Pathological Aspects of Thermal and Flash Burns.

Western Reserve University. H. L. Friedell, Thorium Toxicity Studies.

Worcester Foundation. H. Hoagland and G. Pincus, Investigation of the Effects of Radiation on the Biosynthesis and Metabolism of Adrenocortical Steroids.

Biophysics

Chicago, University of. R. E. Zirkle, Use of a Microbeam of Light Atomic Nuclei for Biological Investigations.

Columbia University. G. Failla, Research in Radiological Physics and Radiobiology.

Florida, University of. A. A. Bless, Radiation Injury Studies.

Howard University. H. Branson, Studies with Radioactive and Stable Isotopes.

Illinois, University of. G. A. Bennett and R. A. Harvey, Distribution and Effect of Radioactive Calcium and Strontium in Bone Development.

Johns Hopkins University. C. Renn and A. Wolman, Investigation of the Absorption and Assimilation of Radioactive Waste by Bacterial Slimes.

Kansas, University of. F. E. Hoecker, Biological Effects of Ionizing Radiation.

Marquette University. W. A. D. Anderson, The Pathological Effects of Radioactive Isotopes of Calcium and Strontium on Bone and Soft Tissue.

Massachusetts Institute of Technology. J. G. Trump, Biological Effects of High Energy X-rays and Cathode Rays.

Massachusetts Institute of Technology. R. Eliassen and A. A. Thomas, The Efficiency of Present Water Treatment Methods in Removing Radioactive Substances from Water.

Massachusetts Institute of Technology. R. D. Evans, Research in Applied Radioactivity.

Michigan, University of. H. J. Gomberg and L. J. Hodges, High Resolution Detection of Radioactive Isotopes.

Mount Sinai Hospital, New York City. R. Loevinger, Measurement of Tissue Dosage Delivered by Gamma and Beta Active Radioisotopes.

Mount Sinai Hospital, New York City. S. Feitelberg, Investigation of Sewage Water Contamination by Radioactive Isotopes.

New York University. V. H. Whitten, Effects of Thorium-X in Selected Vehicles Applied to the Skin of Man and the Effect of Selected Pure Beta Emitters on the Skin of Man.

Ohio State University. M. L. Pool, Improvement of Radioautographs.[1]

Pittsburgh, University of. A. J. Kammer and F. F. Hatch, Hazard from Inhaled Radioactive Particulate Matter.

Southern Research Institute. L. White, Improvement in Photoelectric Smoke Penetrometers or Filter Testers.

Washington, University of. R. G. Fleagle, Meteorological Studies.

Washington, University of. P. E. Church, Meteorological Studies.

Wisconsin, University of. D. M. Angevine, Development and Application of Historadiography in Relation to the Distribution of Mass and Localization of Elements in Normal and Pathologic Tissues.

[1] Contracts administered through Office of Naval Research, Washington, D. C.

APPENDIX 10

AMENDMENTS TO THE ATOMIC ENERGY ACT OF 1946

[PUBLIC LAW 898—80TH CONGRESS]

[CHAPTER 828—2D SESSION]

[H. R. 6402]

AN ACT

To provide for extension of the terms of office of the present members of the Atomic Energy Commission.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 2 (a) (2) of the Atomic Energy Act of 1946 is amended to read as follows:

"(2) Members of the Commission shall be appointed by the President, by and with the advice and consent of the Senate. In submitting any nomination to the Senate, the President shall set forth the experience and the qualifications of the nominee. The term of office of each member of the Commission taking office prior to June 30, 1950, shall expire at midnight on June 30, 1950. The term of office of each member of the Commission taking office after June 30, 1950, shall be five years, except that (A) the terms of office of the members first taking office after June 30, 1950, shall expire, as designated by the President at the time of the appointment, one at the end of one year, one at the end of two years, one at the end of three years, one at the end of four years, and one at the end of five years, after June 30, 1950; and (B) any member appointed to fill a vacancy, occurring prior to the expiration of the term for which his predecessor was appointed, shall be appointed for the remainder of such term. Any member of the Commission may be removed by the President for inefficiency, neglect of duty, or malfeasance in office. Each member, except the Chairman, shall receive compensation at the rate of $15,000 per annum; and the Chairman shall receive compensation at the rate of $17,500 per annum. No member of the Commission shall engage in any other business, vocation, or employment than that of serving as a member of the Commission."

Approved July 3, 1948.

[PUBLIC LAW 347—81ST CONGRESS]

[CHAPTER 673—1ST SESSION]

[S. 2372]

AN ACT

To amend the Atomic Energy Act of 1946.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 2 (c) of the Atomic Energy Act of 1946 is amended to read as follows:

"(c) MILITARY LIAISON COMMITTEE.—There shall be a Military Liaison Committee consisting of a Chairman, who shall be the head thereof, and of a representative or representatives of the Departments of the Army, Navy, and Air Force, detailed or assigned thereto, without additional compensation, in such number as the Secretary of Defense may determine. Representatives from each of the three Departments shall be designated by the respective Secretaries of the Army, Navy, and Air Force. The Committee Chairman shall be appointed by the President, by and with the advice and consent of the Senate, and shall receive compensation at a rate prescribed by law for the Chairman of the Munitions Board. The Commission shall advise and consult with the Committee on all atomic energy matters which the Committee deems to relate to military applications, including the development, manufacture, use and storage of bombs, the allocation of fissionable material for military re-

search, and the control of information relating to the manufacture or utilization of atomic weapons. The Commission shall keep the Committee fully informed of all such matters before it and the Committee shall keep the Commission fully informed of all atomic energy activities of the Department of Defense. The Committee shall have authority to make written recommendations to the Commission on matters relating to military applications from time to time as it may deem appropriate. If the Committee at any time concludes that any action, proposed action, or failure to act of the Commission on such matters is adverse to the responsibilities of the Department of Defense, derived from the Constitution, laws, and treaties, the Committee may refer such action, proposed action, or failure to act to the Secretary of Defense. If the Secretary concurs, he may refer the matter to the President, whose decision shall be final."

SEC. 2. Section 2 (d) of the Atomic Energy Act of 1946 is amended by striking out "Army or the Navy" and inserting in lieu thereof, "Army, Navy, or Air Force."

SEC. 3. Section 2 (d) of the Atomic Energy Act of 1946 is also amended by inserting at the end thereof the following two sentences: "Likewise, notwithstanding the provisions of any other law, any active or retired officer of the Army, Navy, or Air Force may serve as Chairman of the Military Liaison Committee established by subsection (c) of this section, without prejudice to his commissioned status as such officer. Any such officer serving as Chairman of the Military Liaison Committee shall receive, in addition to his pay from the United States as such officer, an amount equal to the difference between such pay and the compensation prescribed in subsection (c) of this section."

Approved October 11, 1949.

[PUBLIC LAW 820—81ST CONGRESS]

[CHAPTER 1000—2D SESSION]

[S. 3437]

AN ACT

To amend the Atomic Energy Act of 1946.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the next-to-last sentence of section 2 (a) (2) of the Atomic Energy Act of 1946 is amended to read as follows: "Each member, except the Chairman, shall receive compensation at the rate of $18,000 per annum; and the Chairman shall receive compensation at the rate of $20,000 per annum."

SEC. 2. Section 2 (a) (4) (A) of the Atomic Energy Act of 1946 is amended to read as follows:

"(A) a General Manager, who shall discharge such of the administrative and executive functions of the Commission as the Commission may direct. The General Manager shall be appointed by the Commission, shall serve at the pleasure of the Commission, shall be removable by the Commission, and shall receive compensation at a rate fixed in the Commission's discretion but not to exceed $20,000 per annum."

Approved September 23, 1950

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